47.72 **A 460-V three phase AC motor rated for $60hp$ operates with an efficiency of 93% and a power factor of 0.85. How much current will the motor draw?**

A. $60A$

B. $66A$

C. $71A$

D. $123A$

Use the first three-phase equation in the table Power for Different Motor Phases, where the power rating is given in horsepower. Voltage, power factor, and efficiency are all given. Calculate the current.

$$I_{[amps]} = \frac{P_{[hp]}\,(746)}{\sqrt{3}V\eta\,(pf)}$$

$$I_{[amps]} = \frac{(60)\,(746)}{\sqrt{3}\,(460)\,(0.93)\,(0.85)} = 71A$$

Answer C

47.73 **Steam enters a turbine at a pressure of $1000psia$ and a temperature of $800°F$ and exits at a pressure of $90psia$ and a temperature of $400°F$. What is the efficiency?**

A. 52%

B. 67%

C. 72%

D. 89%

Consider the entering steam as State 1 and the exit steam as State 2. Both states are fully defined and superheated. Use the properties of Superheated Steam tables to look up the enthalpy and entropy for State 1, and the *actual* enthalpy for State 2.

$$P_1 = 1000psia$$

$$T_1 = 800°F$$

$$h_1 = 1389\frac{Btu}{lb}$$

$$s_1 = 1.567\frac{Btu}{lb \cdot °R}$$

$$P_2 = 90psia$$

$$T_2 = 400^\circ F$$

$$h_2^{'} = 1229.3\frac{Btu}{lb}$$

If the expanstion process was isentropic, i.e. 100% efficient, the entropy at State 2 would be equal to the entropy at State 1. Use the properties of Saturated Water and Steam table to obtain the enthalpy and entropy values at $P_2 = 90psia$ and determine the quality at State 2 for isentropic expansion.

$$s_2 = s_1 = 1.567\frac{Btu}{lb \cdot {}^\circ R}$$

$$\chi_2 = \frac{s_2 - s_f}{s_{fg}} = \frac{1.567\frac{Btu}{lb \cdot {}^\circ R} - 0.4643\frac{Btu}{lb \cdot {}^\circ R}}{1.1474\frac{Btu}{lb \cdot {}^\circ R}} = 0.961$$

Use the quality to find the *ideal* enthalpy at State 2.

$$h_2 = h_f + \chi_2 h_{fg} = 290.76\frac{Btu}{lb} + (0.961)\left(894.9\frac{Btu}{lb}\right) = 1150.7\frac{Btu}{lb}$$

The efficiency is the *actual* change in enthalpy compared with the *ideal* difference in enthalpy for an isentropic process across the same pressure range. Calculate the efficiency.

$$\eta = \frac{h_1 - h_2^{'}}{h_1 - h_2}$$

$$\eta = \frac{1389\frac{Btu}{lb} - 1229.3\frac{Btu}{lb}}{1389\frac{Btu}{lb} - 1150.7\frac{Btu}{lb}} = 0.67$$

Answer B