Answer on Question #81370 - Engineering - Electrical Engineering

A small motor rated at 50 Va, 120 V and with a power factor of 0.65 lagging.
a) Determine the current of the motor.
b) What is the capacitance of the capacitor to be connected across the motor to make the power factor 0.94?
c)What will be the line current upon the addition of the capacitor?

Solution

a) The current is:

$$I = \frac{S}{V} = \frac{50}{120} = 0.42 \text{ A}.$$

b) With old power factor:

$$P = S\cos\varphi = 50 \cdot 0.65 = 32.5 \text{ W}$$

With new power factor:

$$S_n = \frac{P}{0.94} = 34.57 \text{ V} \cdot \text{A}.$$

A capacitor affects reactive (and complex) power and does not affect active power, so:

$$S_n{}^2 = P^2 + Q^2 \;\Rightarrow\; Q = \sqrt{S_n{}^2 - P^2} = \sqrt{34.57^2 - 32.5^2} = 11.78 \text{ Var}.$$

$$Q = 2\pi f C V^2 \;\Rightarrow\; C = \frac{Q}{2\pi f V^2} = \frac{11.78}{2\pi 50 \cdot 120^2} = 2.6 \text{ μF}.$$

c) The new current will be

$$I_n = \frac{S_n}{V} = \frac{34.57}{120} = 0.29 \text{ A},$$

or 30.1% less than the old current.

Answer

a) 0.42 A; b) 2.6 μF; c) 0.29 A