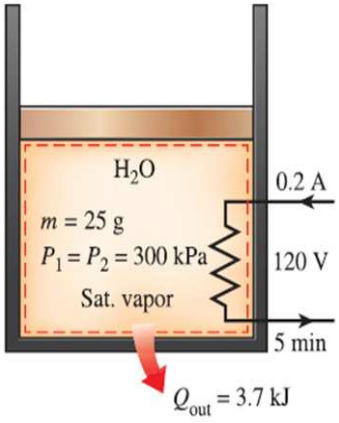
Given:
A piston cylinder device contains $25\ g$ of saturated water vapor that is maintained at a constant pressure of $300\ kPa$. A resistance heater running of $0.2\ A$ and $120\ V$ is used to heat the vapor for 5 minutes. At the same time, the system experiences a heat loss of $3.7\ kJ$.

$m := 25\ g$ $P_1 := 300\ kPa$ $I_s := 0.2\ A$ $V_s := 120\ V$

$\Delta t := 5\ min$ $Q_{out} := 3.7\ kJ$



Required:
Determine the final temperature.

Solution:
Since the water initially a saturated vapor, the quality is

$x_1 := 1$

The total heat supplied by the heat is

$Q_{in} := V_s \cdot I_s \cdot \Delta t = 7.2\ kJ$

1st Law for closed system with no KE or PE

$\Delta E_{sys} = \Sigma E_{in} - \Sigma E_{out}$

$\Delta U + \Delta KE + \Delta PE = Q_{in} - Q_{out} - W_b$

$\Delta U + W_b = \Delta H = Q_{in} - Q_{out}$

$m \cdot \Delta h = Q_{in} - Q_{out}$

Going to Table A-5 @ $P := P_1 = 300\ kPa$ and $x := x_1 = 1$ shows

$h_1 := 2724.9\ \frac{kJ}{kg}$

Rearranging the 1st Law equation, the enthalpy at state may be found

$m \cdot \left(h_2 - h_1 \right) = Q_{in} - Q_{out}$

$h_2 := \frac{Q_{in} - Q_{out}}{m} + h_1 = 2865\ \frac{kJ}{kg}$

Going to Table A-5 @ $P := P_1 = 300\ kPa$ shows

$h_g := 2724.9\ \frac{kJ}{kg}$

Since $h_2 > h_g$, state 2 is superheated. Going to Table A-6 @ $P := P_1 = 0.3\ MPa$ and $h := h_2 = 2865\ \frac{kJ}{kg}$ shows that interpolating is needed.

$T_a := 150\ °C$ $T_b := 200\ °C$

$h_a := 2761.2\ \frac{kJ}{kg}$ $h_b := 2865.9\ \frac{kJ}{kg}$

$T_2 := \frac{h_2 - h_a}{h_b - h_a} \cdot \left(T_b - T_a \right) + T_a = 472.7\ K$ $\boxed{T_2 = 199.5\ °C}$