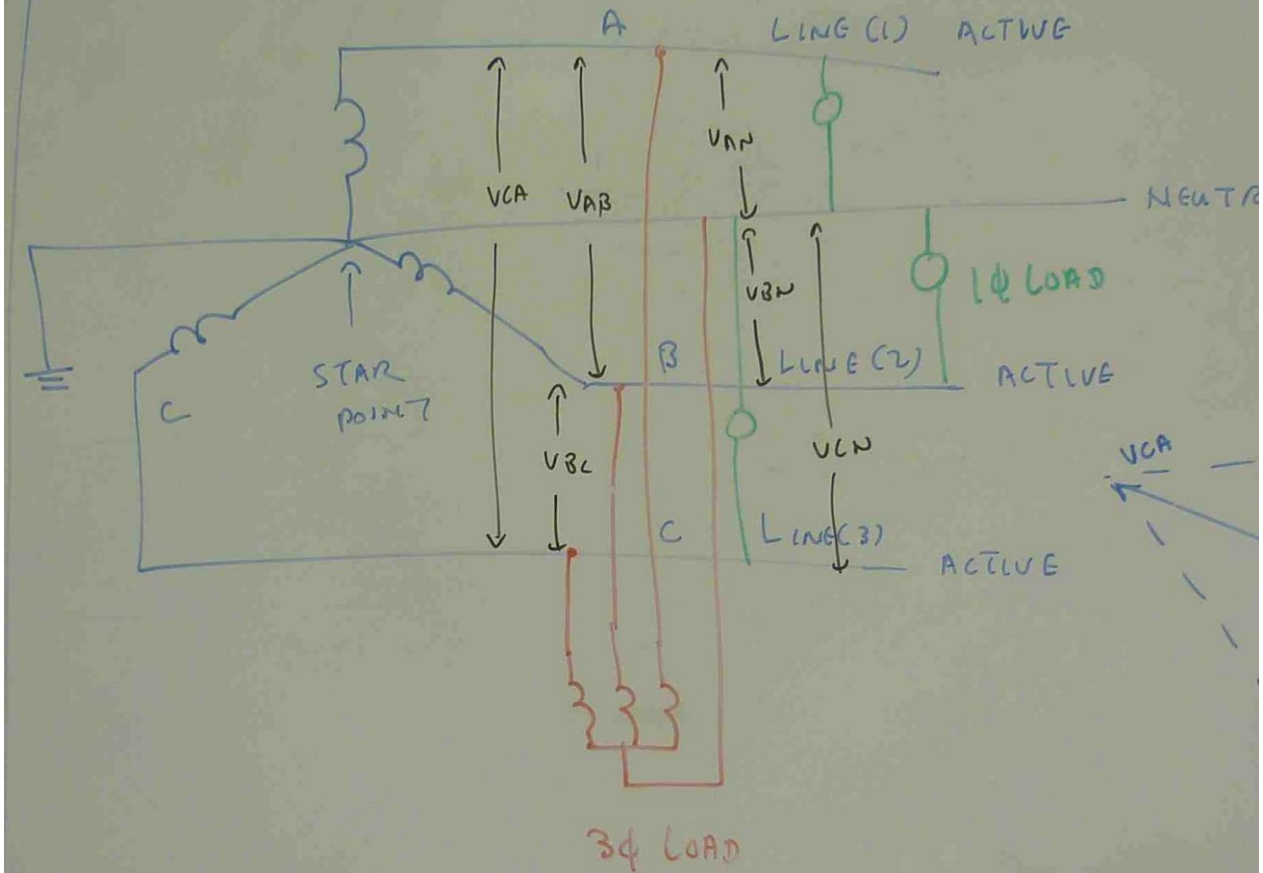
MULTI PHASE Supply SYSTEM



$V_{AB} = V_{AN} - V_{BN}$

$V_{BC} = V_{BN} - V_{CN}$

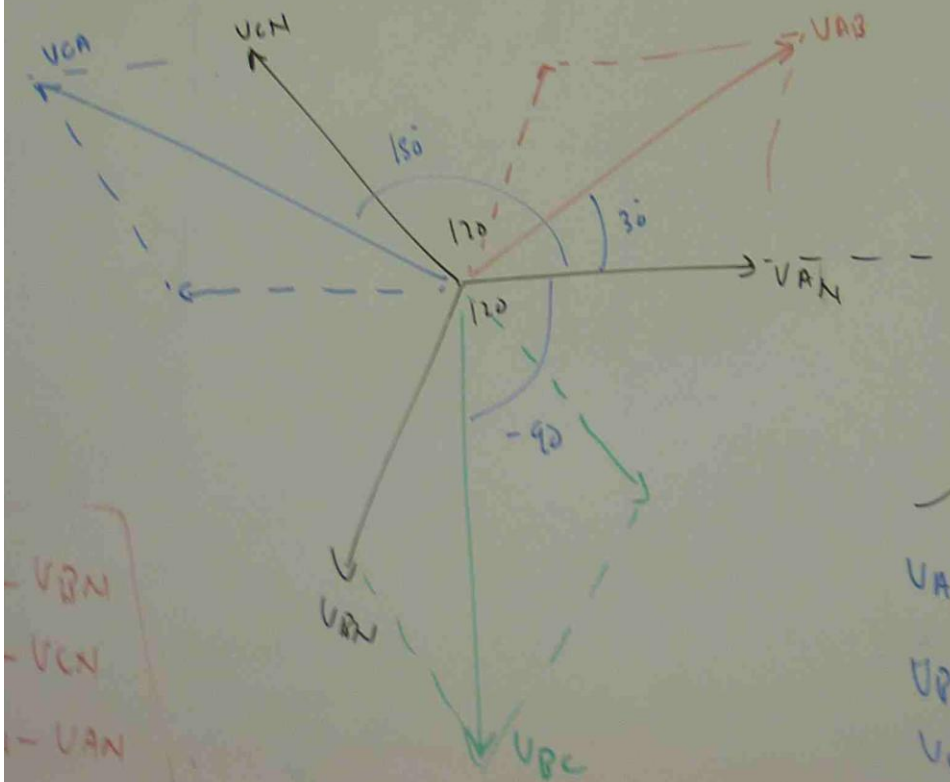
$V_{CA} = V_{CN} - V_{AN}$

LINE VOLTAGE = $V_{AB} = V_{BC} = V_{CA} = 415\ V$ (L – L)

PHASE VOLTAGE : $V_{AN} = V_{BN} = V_{CN} = 240V$ (L – N)

NEUTRAL

LINE VOLTAGE = $\sqrt{3}$ PHASE VOLTAGE



SEQUENCE ABC

$V_{AN} \angle 0^\circ$

$V_{BN} \angle -120$

$V_{CN} \angle -240$

(OR)

$V_{CN} \angle +120$

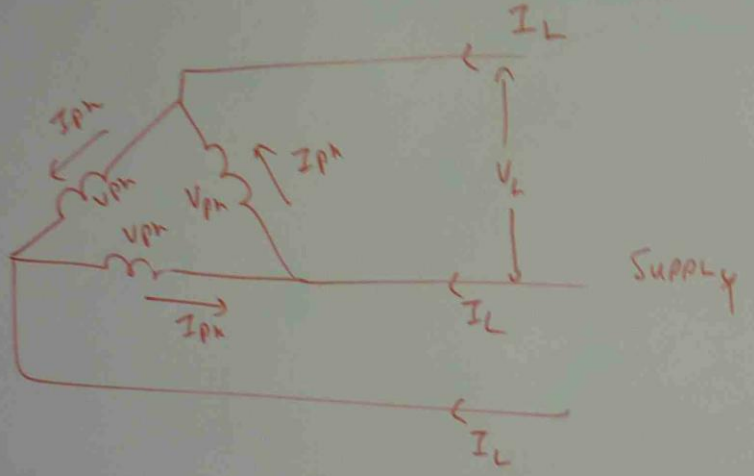
$V_{AB} \angle 30^\circ$

$V_{BC} \angle -90$

$V_{CA} \angle +150$

MULTI PHASE SUPPLY SYSTEM

DELTA CONNECTION



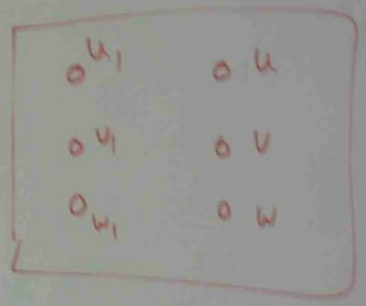
$$I_{LINE} = \sqrt{3} \times I_{PHASE}$$

$$I_L = 1.732 I_{ph}$$

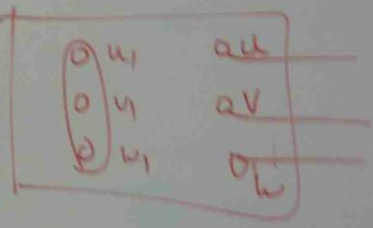
$$V_L = V_{ph}$$

DELTA CONNECTION

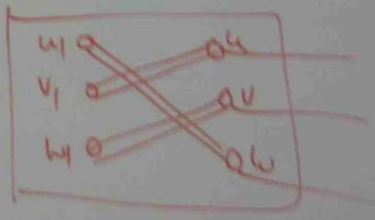
USE FUL FOR 3ϕ MOTOR CONNECTION



Y

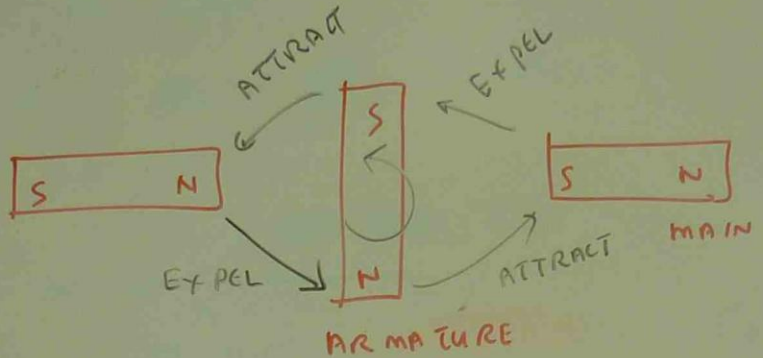


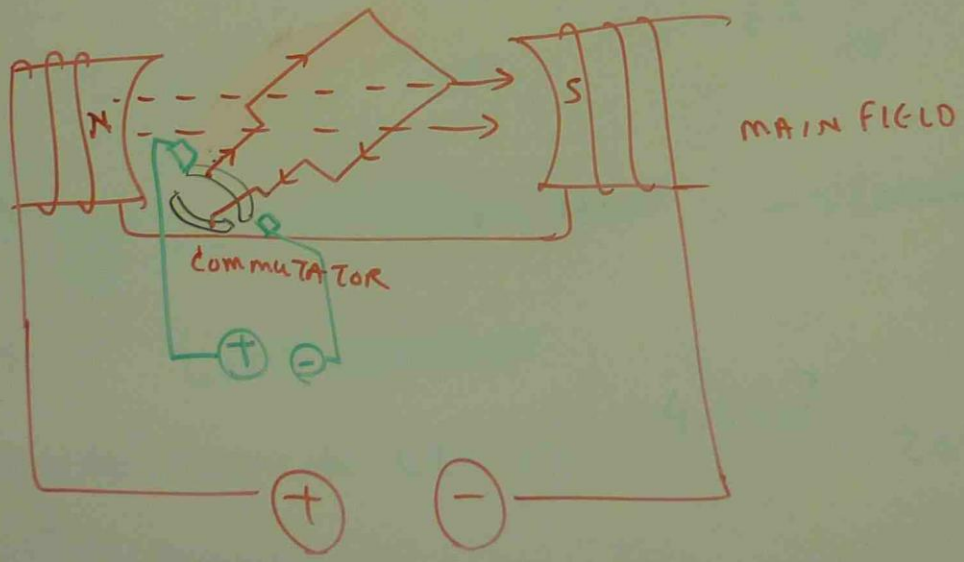
Δ



PRINCIPLE OF ELECTRIC MOTORS

PRINCIPLE OF OPERATION



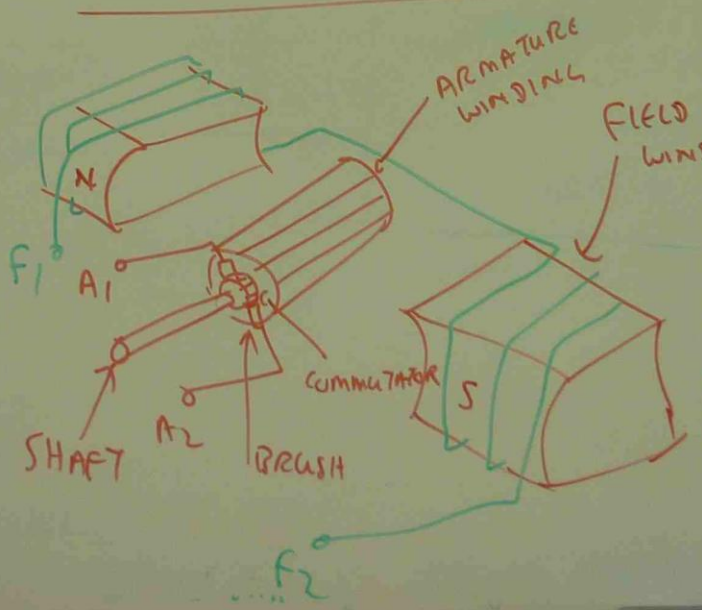


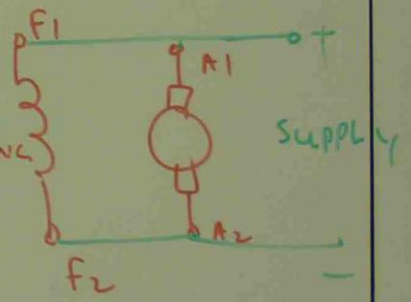
A BAR MAGNET IS PLACED BETWEEN TWO MAIN MAGNETIC POLES, DUE TO REPELLING AND ATTRACTING, THE BARMAGNETIC WILL ROTATE.

TO ACHIEVE THE SWITCHING OF MAGNETIC POLES, THE SIMPLEST MEAN IS TO USE COMMUTATOR.

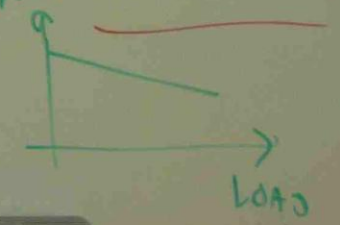
THE MAGNETIC FIELD CREATED IN ARMATURE AND MAIN FIELD INTERACTS AND THE MOTOR WILL ROTATE.

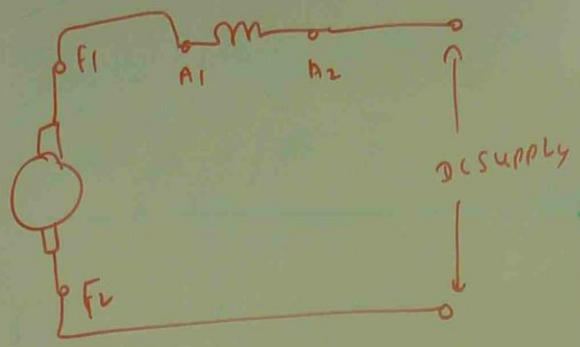
CHARACTERISTICS AND CONNECTION OF DC MOTORS



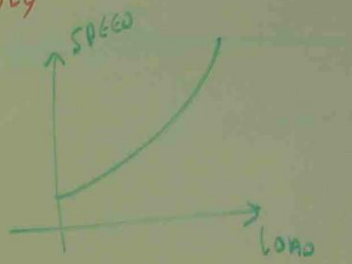


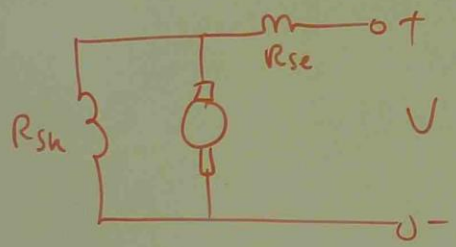
SHUNT MOTOR



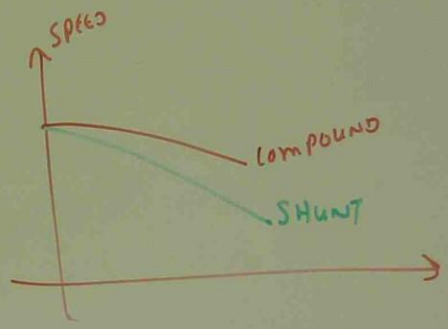


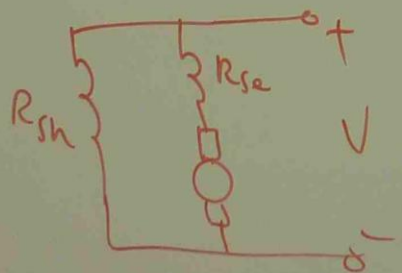
SERIES MOTOR





SHORT SHUNT COMPOUND





LONG SHUNT COMPOUND

APPLICATIONS of DC MOTORS

DC PERMANENT MAGNET MOTORS

TOY, HIFI EQUIPMENTS, SMALL INSTRUMENTS, LIGHT MACHINERY.

LOW COST, RELIABLE,

DC SERIES MOTORS

HIGH STARTING TORQUE.

CRANES, ELECTRIC TRAINS,

DC SHUNT MOTORS

VERY COMMON TYPES IN INDUSTRY.

MOTOR RUNS AT CONSTANT SPEED.

GOOD SPEED REGULATION.

DC COMPOUND MOTOR

- SHUNT AND SERIES FIELD COILS.
- CAN PROVIDE HIGHER STARTING TORQUE THAN SHUNT MOTOR.

UNIVERSAL MOTOR

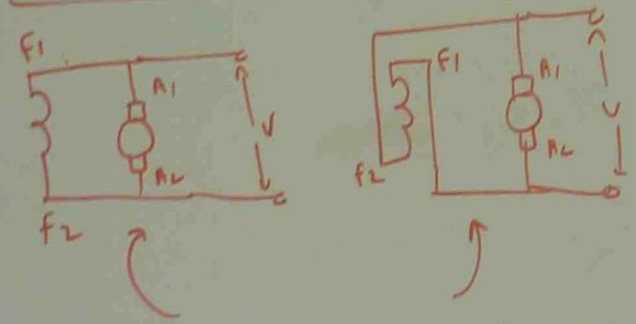
UNIVERSAL MOTOR CAN RUN WITH BOTH AC AND DC.

HIGH POWER TO WEIGHT RATIO.

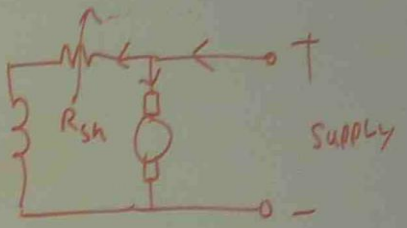
SMALLER SIZE TO 1 KW.

MOSTLY USE FOR ELECTRIC DRILLS.

REVERSE DIRECTION



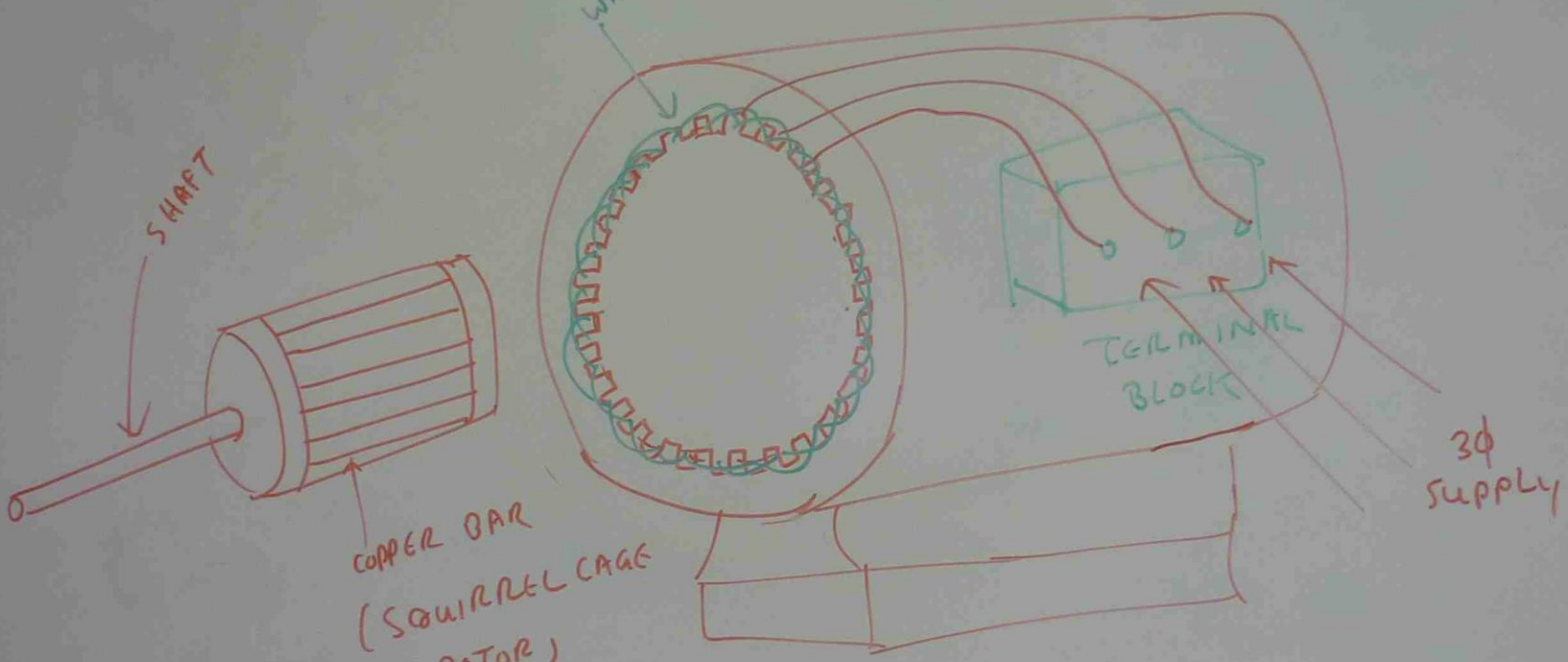
BY CHANGING THE DIRECTION OF FIELD WINDING, THE DC MOTOR ROTATION CAN BE REVERSED.



BY ADJUSTING THE RESISTANCE OF FIELD RHEOSTAT, MOTOR ROTATION CAN BE REVERSED.

THREE PHASE CAGE INDUCTION MOTOR

(SQUIRREL CAGE INDUCTION MOTOR)



THE SQUIRREL CAGE INDUCTION MOTOR CONSISTS of 3ϕ STATOR WINDING AND SQUIRREL CAGE ROTOR WINDING (COPPER BARS ARE WELDED TOGETHER AT BOTH SIDES).

WHEN THE STATOR WINDING IS CONNECTED TO 3ϕ SUPPLY, THE REVOLVING MAGNETIC FIELD IS INDUCED.

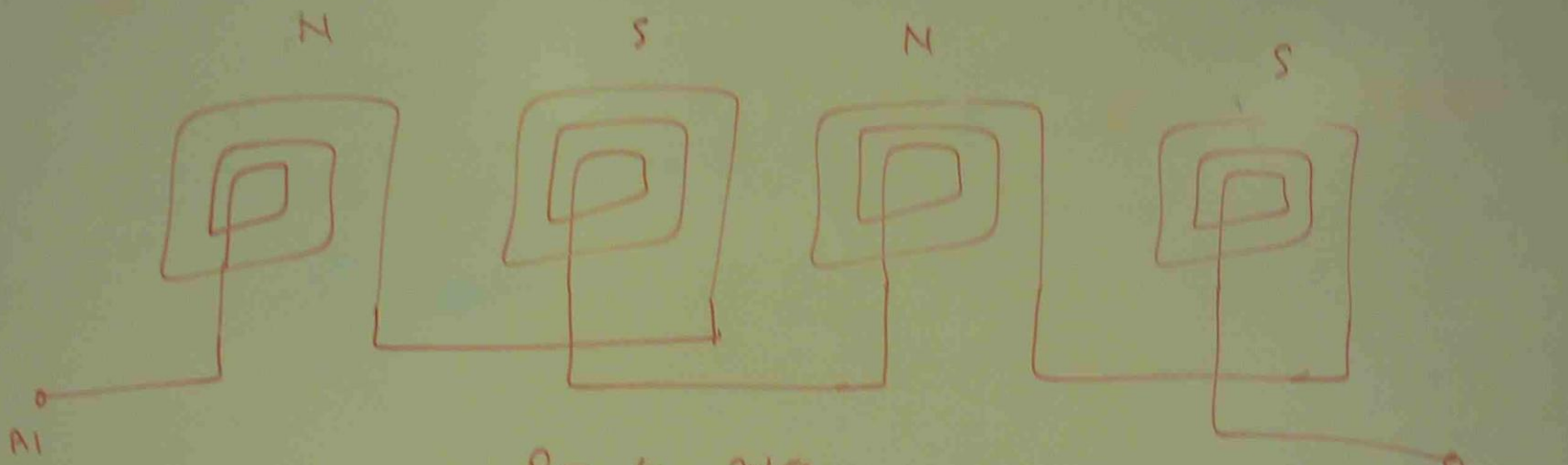
THE REVOLVING MAGNETIC FIELD PASSES THROUGH THE ROTOR COPPER BARS AND THE VOLTAGE AND CURRENT ARE INDUCED IN ROTOR COPPER BARS.

THE MAGNETIC FIELD INDUCED IN ROTOR BAR INTERACTS WITH THE STATOR FIELD AND THE ROTOR IS ROTATED.

N_s = SYNCHRONOUS SPEED

P = NO. of POLES

f = FREQUENCY



P = 4 poles

f = 50 Hz N_s = ?

$$N_s = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500 \text{ RPM}$$

pb ①

CALCULATE THE SPEED IN RPM IF FREQUENCY IS 25 HZ FOR 2 POLES MOTOR

$$N_S = \frac{120f}{P} = \frac{120 \times 25}{4} = 750 \text{ RPM}$$

SLIP

THE DIFFERENCE OF SPEED BETWEEN THEORETICAL CALCULATED VALUE (N_S) AND PRACTICALLY MEASURED VALUE (N_r)

$$\text{SLIP SPEED} = N_S - N_r$$

$$\% \text{ SLIP} = \frac{N_S - N_r}{N_S} \times 100$$

pb ②

THE MEASURED SPEED OF 3ϕ, 415V, 50HZ, 2 POLES MOTOR IS 2700 RPM. CALCULATE SLIP SPEED & % SLIP.

$$N_S = \frac{120f}{P} = \frac{120 \times 50}{2} = 3000 \text{ RPM}$$

$$\text{Slip speed} = N_s - N_r$$

$$= 3000 - 2700$$

$$= 300 \text{ RPM}$$

$$\%\ \text{Slip} = \frac{N_s - N_r}{N_s} \times 100$$

$$= \frac{3000 - 2700}{3000} \times 100$$

$$= \frac{300 \times 100}{3000}$$

$$= 10\ \%$$

CHARACTERISTICS of 3ϕ INDUCTION MOTOR

3ϕ INDUCTION MOTOR USUALLY DRAWS A HIGH STARTING CURRENT.

THE STARTING CURRENT CAN BE 2 TO 7 TIMES FULL LOAD CURRENT.

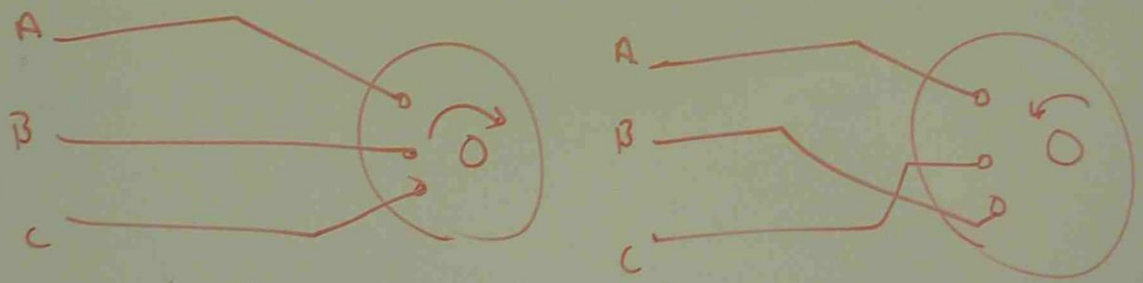
IT NEEDS TO REDUCE THE STARTING CURRENT AT STARTING TIME.

THE REDUCED VOLTAGE METHODS ARE

(a) STAR | DELTA STARTING METHOD

(b) AUTO TRANSFORMER STARTING METHOD.

MOTOR REVERSAL



BY CHANGING THE CONNECTION OF ANY TWO PHASES, THE MOTOR ROTATION DIRECTION CAN BE REVERSED.

MOTOR POWER FACTOR

AT LOW LOAD, POWER FACTOR IS LOW (ABOUT 0.15).

AT FULL LOAD, POWER FACTOR CAN INCREASE UP TO 0.85 (OR) 0.9