Tutoria1 7

Real, reactive, apparent power, power factor and power factor correction

1. A 440 V, 50 Hz, star-connected induction motor takes a line current of 50 A at a power factor of 0.8 lagging. A three-phase capacitor bank, connected in star, is to be used to improve the power factor to 0.95 lagging. Determine the capacitance of each capacitor.
Ans: C = 211 μF

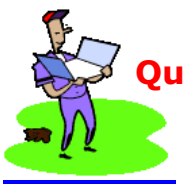
2. A 415 V, 50 Hz, three-phase distribution system supplies a 20 kVA, three-phase induction motor load at a power factor of 0.8 lagging, and a star-connected set of impedances, each having a resistance of 10 Ω in series with an inductive reactance of 8 Ω. Calculate the phase capacitance of delta-connected capacitors required to improve the overall power factor to 0.95 lagging.
Ans: C = 72.1 μF

3. A three-phase, 50 hp (1 hp = 746 W), 440 V, 50 Hz induction motor operates on full load with an efficiency of 89% and at a p.f. of 0.85 lagging. Calculate the total kVA rating of capacitors required, to raise the full load p.f. to 0.95 lagging. What will be the capacitance per phase if the capacitors are
(a) delta-connected, and
(b) star-connected.
Ans: S_C = 12.193 kVA, C_Δ = 66.77 μF, C_Y = 200.27 μF

4. A 3-phase, 50 Hz induction motor is connected to a 3-phase 450V, 50 Hz, power supply. The motor has 4000 W output power on full-load operation. If the efficiency of the motor running on full load is 89%, calculate the input power of the motor.
(a) If the power factor of the motor running on full load is 0.8 lagging, calculate its apparent input power at full load.
(b) Calculate the reactive input power supplied to the motor on full load.
(c) Calculate the total kVA rating of the capacitor bank required, to raise the full load power factor to 0.95 leading.
(d) Calculate the capacitance per phase if the 3 balanced capacitors are connected in delta.

Ans: S = 5.618 kVA, Q = 3.373 kVAR, S_C = Q_C =4.85 kVA, C = 25.39 μF

5. A 400 V, 60 Hz distribution system supplies a 15 kVA three-phase motor at a power factor of 0.7 lagging. A three-phase capacitor bank of 6 kVAR is connected across the motor terminals to improve the power factor. Determine the new power factor.
Ans: 0.912 (lagging)



Quiz – 2 questions