A balanced three-phase distribution line has an impedance of 1+j5 $\Omega/\Ø$. This line is used to supply a three-phase induction motor. This motor output 300 hp, with 96% efficiency and power factor of 0.9 lag. The magnitude of the line voltage at the terminal of the motor is 2080V (1 hp = 746 W)

a) What is the magnitude of the line current drawn from the 2080V outlet?

\[ I_{\text{eff}} = \frac{P_{\text{out}}}{\text{Pin}} = \frac{300 \, \text{hp} \times \frac{746 \, \text{W}}{1 \, \text{hp}}}{0.96} = 223800 \, \text{W} \]

\[ P_{\text{in}} = 223800 \times \frac{0.96}{0.96} = 233125 \, \text{W} \]

\[ \sqrt{3} V_L I_L \cos \theta = 233125 \]

\[ I_L = \frac{233125}{\sqrt{3} (2080)(0.9)} = 71.899 \, \text{A} \]

b) Calculate the reactive power supplied to the motor.

\[ Q = \sqrt{3} V_L I_L \sin \theta_a = \sqrt{3} (2080)(71.899)(0.436) \]

\[ = 112936.234 \, \text{VAR} \]

c) What is the total average power loss in the three-phase line?

\[ P_{\text{loss}} = 3 I_L^2 R = 3 (71.899)^2 (1) = 15508.399 \, \text{Watts} \]

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Good Luck,

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