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# FACULTY OF ENGINEERING & TECHNOLOGY

## Electrical Machine-ii

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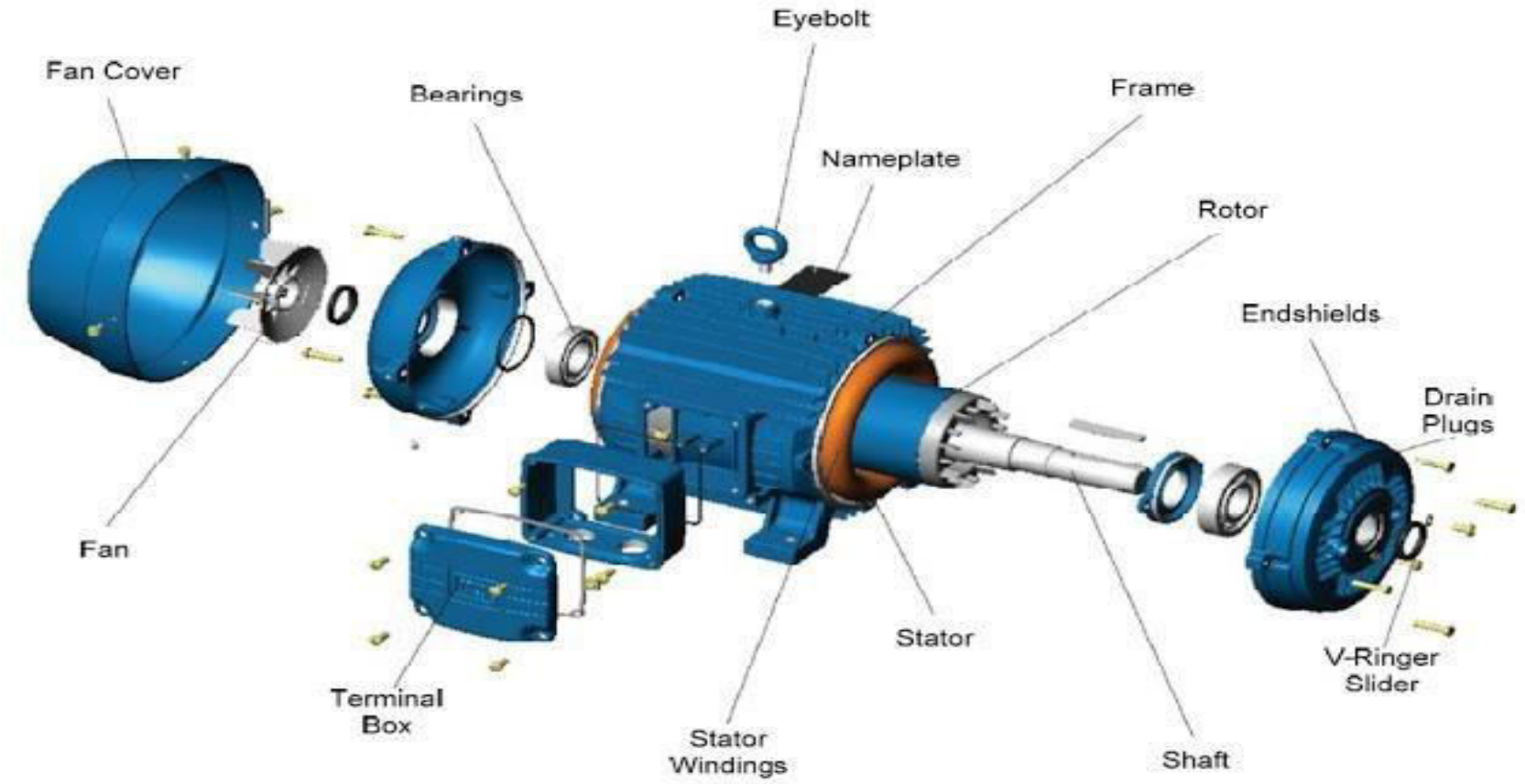
## ASSEMBLY OF 3-PH INDUCTION MOTER




A typical 3-phase induction motor [Courtesy of Electromotors WEG SA, Brazil]

## Principle of Operation I.M

When a 3 phase stator winding is connected to a 3 phase voltage supply, 3 phase current will flow in the windings, which also will induced 3 phase flux in the stator. These flux will rotate at a speed called a Synchronous Speed, $n_s$. The flux Is called as Rotating magnetic Field.

Synchronous speed is given by the expression $N_s = \frac{120f}{P}$

Where $p$ = is the number of poles, and

$f$ = the frequency of supply

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❖This rotating magnetic field cuts the rotor windings and produces an induced voltage in the rotor windings

❖Due to the fact that the rotor windings are short circuited, for both squirrel cage and wound-rotor, and induced current flows in the rotor windings

❖The rotor current produces another magnetic field

❖A torque is produced as a result of the interaction of those two magnetic fields

$$\tau_{ind} = kB_R \times B_s$$

Where $\tau_{ind}$ is the induced torque and $B_R$ and $B_S$ are the magnetic flux densities of the rotor and the stator respectively

# SLIP

- The force exerted by the rotor bars causes the rotor to turn in the direction of the rotating magnetic field.
- The difference between the rotor speed, $n_r$, and the synchronous speed, $ns$, is called the **Slip Speed**.

$$\text{Slip Speed} = n_s - n_r \quad (\text{rpm or rev/s})$$

- The ratio $(n_s - n_r)/ n_s$ is called the **Fractional Slip** or just the **Slip**, s, and is usually expressed as a percentage. Thus

$$Slip\ ,\ S = (n_s - n_r)/ n_s$$

- Typical values of slip between no load and full load are about 4 to 5 per cent for small motors and 1.5 to2 per cent for large motors.

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## Rotor E.M.F. and Other Parameters

### • Rotor e.m.f

When an induction motor is stationary, the stator and rot

- when running, rotor e.m.f. per phase = $E_r = SE_2$
- $$E_2 = S \frac{N_2}{N_1} E_1$$