SELECTION AND APPLICATION OF ELECTRICAL MOTORS

- HIGH STARTING TORQUE
- FREQUENT STARTING
- FREQUENT REVERSING
- DUTY CYCLE LOADING
- HIGH LOAD INERTIA
- FREQUENT PEAK TORQUE
- VARIABLE SPEED

CHARACTERISTICS of MOTOR

CHARACTERISTICS OF LOAD

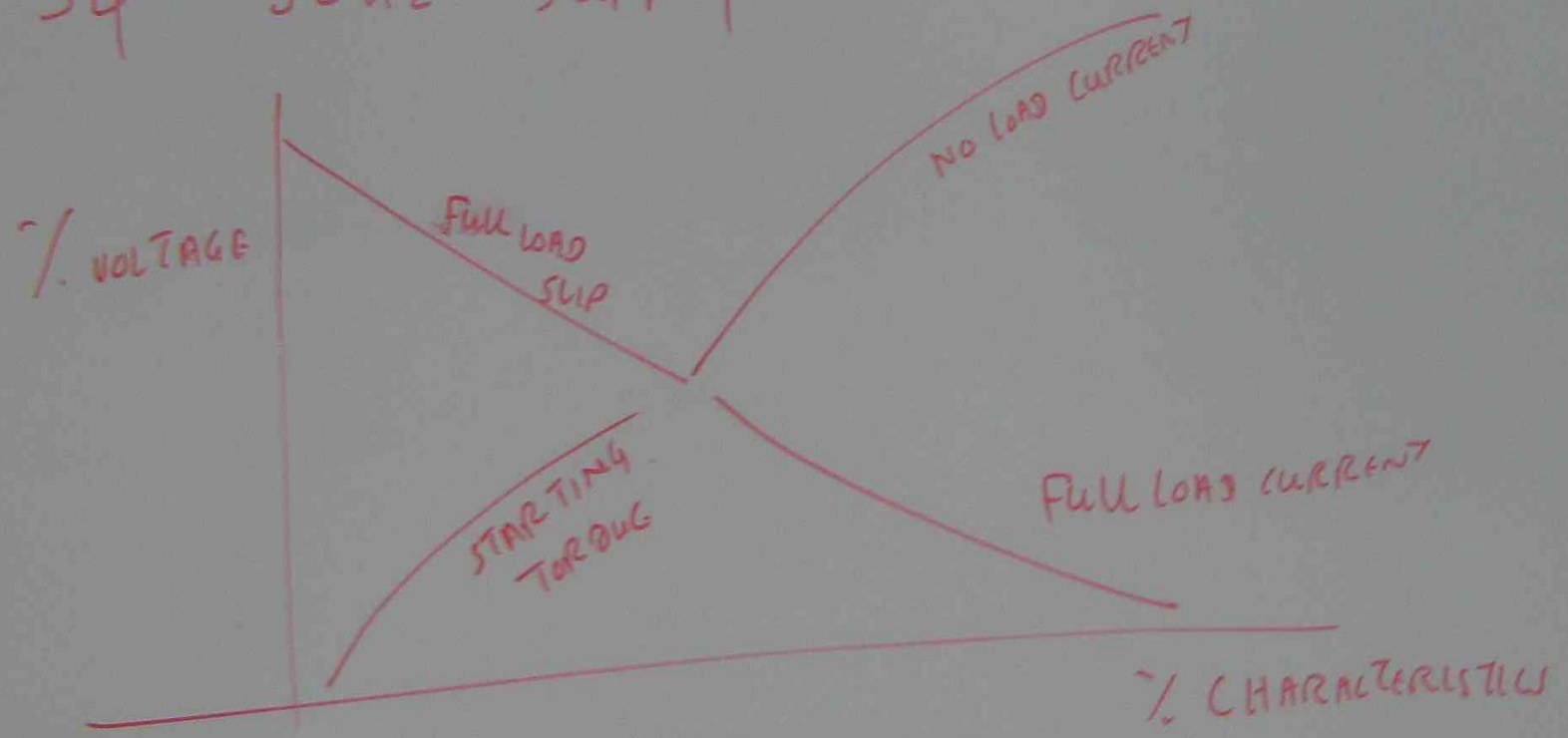
MATCHING THE MOTOR TO LOAD

VOLTAGE, FREQUENCY, TYPE OF SUPPLY

RATED VOLTAGE	MAXIMUM RATED OUTPUT
415V	-
3.3KV	150KW
6.6KV	300KW
11KV	750KW

FREQUENCY VARIATION = ± 5 % of NAME PLATE RATING

3φ 50Hz supply



EFFECT OF UNBALANCED VOLTAGE ON MOTOR PERFORMANCE

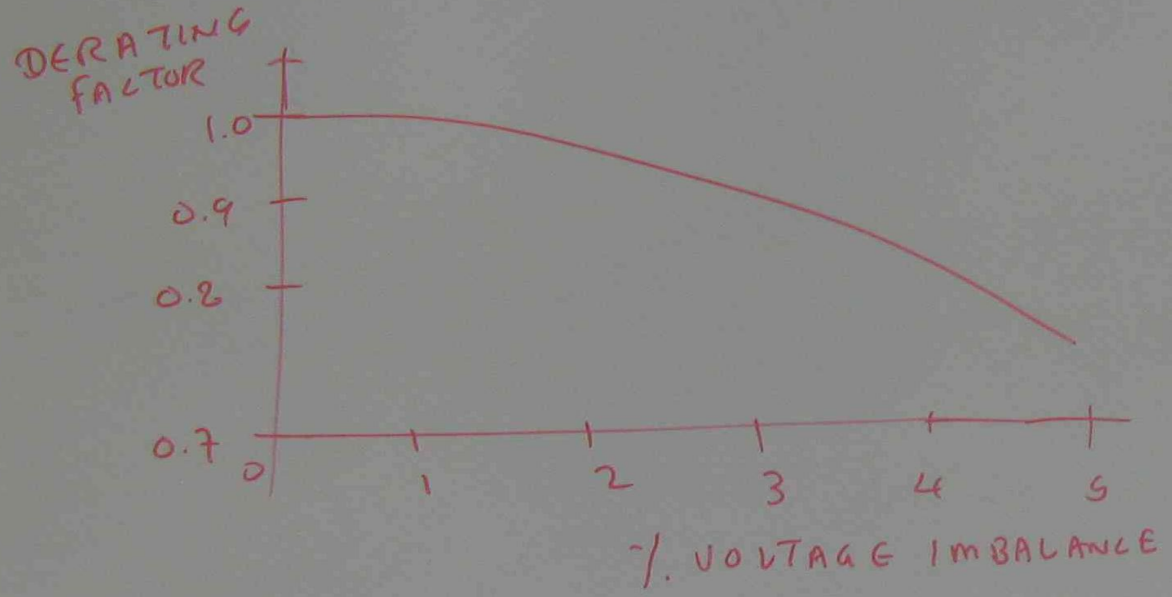
$$\%\ \text{VOLTAGE IMBALANCE} = \frac{\text{MAXIMUM DEVIATION FROM AVERAGE VOLTAGE}}{\text{AVERAGE VOLTAGE}} \times 100$$

Pb THREE VOLTAGES, PHASE TO NEUTRAL ARE MEASURED TO BE 220, 215 AND 210 V ON NOMINAL 415V, 50HZ Supply. DETERMINE THE % VOLTAGE IMBALANCE FOR 220V.

$$\text{AVERAGE VOLTAGE} = \frac{220 + 215 + 210}{3} = 215\text{V}$$

$$\%\ \text{VOLTAGE IMBALANCE} = \frac{220 - 215}{215} \times 100 = 2.3\%$$

RELATIONSHIP BETWEEN % VOLTAGE IMBALANCE AND DERATING FACTOR



POWER OUT PUT

COMMONLY AVAILABLE OUT PUT RATINGS OF MOTOR (KW)

0.37, 0.55, 0.75,
1.1, 1.5, 2.2, 3.0, 4.0, 5.5, 7.5
11, 15, 18.5, 22, 30, 37, 45, 55, 75, 90
110, 132, 150, 185, 220, 250

SPEED

$$N_S = \frac{60\,f}{\text{NO. of POLES}}$$

(SYNCHRONOUS SPEED)

SLIP

$$\text{SLIP SPEED} = \frac{N_S - N}{N_S}$$

SQUIRREL CAGE INDUCTION MOTOR

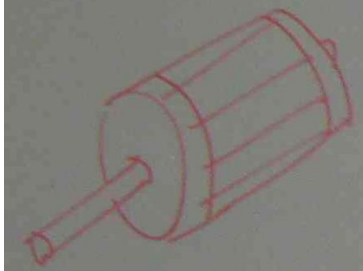
SLIP = 4 %.

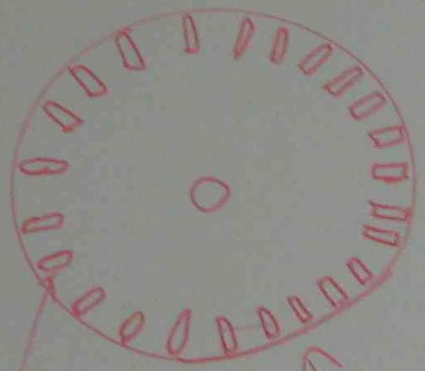
MOTOR CURRENT $\propto$ VOLTAGE

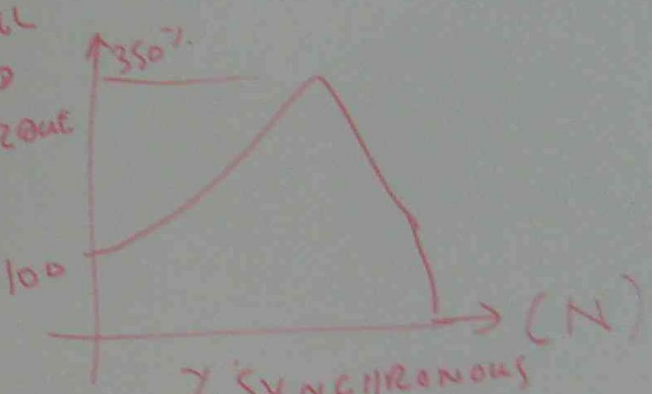
MOTOR TORQUE $\propto$ (VOLTAGE)^2

CONSTRUCTION OF MOTOR ROTOR

NORMAL CAGE



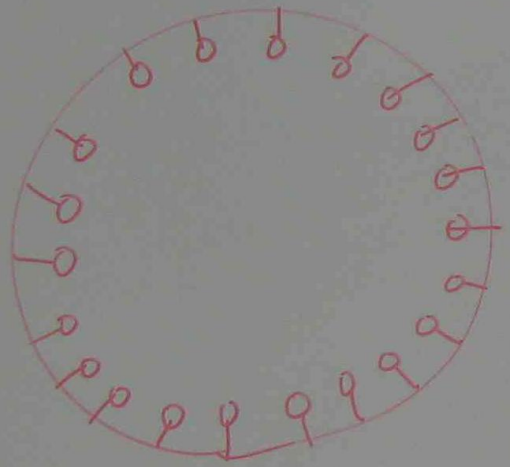


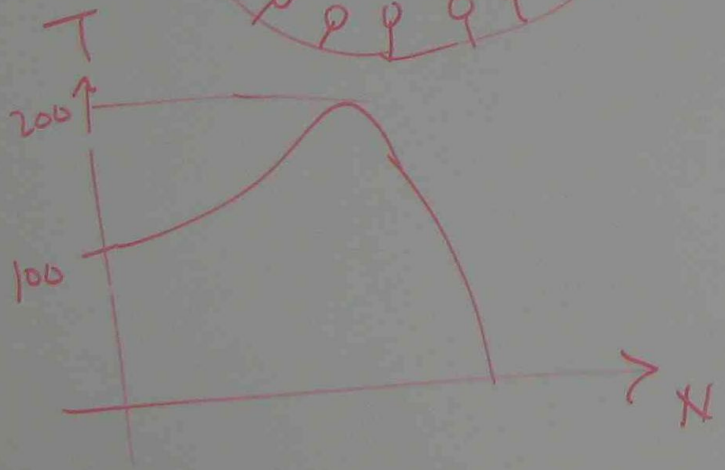


CONDUCTOR BARS

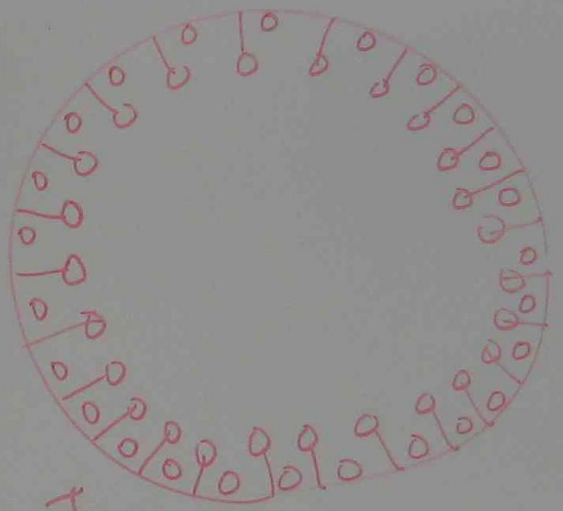
ROTOR

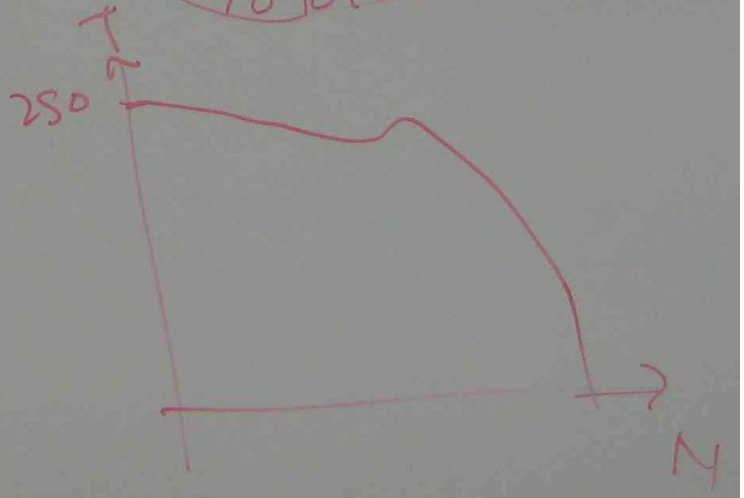
SASH BAR





DOUBLE CAGE



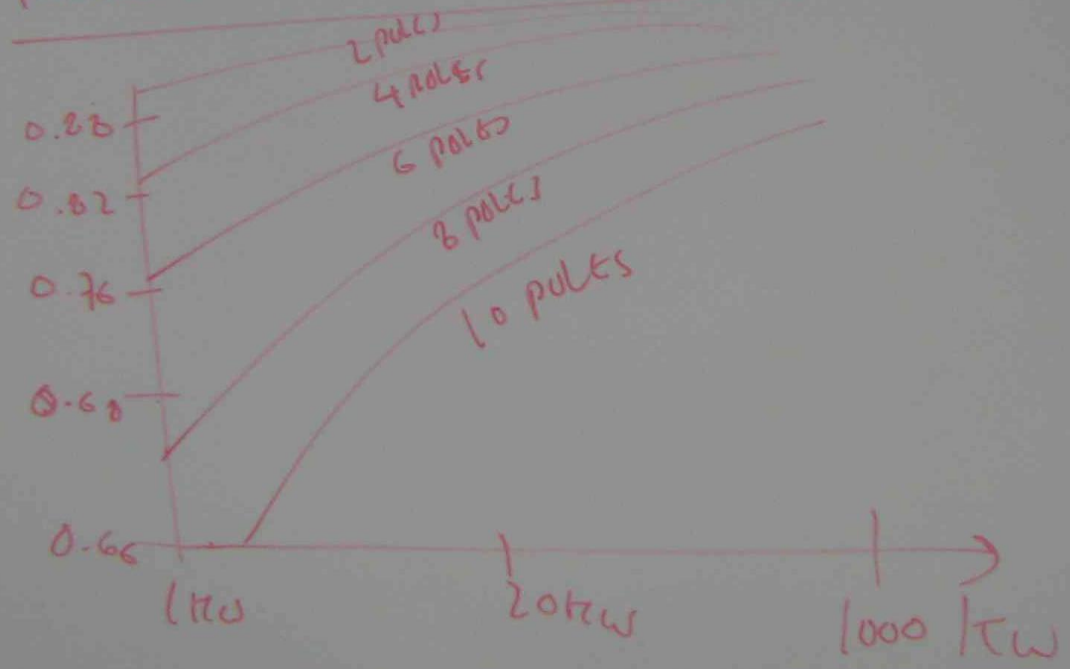


STARTING CURRENT of 3ϕ

INDUCTION MOTOR

450% ⟶ 600%

POWER FACTOR & EFFICIENCY



10 POLES

$$N = \frac{120\,f}{P}$$

$$= \frac{120 \times 50}{10}$$

$$= 600 \text{ rpm}$$

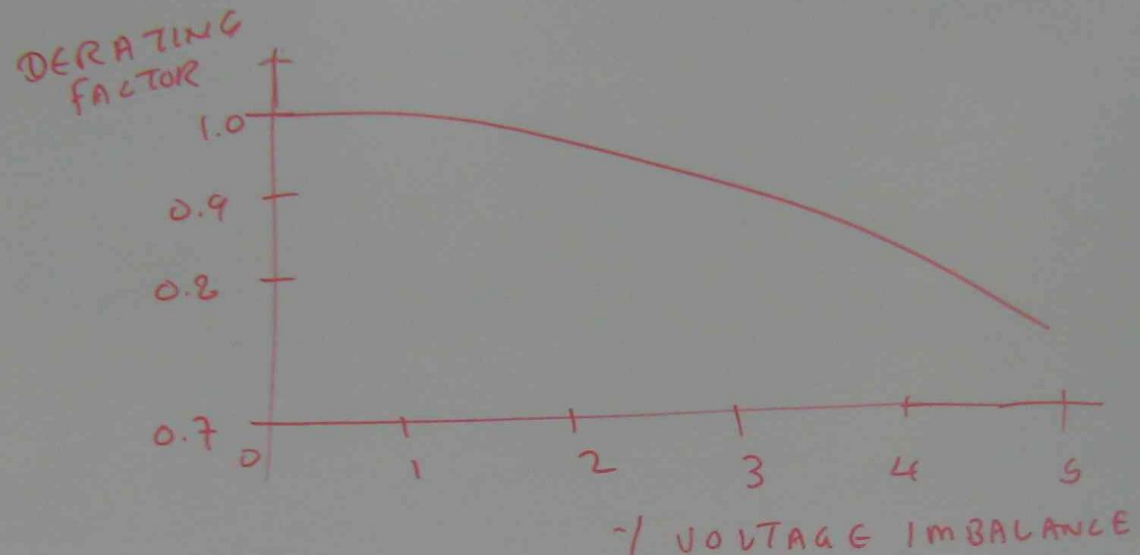
DUTY CYCLE AND CLASSES of RATING

IN THE DETERMINATION OF THE TYPE AND DESIGN of MOTOR, THE FOLLOWING TWO IMPORTANT FACTORS MUST BE CONSIDERED.

- THE DRIVING TORQUE MUST BE CAPABLE OF SUPPLYING THE MAXIMUM TORQUE LIKELY TO BE ENCOUNTERED AT ANY TIME
- TO AVOID DAMAGE TO THE INSULATION OF THE WINDINGS, THE RESULTING TEMPERATURE RISE MUST NOT EXCEED TO RATED VALUE.

70%, 80% of CONTINUOUS RATING

RELATIONSHIP BETWEEN % VOLTAGE IMBALANCE AND DERATING FACTOR



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