ANALYSIS: Reducing an energy rate balance,

\[ 0 = \dot{Q}_{ev} - \dot{W}_{ev} + \dot{m} \left( h_1 - h_4 + \frac{V_i^2}{2} + \frac{V_2^2}{2} \right) \]

\[ \Rightarrow \dot{Q}_{ev} = \dot{m} (h_4 - h_1) \quad (1) \]

In light of assumption 3, \( \dot{Q}_{ev} \) can only account for heat transfer between the evaporator and surroundings.

The required mass flow rate is

\[ \dot{m} = \frac{(AV)_m}{u_4} = \frac{9.5 \text{ ft}^2/\text{min}}{3.168 \text{ ft}^3/\text{lbm}} \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) = 179.92 \text{ lbm/hr} \]

where \( u_4 \) is from Table A-12E. Also from Table A-12E, \( h_4 = 104.38 \text{ Btu/lbm} \).

Referring to Table A-11E at 1200 ft/lb, the saturation temperature at \( \dot{Q}_{ev} \) is 90.54°F. Accordingly, at state 4, R134a is a liquid. Using Table A-10E, \( h_1 = 38.97 \text{ Btu/lbm} \).

Substituting values into Eq. (1)

\[ \dot{Q}_{ev} = \left( 179.92 \frac{\text{lbm}}{\text{hr}} \right) (104.38 - 38.97) \text{ Btu/\( \text{hr} \)} \]

\[ \Rightarrow \dot{Q}_{ev} = 11,765 \text{ Btu/\( \text{hr} \)} \]

1. Refrigerant flowing through the evaporator of a refrigeration system releases energy by heat transfer from the refrigerated space.

See Chap. 10 for discussion.