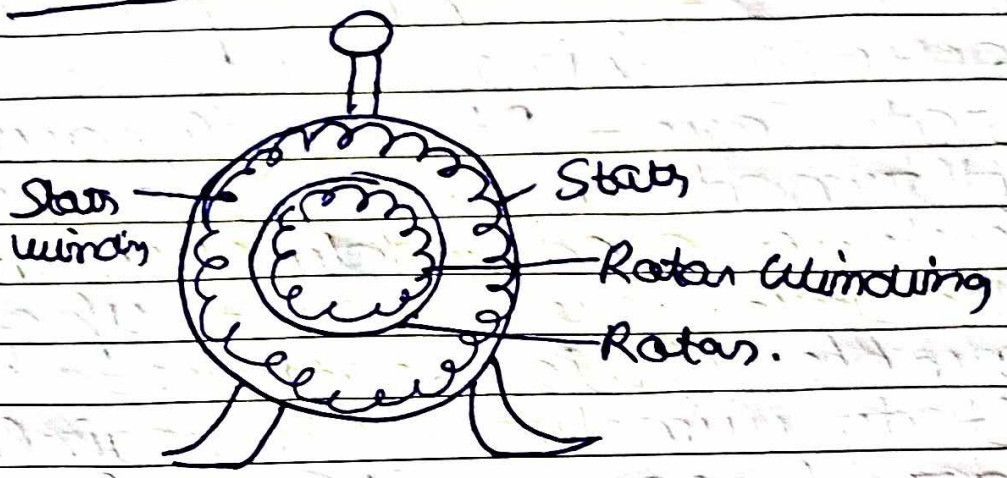
3-ϕ Induction Motor:



↳ Stator

(i) Stator frame
(ii) Stator core
(iii) Stator winding

↳ Rotator

(i) SQIG – Res. is fixed
(ii) ~~Phase Wound~~ Phase wound Rotor – Res is Variable.

Construction:

It mainly have two parts stator and rotor

Stator:

It is the stationary part of the motor and has 3 main parts
→ outer frame, stator core & stator winds

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outerframe - its main function is to support the and the to protect the inner part of the core. machine.

Stater Core - It mainly carri the Alternating MF which produce hysteresis and eddy currents loss. therefore core is built up of high grade silicone steel.

Stater winding - It mainly carries a 3 phase winding which is mainly supplies from 3-phase supply system.

Rotor:

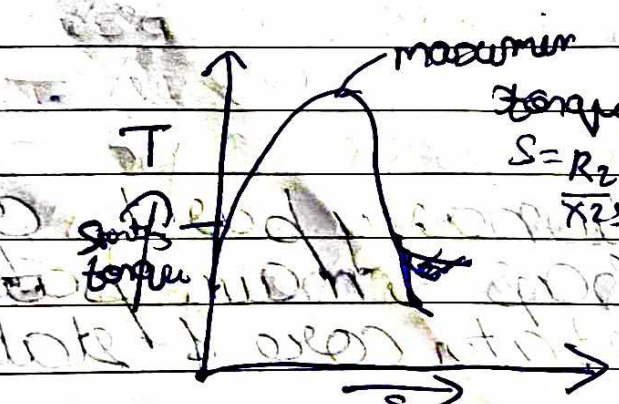
It is the rotating part of the motor and they are of two types.

→ SQIG

→ Phase bound rotor / Slipring rotor.

Torque Slip Curve:

$$T = \frac{3}{\omega_s} \cdot \frac{S E_2^2 R_2}{(R_2^2 + S X_2^2)} \qquad S = \frac{N_s - N_R}{N_s}$$



~~Case I~~ — S is the Slip
R_2 and X_2 are the resistance and reactance of the rotor.

Case I — At synchronous speed, slip is zero.

Case II — When rotor speed is very near to the synchronous speed that is when this slip is very low the term $(SX_{2S})^2$ is very less than and is neglected.

$$[(SX_{2S})^2 << R_2^2].$$

$$\boxed{T = \frac{3}{\omega_S} \cdot \frac{SE_{2S}^2 R_2}{R_2^2} = KS} \quad \boxed{T \propto KS}$$

Case III — As the slip increases torque increases and attains its maximum value

$$R_2 = SX_{2S}$$

$$\boxed{S = \frac{R_2}{X_{2S}}}$$

This maximum value of torque is known as breakdown or pullout torque. It will fall down.

Case IV — With further increase in slip due to increase in

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load beyond the point of max torque ($s = R_2/X_{2s}$). The value of slip will be more and value of resistance is negligible.

$$[(S X_{2s})^2 \gg R_2^2]$$

$$T \propto \frac{1}{S}$$

Hence, at high value of slip (the slip beyond the maximum torque, torque is inversely proportional to slip).
Hence, with the increase of slip beyond the point of maximum torque due to increase in load torque decreases. The result is that the motor couldn't pick up the maximum load and slows down and finally it comes to rest position.

Speed Control of 3ϕ Induction Motor

→ By change in the value of slip.
→ By running the motor at specified load (maintaining value of Res & Reactance)
→ By change in the no. of poles
→ By change in slight variation in the frequency (±2%).
→ By control in input voltage. (±1%)