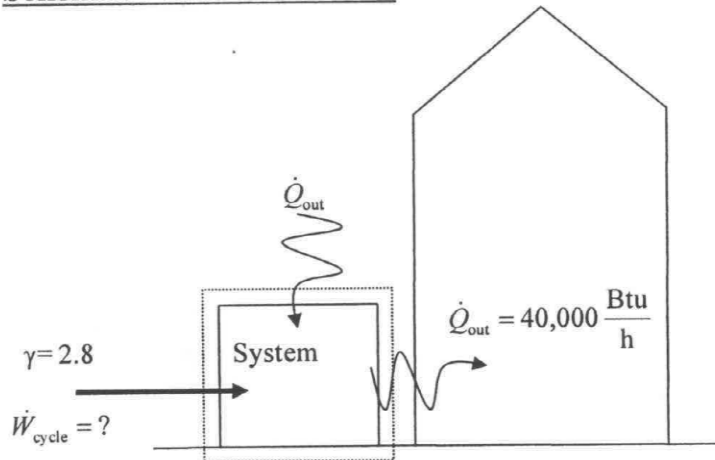


PROBLEM 2.96

Known: Operating data are provided for a heat pump

Find: Determine the power input to the cycle, in hp, and heating season cost to operate the heat pump.

Schematic and Given Data:



Engineering Model:

- (1) The system undergoes a heat pump cycle.
- (2) The cycle operates steadily for 2000 h during the heating season.
- (3) Electricity is valued at \$0.085/kW·h.

Analysis:

- (a) Using the following, determine the power input to the cycle, in hp

$$\gamma = \frac{\dot{Q}_{\text{out}}}{\dot{W}_{\text{cycle}}} \text{ or } \dot{W}_{\text{cycle}} = \frac{\dot{Q}_{\text{out}}}{\gamma} = \frac{40,000 \frac{\text{Btu}}{\text{h}}}{2.8} \left| \frac{1 \text{ hp}}{2545 \frac{\text{Btu}}{\text{h}}} \right| = 5.61 \text{ hp} \quad \leftarrow$$

- (b) Using assumptions 2 and 3, determine the heating season cost to operate the heat pump, in \$/heating season

$$\text{cost} = (5.61 \text{ hp}) \left| \frac{1 \text{ kW}}{1.34 \text{ hp}} \right| \left(\frac{2000 \text{ h}}{\text{heating season}} \right) \left(\frac{\$0.085}{\text{kW} \cdot \text{h}} \right) = \$711 / \text{heating season} \quad \leftarrow$$