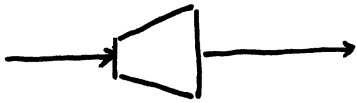


6-51:



$$p_1 = 50 \text{ psia}$$

$$T_1 = 1200 \text{ F}$$

$$\dot{m} = 8.10 \text{ lbm/s}$$

$$p_2 = 14.5 \text{ psia}$$

$$\Delta s = 0$$

$$W = ?$$

$$C_p = 1.01 \text{ kJ/kg}\cdot\text{K}$$

$$\Delta s = C_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1} = 0$$

$$\Rightarrow \ln \frac{T_2}{T_1} = \frac{R}{C_p} \cdot \ln \frac{p_2}{p_1} = \frac{8.314}{1.01} \ln \frac{14.5}{50}$$

$$\Rightarrow T_2 = T_1 \times 3.75 \times 10^{-5}$$

$$T_1 = \frac{5}{9} (1200 - 32) + 273.15 = 922 \text{ K}$$

$$\Rightarrow T_2 = 0.0346 \text{ K}$$

$$W = \dot{m} \cdot C_p \cdot \Delta T = \cancel{8.10 \text{ lbm/s}} \times 1.01 \text{ kJ/kg}\cdot\text{K} \times (922 - 0.0346)$$

$$\cancel{8.10 \times 0.45 \text{ kg/s}}$$

$$= \frac{1.01 \times (922 - 0.0346)}{1 \text{ kg} \times \frac{1 \text{ lbm}}{0.45 \text{ kg}}} = 2069 \text{ kJ/lbm}$$

6:90)

$$a.) S_2 - S_1 = C_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1}$$

$$C_p : 0.919 \text{ kJ/kg} \cdot \text{K}$$

$$R : 8.314 \text{ kJ/kmol} \cdot \text{K}$$

$$\Delta S = 0.919 \cdot \ln \frac{(25 + 273.15) \text{ K}}{(60 + 273.15) \text{ K}} - 8.314 \ln \frac{125}{250}$$

$$= 5.66 > 0.$$

b.)

~~we~~ We assume $\Delta S = 0$

$$0.919 \ln \frac{T_2}{333.15} = 8.314 \ln \frac{125}{250}$$

$$\Rightarrow T_2 = 263 \text{ K}$$

c.) Maximum T is 60°C .

6:93)

$$a) \quad Q_{in} - W_{out} = \dot{m} \cdot c_p \cdot \Delta T$$

$$Q_{in} - 80 \text{ kW} = \cancel{1.4 \text{ kg/s}} \cdot 1.01 \text{ kJ/kg} \cdot \cancel{70 \text{ K}}$$

$$Q_{in} - 80 \text{ kW} = 98.98 \text{ kJ/s}$$

$$Q_{in} = 98.98 \text{ kJ/s} + 80 \text{ kJ/s} = 178.98 \text{ kJ/s}$$

$$Q_{in}(\text{kJ/kg}) = \frac{178.98 \text{ kJ}}{\cancel{\text{s}} \cdot \frac{1.4 \text{ kg}}{\cancel{\text{s}}}} = 127.84 \text{ kJ/kg}$$

$$b) \quad \Delta S = c_p \ln \frac{T_2}{T_1} - R \ln \frac{p_2}{p_1}$$

$$= 1.01 \ln \frac{273.15 + 50}{273.15 + 120} - 8.314 \ln \frac{100}{300}$$

$$= -0.198 + 9.314 = 8.94 \text{ kJ/kg} \cdot \text{K}$$