

Chapter 11, Solution 75.

Consider the power system shown in Fig. 11.90. Calculate:

- (a) the total complex power
- (b) the power factor
- (c) the capacitance necessary to establish a unity power factor

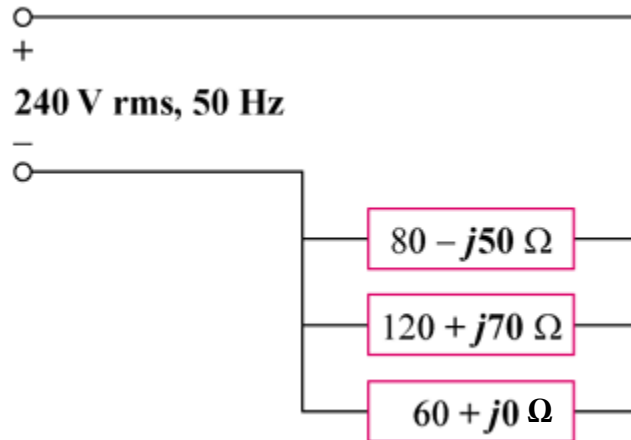


Figure 11.90
For Prob. 11.75.

Solution

$$(a) \quad S_1 = \frac{|V|^2}{Z_1^*} = \frac{(240)^2}{80 + j50} = \frac{5760}{8 + j5} = 517.75 - j323.59 \text{ VA}$$

$$S_2 = \frac{(240)^2}{120 - j70} = \frac{5760}{12 - j7} = 358.13 + j208.91 \text{ VA}$$

$$S_3 = \frac{(240)^2}{60} = 960 \text{ VA}$$

$$S = S_1 + S_2 + S_3 = [1.8359 - j0.11468] \text{ kVA} = (1.8359 - j0.11468) \text{ kVA}$$

$$(b) \quad \theta = \tan^{-1}\left(\frac{114.68}{1835.88}\right) = 3.574^\circ$$
$$\text{pf} = \cos \theta = \boxed{0.998} \{\text{leading}\}$$

- (c) Since the circuit already has a leading power factor, near unity, no compensation is necessary.