

**36.37** 60gpm of hot water is produced by a steam heat exchanger. 5psig saturated steam is provided, and the condensate leaves as a saturated liquid. The flow rate of steam is  $2,000 \frac{lb}{hr}$ . If cold water enters at  $55^\circ F$ , what is the temperature of leaving hot water? Neglect losses.

- A.  $113^\circ F$
- B.  $116^\circ F$
- C.  $119^\circ F$
- D.  $122^\circ F$

All of the heat given up by the steam is added to the water, since losses are to be neglected. Set the heat loss for the steam equal to the heat gain for the water. Write an expression for the steam based on change in enthalpy and an expression for the water using the sensible heating rule of thumb for water.

$$\dot{Q}_{steam} = \dot{Q}_{water}$$

$$\dot{m}_{steam} \Delta h = 500 \text{gpm} \Delta T$$

Use the table **Properties of Saturated Water** by pressure to look up the enthalpy of saturated steam and saturated liquid at 5psig.

$$h_f = 196 \frac{Btu}{lb}$$

$$h_g = 1156 \frac{Btu}{lb}$$

Substitute the given mass flow rate, GPM, and supply water temperature and solve for the leaving hot water temperature.

$$\left( 2000 \frac{lb}{hr} \right) \left( 1156 \frac{Btu}{lb} - 196 \frac{Btu}{lb} \right) = 500 (60) (T_{hws} - 55^\circ F)$$

$$T_{hws} = 119^\circ F$$

**Answer C**