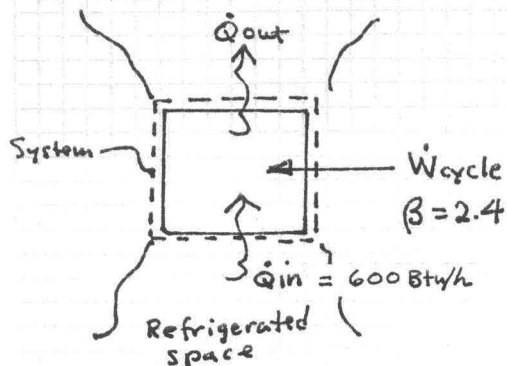


PROBLEM 2.89

KNOWN: Steady-state operating data and cost data are provided for a refrigerator.

FIND: Determine the cost of electricity in a month when the refrigerator operates for 360 hours.

SCHEMATIC & GIVEN DATA:



Unit cost of electricity:
\$0.08 per kW·h

360 hours of operation

ENGINEERING MODEL

1. The system shown in the schematic undergoes a refrigeration cycle.
2. Energy transfers are positive in the direction of the arrows.
3. The cycle operates steadily for 360 hours in the particular month under consideration.
4. Electricity is valued at \$0.08 per kW·h.

ANALYSIS:

Using Eq. 2.45 on a time rate basis,

$$\beta = \frac{\dot{Q}_{in}}{\dot{W}_{cycle}} \Rightarrow \dot{W}_{cycle} = \frac{\dot{Q}_{in}}{\beta} = \frac{600 \text{ Btu/h}}{2.4} = 250 \frac{\text{Btu}}{\text{h}}$$

Then,

$$\text{\$} = (250 \text{ Btu/h}) \left(\frac{360 \text{ h}}{\text{month}} \right) \left[\frac{\text{\$}0.08}{\text{kW}\cdot\text{h}} \right] \left[\frac{1 \text{ kW}}{3413 \text{ Btu/h}} \right]$$

unit conversions:
1 W = 3.413 Btu/h

$$\text{\$} 2.11 / \text{month}$$