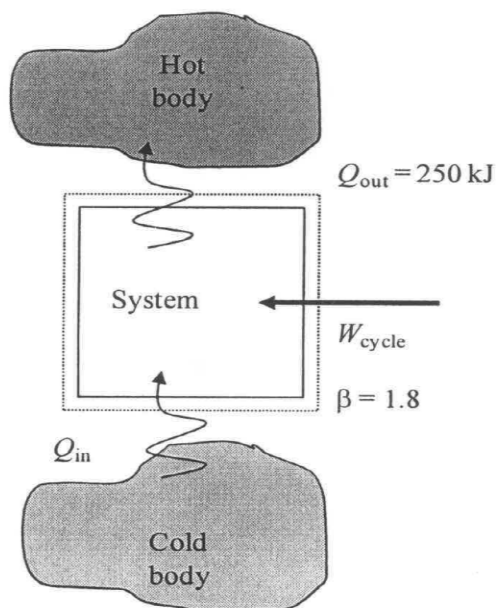


### Problem 2.89

A refrigeration cycle operating as shown in Fig. 2.17b has a coefficient of performance  $\beta = 1.8$ . For the cycle,  $Q_{\text{out}} = 250 \text{ kJ}$ . Determine  $Q_{\text{in}}$  and  $W_{\text{cycle}}$ , each in kJ.

**Solution:**

Schematic and Given Data:



Analysis:

Using the following, determine  $Q_{\text{out}}$  and  $W_{\text{cycle}}$ , each in kJ

$$\beta = \frac{Q_{\text{in}}}{W_{\text{cycle}}} \text{ and } W_{\text{cycle}} = Q_{\text{out}} - Q_{\text{in}}$$

$$\beta = \frac{Q_{\text{in}}}{Q_{\text{out}} - Q_{\text{in}}}$$

$$Q_{\text{in}} = \beta(Q_{\text{out}} - Q_{\text{in}}) = Q_{\text{out}} \left( \frac{\beta}{1 + \beta} \right) = 250 \text{ kJ} \left( \frac{1.8}{1 + 1.8} \right) = 161 \text{ kJ} \quad \longleftarrow$$

$$W_{\text{cycle}} = \frac{Q_{\text{in}}}{\beta} = \frac{161 \text{ kJ}}{1.8} = 89 \text{ kJ} \quad \longleftarrow$$