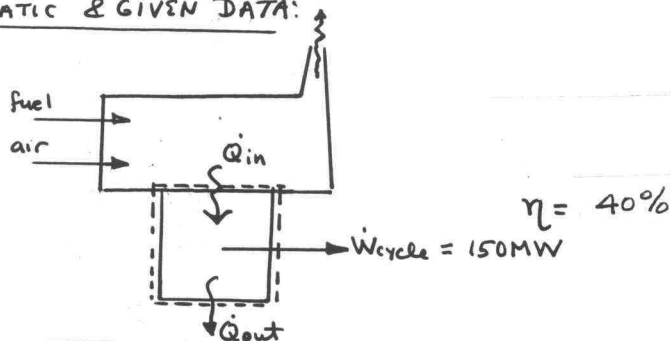


PROBLEM 2.82

KNOWN: Operating data are provided for a power cycle.

FIND: Determine the net rate energy is added by heat transfer, the net work output annually, and the value of the net work, in \$/year.

SCHEMATIC & GIVEN DATA:



ENGR. MODEL: 1. The system undergoes a power cycle. 2. The cycle operates steadily for 8000 h annually. 3. The value of the net work is \$0.08/kW·h

ANALYSIS: (a) To determine \dot{W}_{cycle}

$$\eta = \frac{\dot{W}_{cycle}}{\dot{Q}_{in}} \Rightarrow \dot{Q}_{in} = \frac{\dot{W}_{cycle}}{\eta} = \frac{150 \text{ MW}}{0.40} = 375 \text{ MW} \quad \leftarrow \dot{Q}_{in}$$

(b) With assumption 2

$$W_{cycle} = (150 \text{ MW}) \left| \frac{10^3 \text{ kW}}{1 \text{ MW}} \right| \left(\frac{8000 \text{ h}}{\text{year}} \right) = 1.2 \times 10^9 \frac{\text{kW} \cdot \text{h}}{\text{year}} \quad \leftarrow W_{cycle}$$

(c) With assumption 3

$$\dot{\$} = \left(1.2 \times 10^9 \frac{\text{kW} \cdot \text{h}}{\text{year}} \right) \left(\frac{\$0.08}{\text{kW} \cdot \text{h}} \right) = \$96 \text{ M/year} \quad \leftarrow \$$$