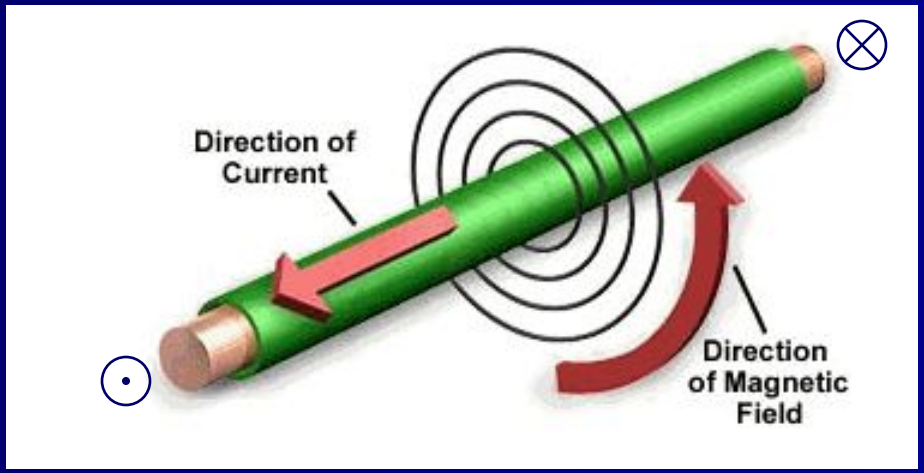
Motors

Motors

Motors convert Electrical energy into Mechanical energy

Magnetic Fields

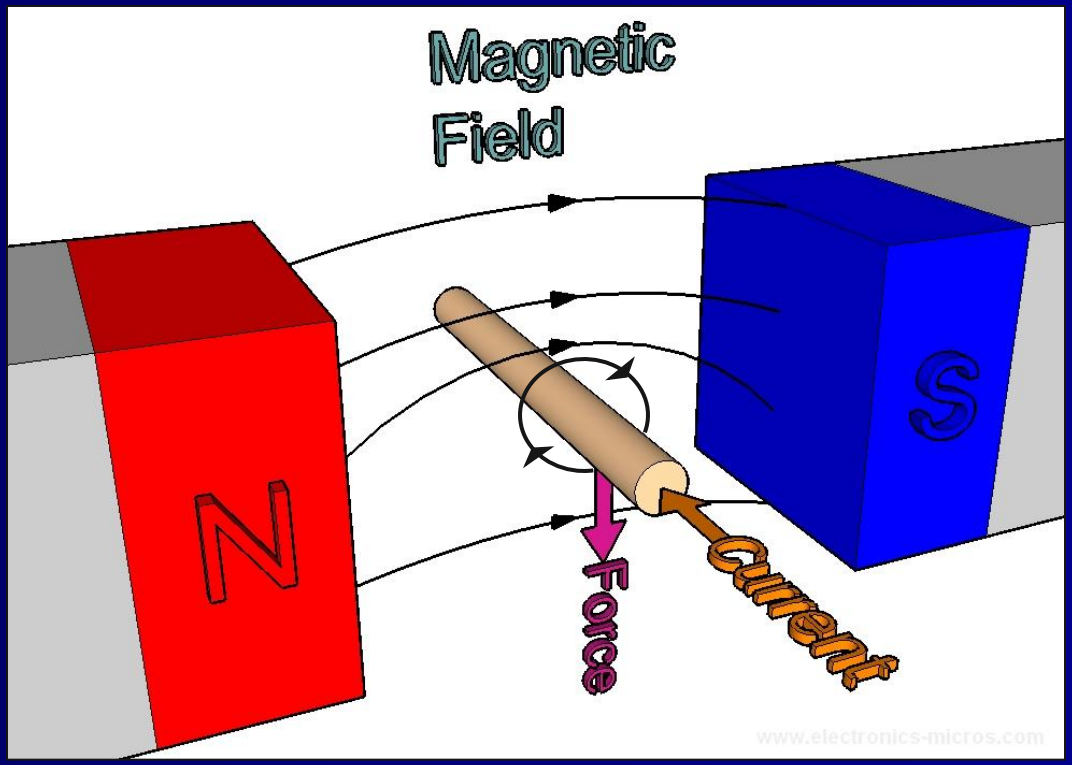
When current flows in a conductor it produces a magnetic field about it - as shown below



Using the corkscrew rule we can see that the field is moving in an anticlockwise direction as we look at it.

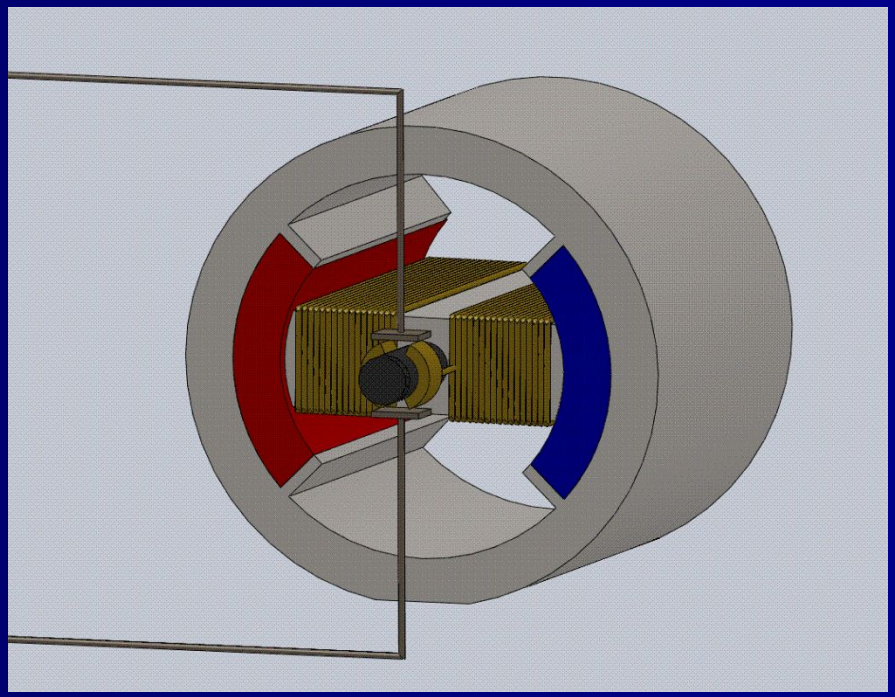
Motion

When the current-carrying conductor is placed within an external magnetic field, the two fields interact and a force is exerted on the conductor (Flemings Left Hand Rule)

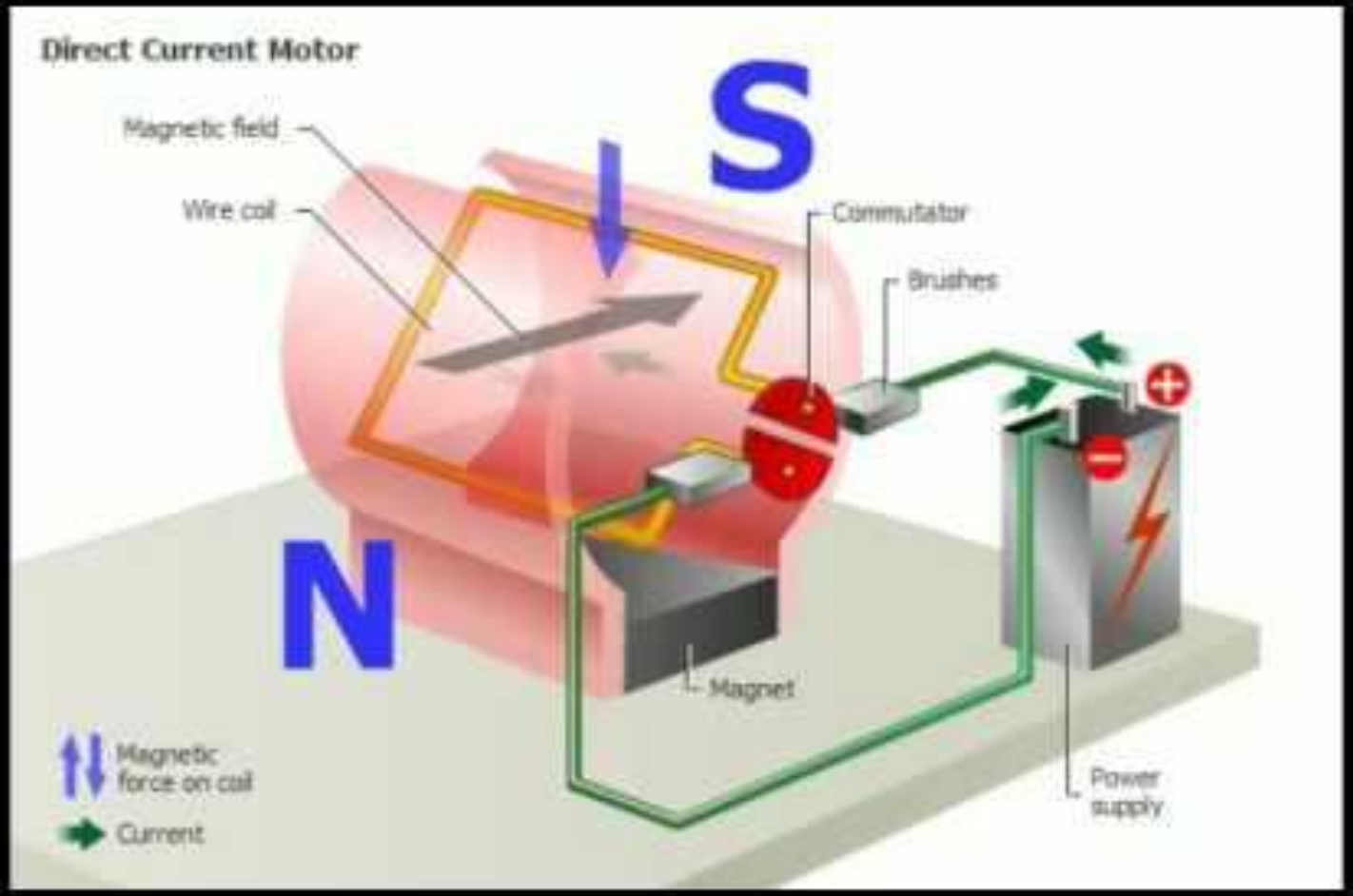


Basic DC Motor

If the current-carrying conductor is placed within an external magnetic field and coiled in a loop the conductor field can be increased in strength, the fields interact on both sides of the loop and a force is exerted on the conductors to make them rotate

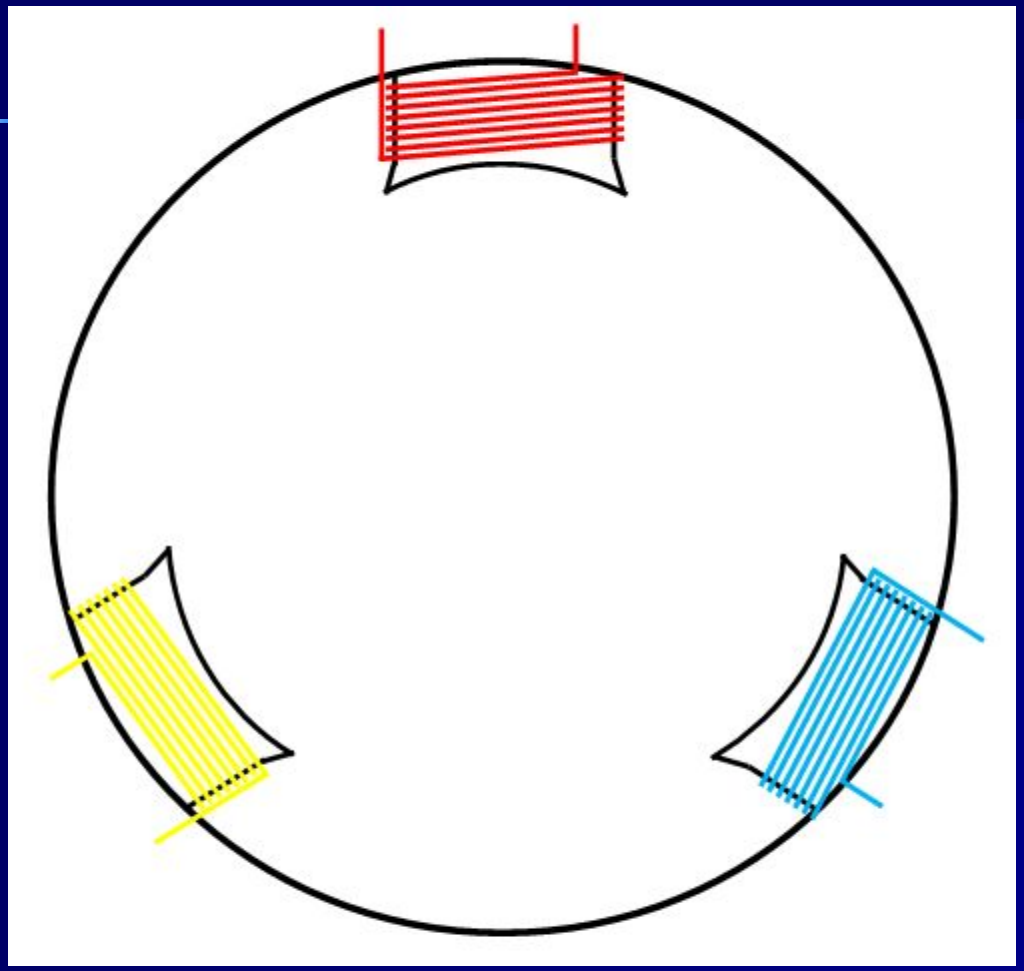


DC MOTOR



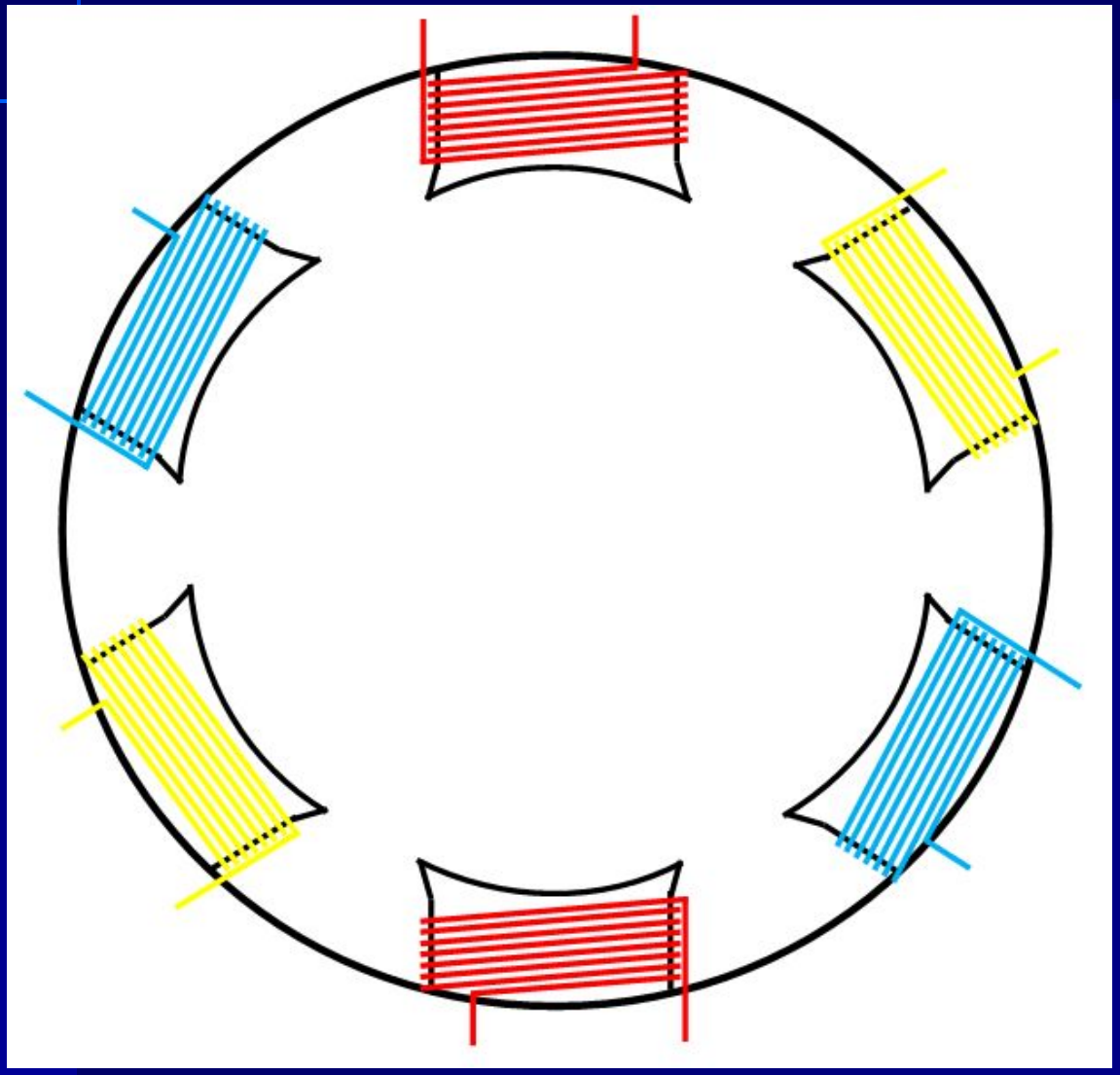
3 Phase Electric Motor

Three Phase AC Winding

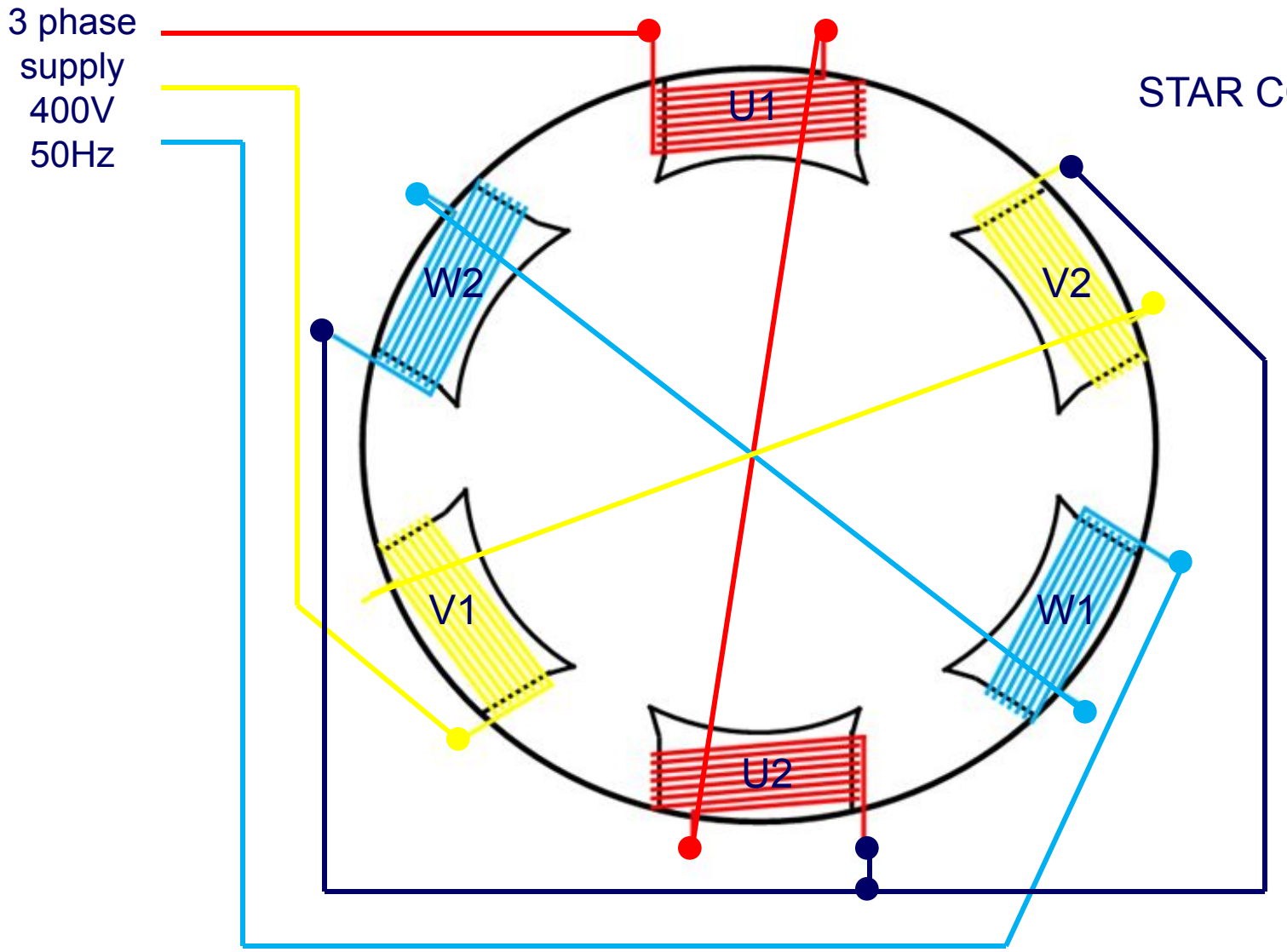


With three windings we can position them 120^0 apart to give us 3 pole faces

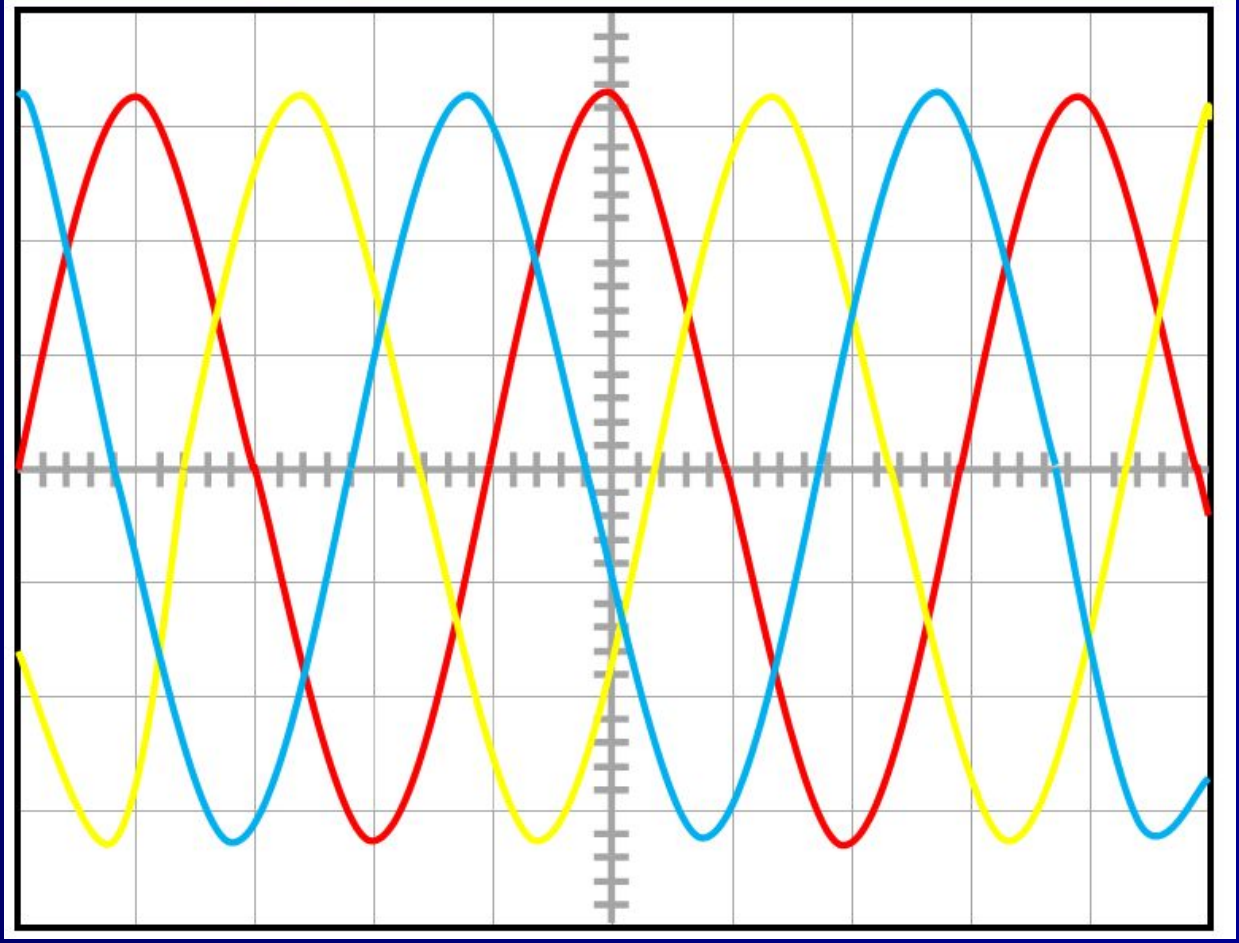
Three Phase AC Motor

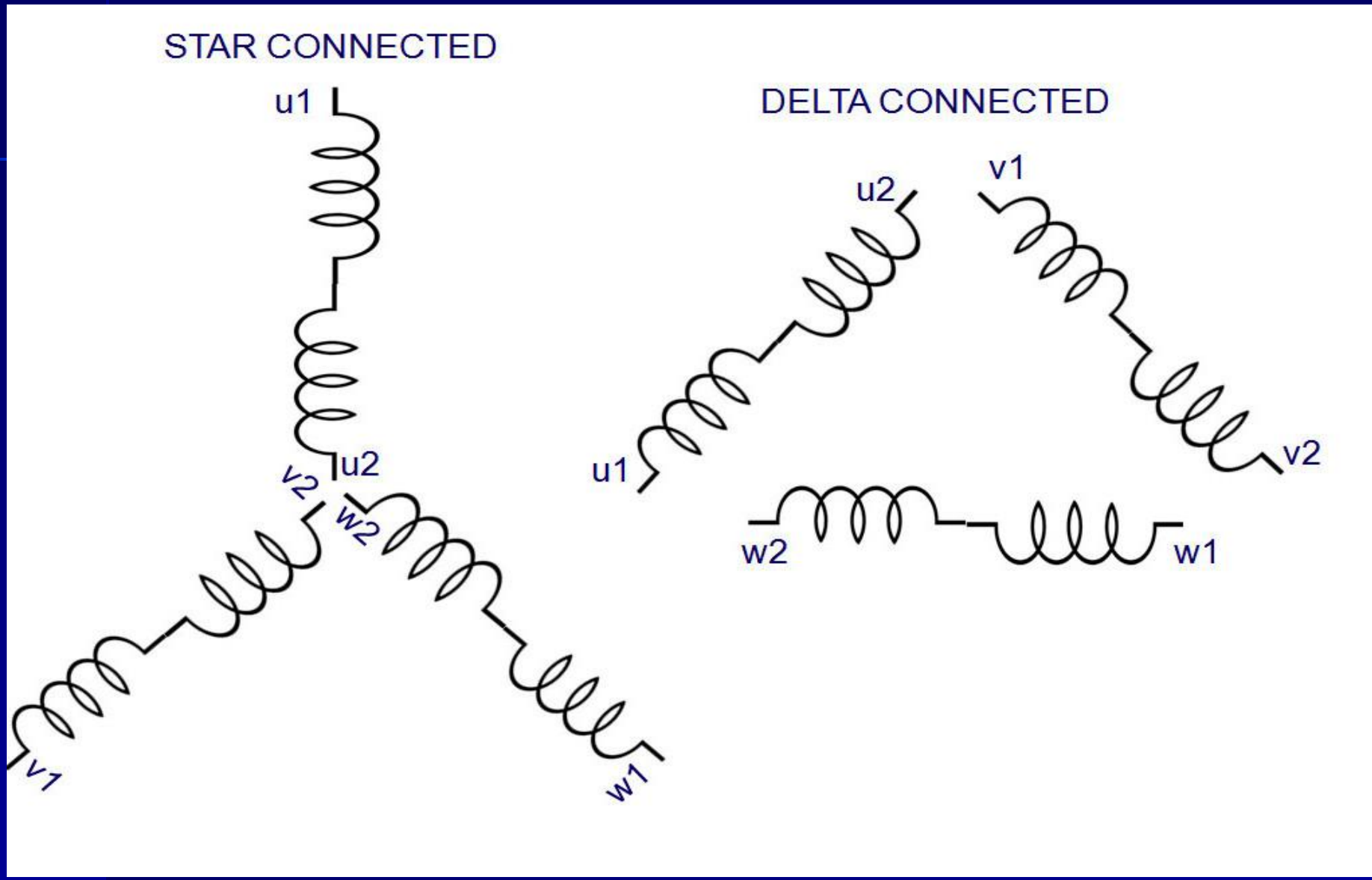


In practice we would wind to give us pole pairs for alternate pole faces to create what would appear to be a rotating magnetic field

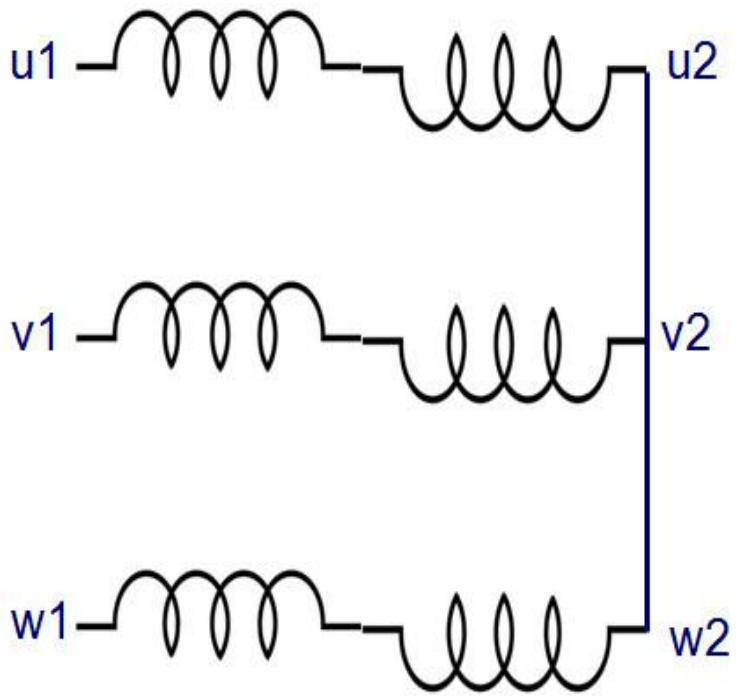

3 phase
supply
400V
50Hz
STAR CONNECTED
U1
W2
V2
V1
W1
U2

Three Phase Supply Rotation

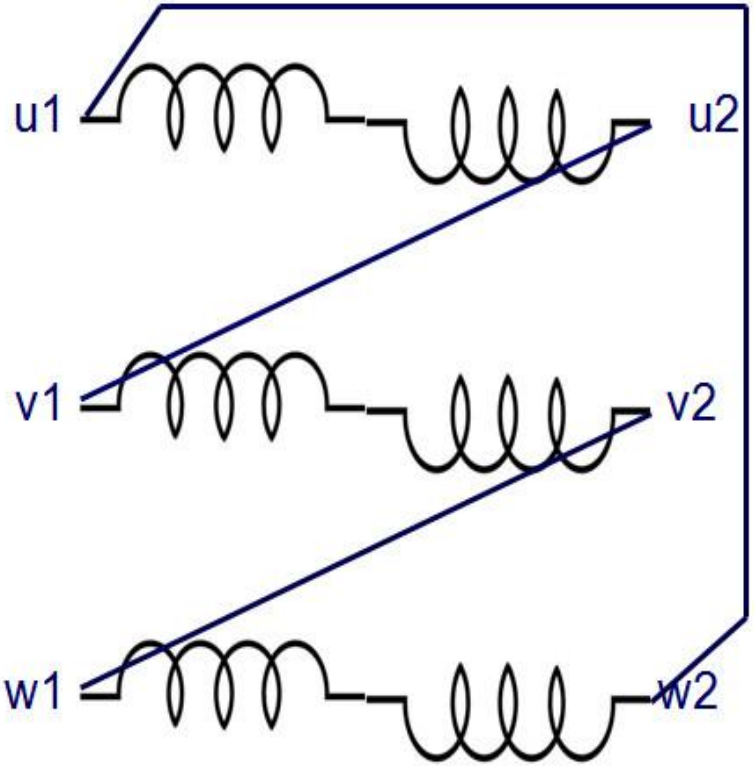




STAR CONNECTED



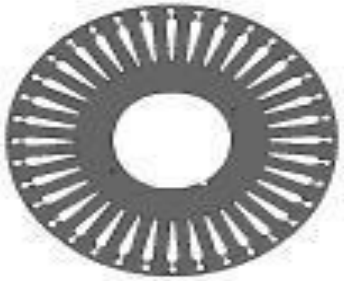
DELTA CONNECTED



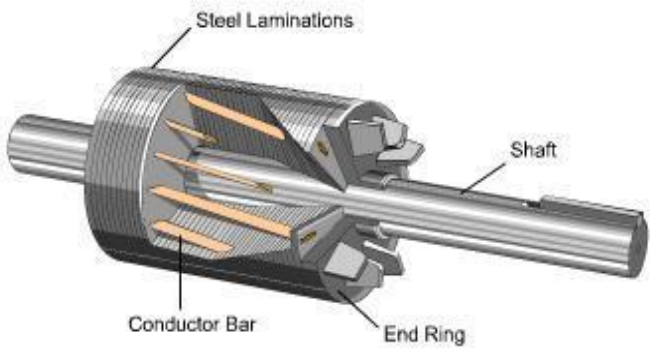
AC Cage Induction Motor

Cage Rotor

Rotor



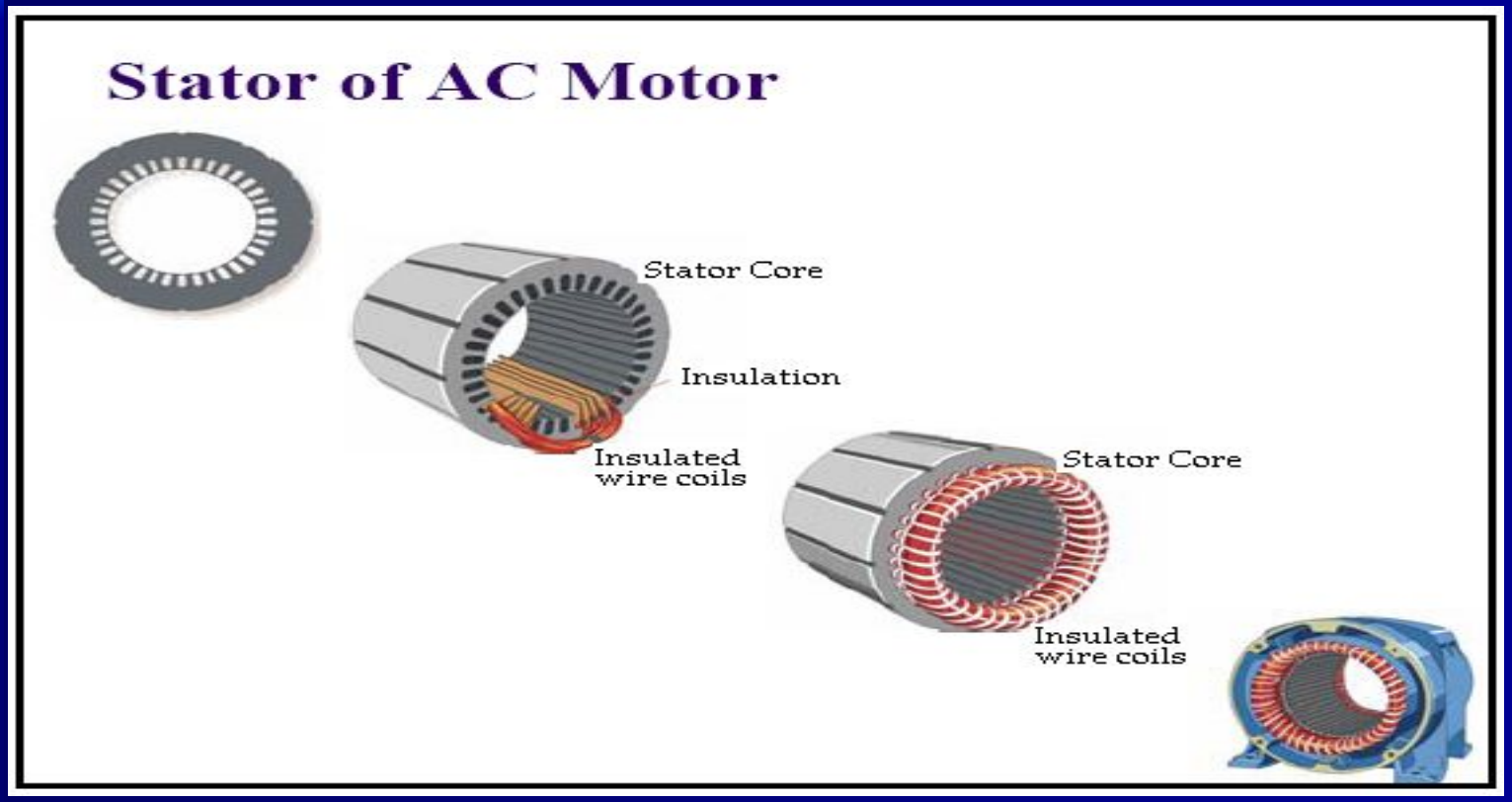
Rotor Lamination



Cutaway View of Rotor

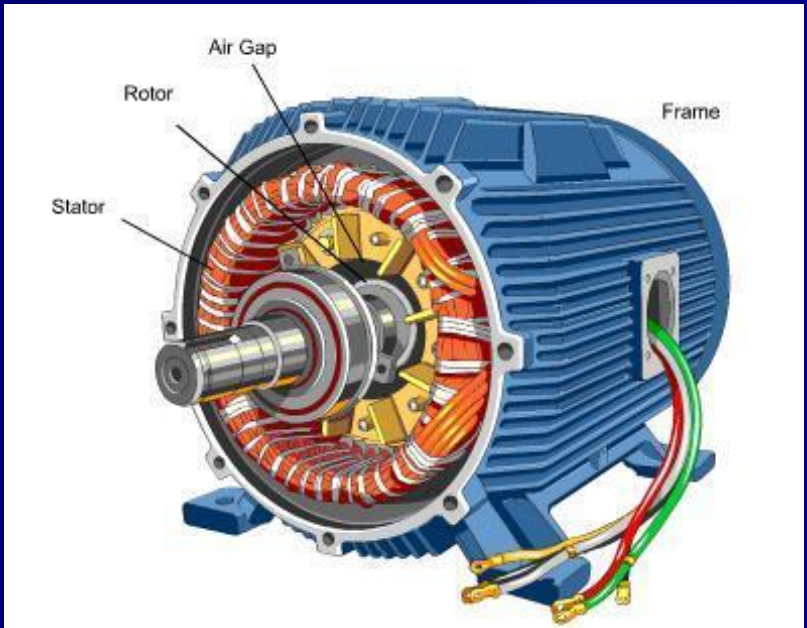
AC Cage Induction Motor

This machine uses the same basic principles of motors but also utilises some of the technology of generators and is essentially consisting of two main parts



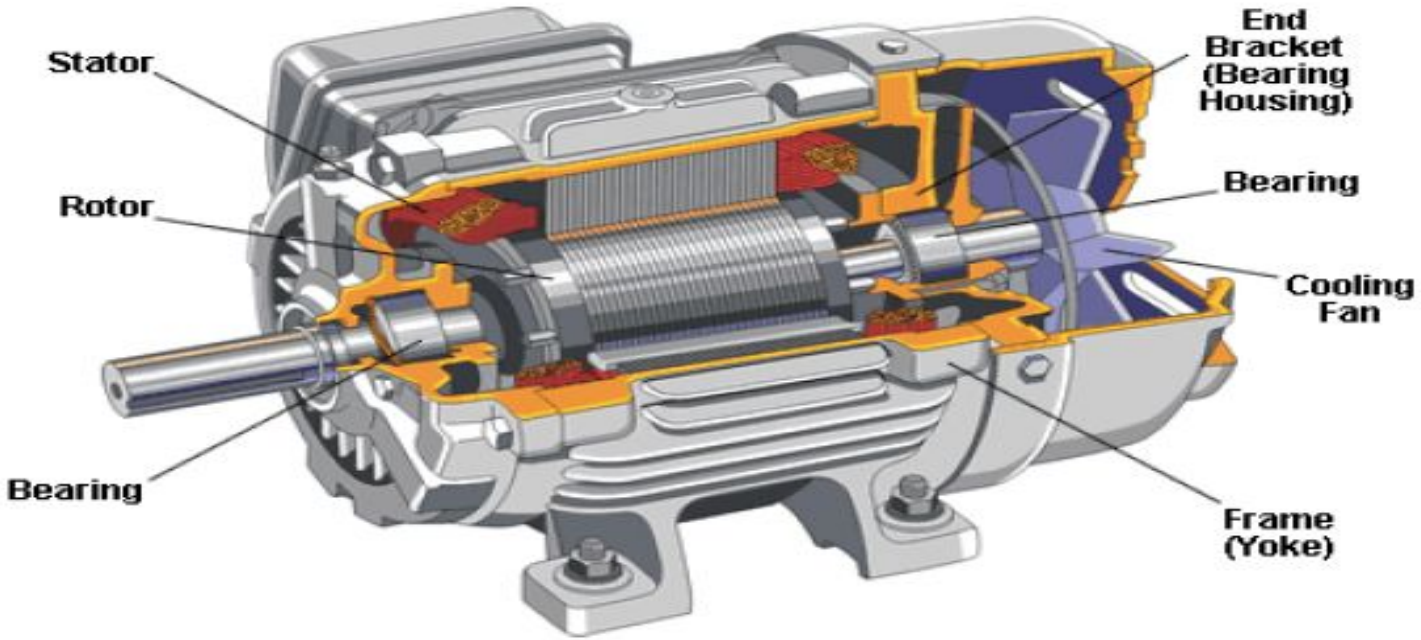
Three Phase AC Motor

- It has three pairs of electromagnets, connected to one of the three phases of the power supply.
- It provides a lot higher power that a single phase motor can deliver.

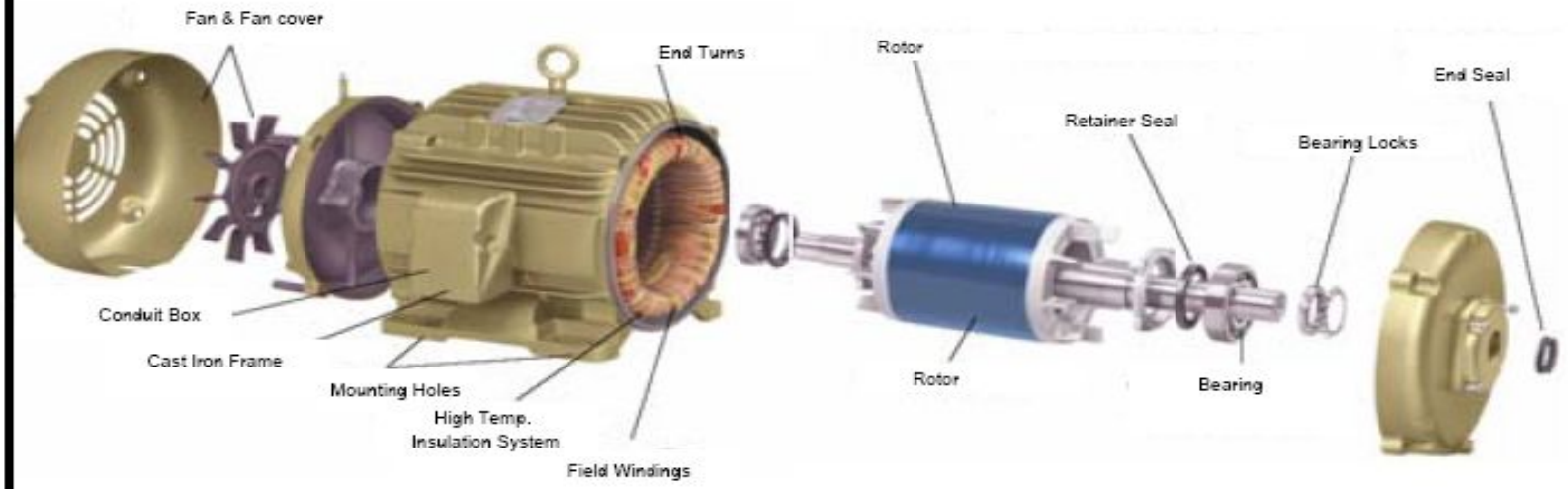


Partially Assembled Motor

Parts of AC Motor

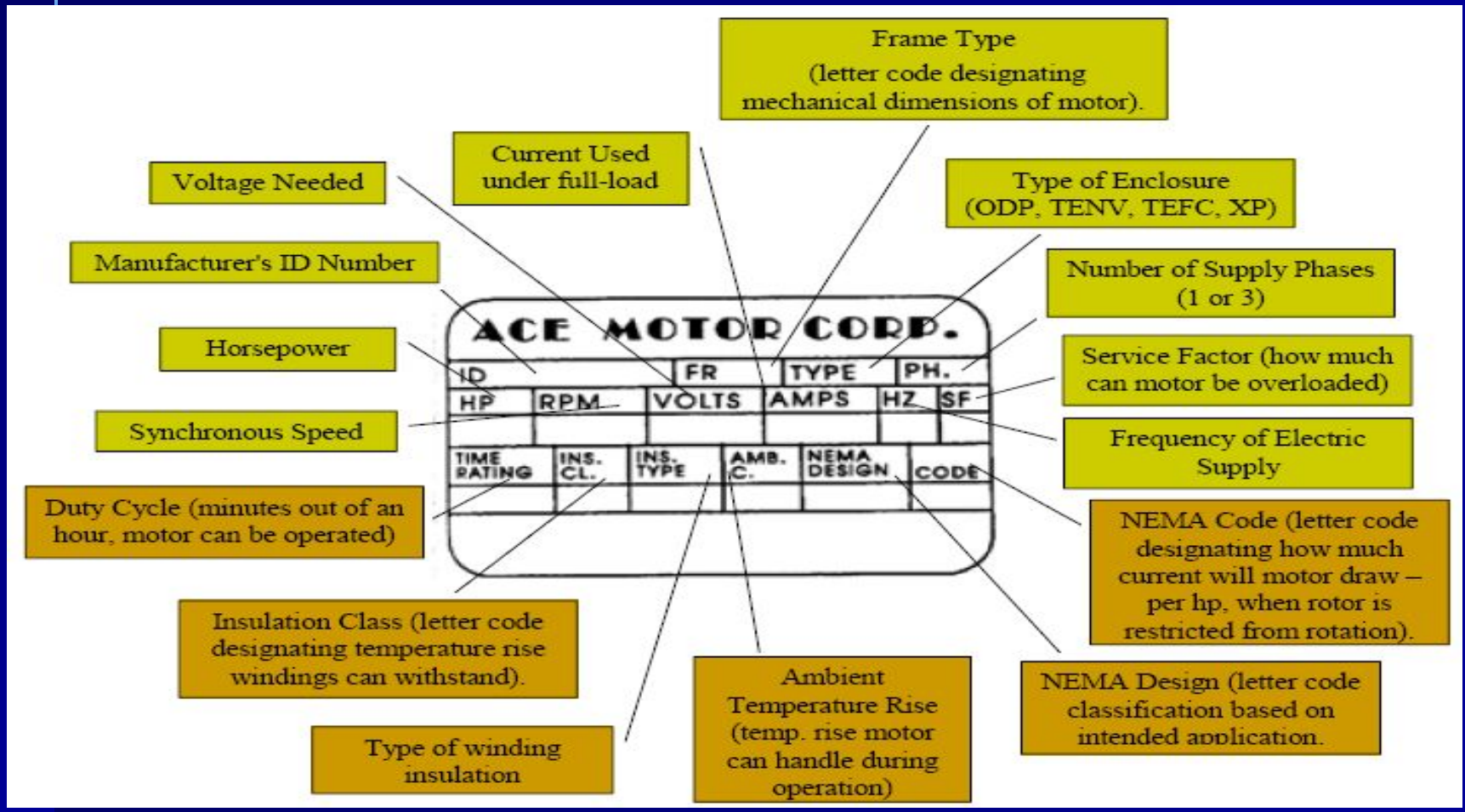


Parts of AC Motor



AC Motor Data Plate

Each motor has a plate mounted on its frame, with electrical and mechanical information.



Full Load Current (FLC) Rating of Motor

A 3 phase motor is connected in star and has a label with the following information.

Volts 415, KW = 5.5, Hz = 50 $\cos\theta = 0.85$

What would be the flc rating of this motor

$IL = P (W) / \sqrt{3} \times VL \times \cos\theta$

5500 / 610.98 = flc = 9 Amps

See manufactures motor fuse rating chart for fuse rating

Slip Speed in an Induction Motor

The non synchronous speed of a cage rotor is known as the slip speed.

Slip speed is the difference between the synchronous and rotor speed of the induction motor. The emf induces in the rotor because of the relative motion, or we can say the slip speed of the motor.