

Sheet (1)

Poly-Phase Induction Motor

Problem: 1 A 208-V, 10-hp, four-pole, 60-Hz, Y-connected induction motor has a full-load slip of 5 percent.

- (a) What is the synchronous speed of this motor?
- (b) What is the rotor speed of this motor at the rated load?
- (c) What is the rotor frequency of this motor at the rated load?
- (d) What is the shaft torque of this motor at the rated load?

Problem: 2 A 480-V, 60-Hz, 50-hp, three-phase induction motor is drawing 60 A at 0.85 PF lagging. The stator copper losses are 2 kW, and the rotor copper losses are 700 W. The friction and windage losses are 600 W, the core losses are 1800 W, and the stray losses are negligible. Find the following quantities:

- (a) The air-gap power P_{AG}
- (b) The power converted P_{conv}
- (c) The output power P_{out}
- (d) The efficiency of the motor

Problem: 3 A 460-V, 25-hp, 60-Hz, four-pole, Y-connected induction motor has the following impedances in ohms per phase referred to the stator circuit:

$$\begin{aligned} R_1 &= 0.641 \, \Omega & R_2 &= 0.332 \, \Omega \\ X_1 &= 1.106 \, \Omega & X_2 &= 0.464 \, \Omega & X_M &= 26.3 \, \Omega \end{aligned}$$

The total rotational losses are 1100 W and are assumed to be constant. The core loss is lumped in with the rotational losses. For a rotor slip of 2.2 percent at the rated voltage and rated frequency, find the motor's

- (a) Speed
- (b) Stator current
- (c) Power factor
- (d) P_{conv} and P_{out}
- (e) τ_{ind} and τ_{load}
- (f) Efficiency