

INDUCTION MOTOR

INTRODUCTION

- An induction motor is an alternating current motor in which the primary winding on one member (usually the stator) is connected to the power source and a secondary winding or a squirrel-cage secondary winding on the other member (usually the rotor) carries the induced current.
- There is no physical electrical connection to the secondary winding, its current is induced
- Two or three-phase induction motors have their windings, one for each phase, evenly divided by the same number of electrical degrees.
- Reversal of the two-phase motor is accomplished by reversing the current through either winding.
- Reversal of a three-phase motor is accomplished by interchanging any two of its connections to the line.
- Poly phase motors are used where a poly phase (3-phase) power supply is available and is limited primarily to industrial applications.
- Starting and reversing torque characteristics of poly phase motors are exceptionally good. This is due to the fact that the different windings are identical and, unlike the capacitor motor, the currents are balanced.
- The Induction motor is a three-phase AC motor and is the most widely used machine.

Its characteristic features are

- Simple and rugged construction
- Low cost and minimum maintenance
- High reliability and sufficiently high efficiency
- No need of extra starting motor and need not be synchronized

CONSTRUCTION

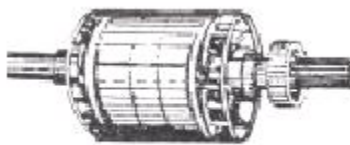
An Induction motor has basically two parts – Stator and Rotor

Stator:

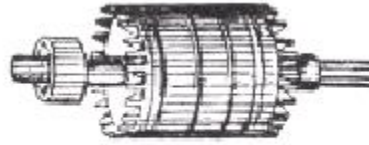
- The part of an AC induction motor's magnetic structure, which does not rotate.
- It usually contains the primary winding. The stator is made up of laminations with a large hole in the center in which the rotor can turn; there are slots in the stator in which the windings for the coils are inserted.
- The Stator is made up of a number of stampings with slots to carry three phase windings. It is wound for definite number of poles.
- The windings are geometrically spaced 120 degrees apart.

Rotor:

- Two types of rotors are used in Induction motors.
- A squirrel-cage rotor consists of thick conducting bars embedded in parallel slots.
- These bars are short-circuited at both ends by means of short-circuiting rings.

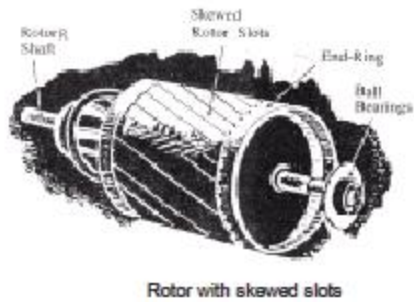


Squirrel cage rotor



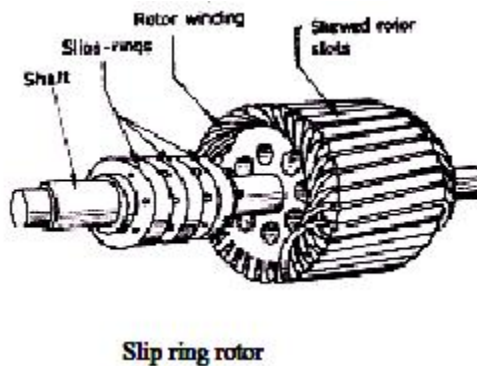
Rotor with shaft and bearings

- The rotor slots are usually not quite parallel to the shaft but are purposely given a slight skew.
- It helps to make the motor run quietly by reducing the magnetic hum.
- It helps in reducing the locking tendency of the rotor i.e. the tendency of the rotor teeth to remain under the stator teeth due to direct magnetic attraction between the two.



¾ WOUND ROTOR

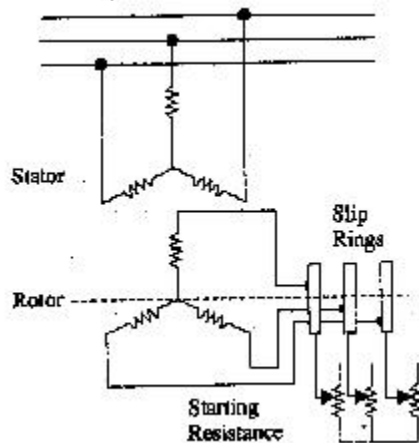
- A wound rotor has three-phase, double-layer, distributed winding. It is wound for as many poles as the stator.
- It is always wound 3-phase even when the stator is wound two- phase. The three phases are starred internally. The other three winding terminals are brought out and connected to three insulated slip rings mounted on the shaft with brushes resting on them.
- These three brushes are further externally connected to a 3-phase star connected rheostat
- This makes possible the introduction of additional resistance in the rotor circuit during the Starting period for increasing the starting torque of the motor.



- When running under normal conditions, the slip rings are automatically short-circuited by means of a metal collar, which is pushed along the shaft and connects all the rings together.

- The brushes are automatically lifted from the slip rings to reduce the frictional losses and the wear and tear.

- Hence, it is seen that under normal running conditions, the wound rotor is short-circuited on itself just like the squirrel-case rotor.



1. Frame:

Made of close-grained alloy cast iron.

2. Stator and Rotor Core:

Built from high-quality low-loss silicon steel laminations and flash enameled on both sides.

3. Stator and Rotor Windings:

Have moisture proof tropical insulation embodying mica and high quality varnishes. Are carefully spaced foremost effective air circulation and are rigidly braced to withstand centrifugal forces and any short-circuit stresses.

4. Air-gap:

The stator rabbets and bore are machined carefully to ensure uniformity of air - gap.

5. Shafts and Bearings:

Ball and roller bearings are used to suit heavy duty, trouble-free running and for enhanced service life.

6. Fans:

Light Aluminium fans are used for adequate circulation of cooling air and are securely keyed onto the rotor shaft.

7. Slip rings and Slip-ring Enclosures

- Slip rings are made of high quality phosphor bronze and are of molded construction.
- The three phases are connected internally and the other ends are connected to slip rings mounted on shaft with brushes resting on them.
- The brushes are connected to an external resistance that does not rotate with the rotor and can be varied to change the N-T characteristics.

In fact an Induction motor can be compared with a transformer because of the fact that just like a transformer it is a singly energized device which involves changing flux linkages with respect to a primary (stator) winding and Secondary (rotor) winding.



A view of three phase induction motor

Source : <http://mediatoget.blogspot.in/2011/06/induction-motor.html>