4.5 Magnetic leakage calculations & Operating characteristics

Magnetic leakage calculations

Leakage factor or Leakage coefficient LC.

All the flux produced by the pole will not pass through the desired path i.e., air gap. Some of the flux produced by the pole will be leaking away from the air gap. The flux that passes through the air gap and cut by the armature conductors is the useful flux

$$\phi_P = \phi + \phi_l$$

As the leakage flux is generally around (15 to 25)% of ϕ,

$$\phi_P = \phi + (0.15\ to\ 0.25)\phi$$

$$\phi_P = \phi * LC$$

and that flux that leaks away from the desired path is the leakage flux where LC is the Leakage factor or Leakage coefficient and lies between (1.15 to 1.25). Magnitude of flux in different parts of the magnetic circuit.

Leakage reactance of polyphase machines:

Leakage reactance = 2πf x inductance = 2πf x Flux linkage / current

Note:

1. Useful flux: It is the flux that links with both primary and secondary windings and is responsible in transferring the energy Electro-magnetically from primary to secondary side. The path of the useful flux is in the magnetic core.
2. Leakage flux: It is the flux that links only with the primary or secondary winding and is responsible in imparting inductance to the windings. The path of the leakage flux depends on the geometrical configuration of the coils and the neighboring iron masses.

Magnetizing current:

Effect of magnetizing current and its effect on the power factor can be understood from the phasor diagram of the induction motor shown in Fig.

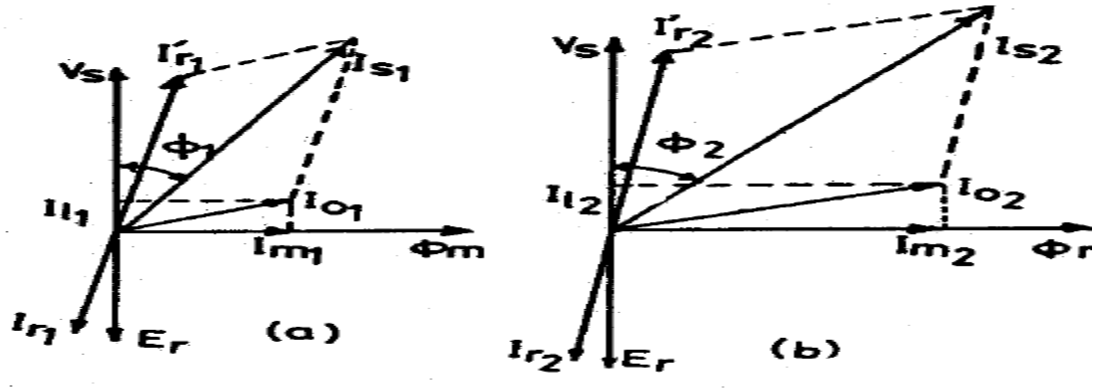

Figure 4.5.1 Phasor diagram of induction motor

[Source: "A Course in Electrical Machine Design" by A.K.Sawhney, page-10.48]

Magnetizing current and power factor being very important parameters in deciding the performance of induction motors, the induction motors are designed for optimum value of air gap or minimum air gap possible. Hence in designing the length of the air gap following empirical formula is employed.