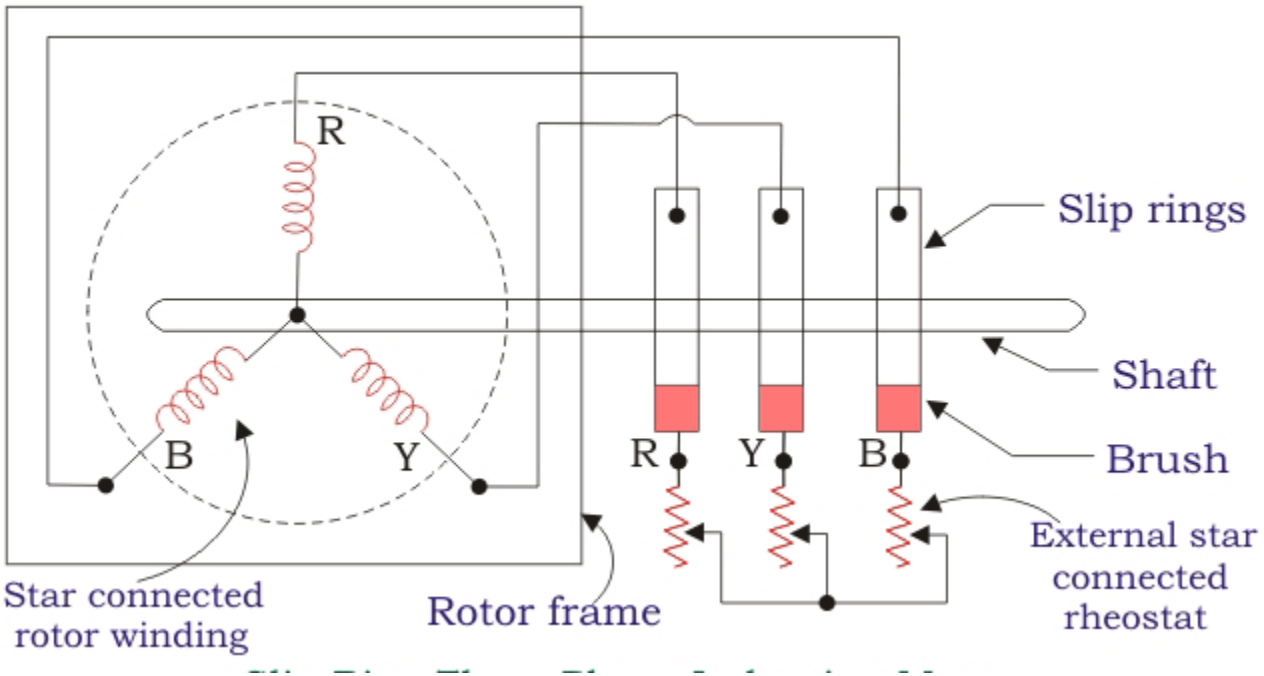
3-PHASE AC INDUCTION MOTORS

For industrial and mining applications, **3-phase AC induction motors** are the prime movers for the vast majority of machines. These motors can be operated either directly from the mains or from adjustable variable frequency drives. In modern industrialized countries, more than half the total electrical energy used in those countries is converted to mechanical energy through AC induction motors.

Applications;

- **Drive pumps,**
- **fans,**
- **compressors,**
- **mixers,**
- **agitators,**
- **mills,**
- **conveyors,**
- **crushers,**
- **machine tools,**
- **cranes, etc, etc.**

Diagram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Slip rings
Shaft
Brush
External star connected rheostat
Star connected rotor winding
Rotor frame

Basic construction

The AC induction motor comprises 2 electromagnetic parts:

- Stationary part called the stator
- Rotating part called the rotor, supported at each end on bearings

The stator and the rotor are each made up of:

- An electric circuit, usually made of insulated copper or aluminum, to carry current
- A magnetic circuit, usually made from laminated steel, to carry magnetic flux

THE STATOR

The stator is the outer stationary part of the motor, which consists of:
The outer cylindrical frame of the motor, which is made either of welded sheet steel, cast iron or cast aluminum alloy. This may include feet or a flange for mounting.

The magnetic path, which comprises a set of slotted steel laminations pressed into the cylindrical space inside the outer frame. The magnetic path is laminated to reduce eddy currents, lower losses and lower heating.

A set of insulated electrical windings, which are placed inside the slots of the laminated magnetic path. The cross-sectional area of these windings must be large enough for the power rating of the motor. For a 3-phase motor, 3 sets of windings are required, one for each phase.

THE ROTOR

This is the rotating part of the motor.

As with the stator above, the rotor consists of a set of slotted steel laminations pressed together in the form of a cylindrical magnetic path and the electrical circuit.

The electrical circuit of the rotor can be either:

Wound rotor type, which comprises 3 sets of insulated windings with connections brought out to 3 sliprings mounted on the shaft. The external connections to the rotating part are made via brushes onto the sliprings. Consequently, this type of motor is often referred to as a slipring motor.

Squirrel cage rotor type, which comprises a set of copper or aluminum bars installed into the slots, which are connected to an end-ring at each end of the rotor. The construction of these rotor windings resembles a 'squirrel cage'. Aluminum rotor bars are usually die-cast into the rotor slots, which results in a very rugged construction. Even though the aluminium rotor bars are in direct contact with the steel laminations, practically all the rotor current flows through the aluminum bars and not in the laminations

Advantage:

- They have very simple and rugged (almost unbreakable) construction
- they are very reliable and having low cost
- they have high efficiency and good power factor
- minimum maintenance required