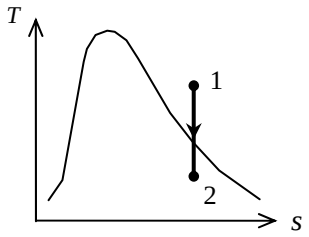
7-39 Water vapor is expanded in a turbine during which the entropy remains constant. The enthalpy difference is to be determined.

Analysis The initial state is superheated vapor and thus



$$\left.\begin{array}{l} P_1 = 6\ \text{MPa} \\ T_1 = 400°\text{C} \end{array}\right\} \begin{array}{l} h_1 = 3178.3\ \text{kJ/kg} \\ s_1 = 6.5432\ \text{kJ/kg}\cdot\text{K} \end{array} \quad \text{(Table A - 6)}$$

The entropy is constant during the process. The final state is a mixture since the entropy is between s_f and s_g for 100 kPa. The properties at this state are (Table A-5)

$$x_2 = \frac{s_2 - s_f}{s_{fg}} = \frac{(6.5432 - 1.3028)\ \text{kJ/kg}\cdot\text{K}}{6.0562\ \text{kJ/kg}\cdot\text{K}} = 0.8653$$

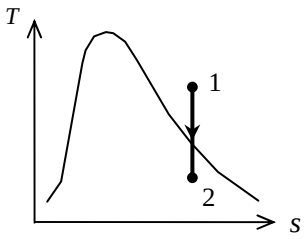
$$h_2 = h_f + x_2 h_{fg} = 417.51 + (0.8653)(2257.5) = 2370.9\ \text{kJ/kg}$$

The change in the enthalpy across the turbine is then

$$\Delta h = h_2 - h_1 = 2370.9 - 3178.3 = \mathbf{-807.4\ kJ/kg}$$

7-40 R-134a undergoes a process during which the entropy is kept constant. The final temperature and internal energy are to be determined.

Analysis The initial entropy is



$$\left.\begin{array}{l} T_1 = 25°\text{C} \\ P_1 = 600\ \text{kPa} \end{array}\right\} \ s_1 = 0.9341\ \text{kJ/kg}\cdot\text{K} \quad \text{(Table A -13)}$$

The entropy is constant during the process. The final state is a mixture since the entropy is between s_f and s_g for 100 kPa. The properties at this state are (Table A-12)

$$T_2 = T_{\text{sat @ 100 kPa}} = \mathbf{-26.37°C}$$

$$x_2 = \frac{s_2 - s_f}{s_{fg}} = \frac{(0.9341 - 0.07188)\ \text{kJ/kg}\cdot\text{K}}{0.87995\ \text{kJ/kg}\cdot\text{K}} = 0.9799$$

$$u_2 = u_f + x_2 u_{fg} = 17.21 + (0.9799)(197.98) = \mathbf{211.2\ kJ/kg}$$