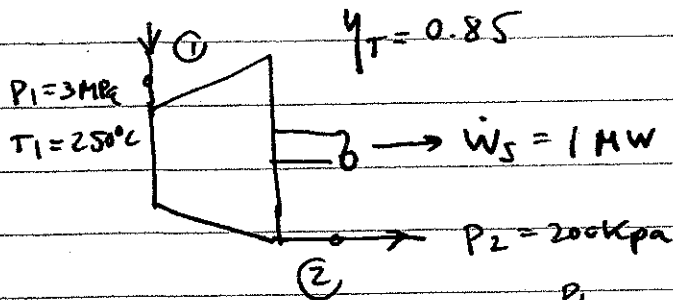


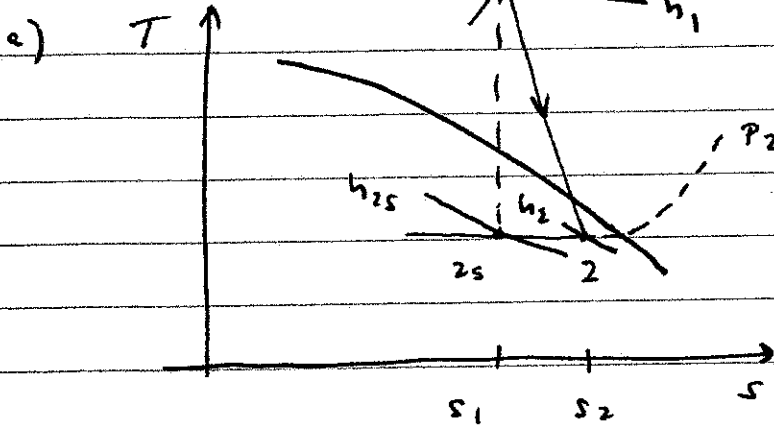
T10

16. Verified Sp 09
25



Tables: $P_1, T_1 \rightarrow h_1 = 2855.8 \text{ kJ/kg}$
 $s_1 = 6.2872 \text{ kJ/kgK}$

interp. $P_2, s_{2s} = s_1 \rightarrow h_{2s} = ?$



$$\eta_T = \frac{h_1 - h_2}{h_1 - h_{2s}}$$

P_{2sat} : $s_g = 7.1271$ $s_f = 1.5301 \text{ kJ/kgK}$
 $h_g = 2706.7$ $h_f = 504.7 \text{ kJ/kg}$

b) $s_{2s} = s_1$, $s_{2s} = s_g(p_2)x_{2s} + s_f(p_2)(1-x_{2s})$, $x_{2s} = \frac{s_{2s} - s_f}{s_g - s_f} = 0.85$

$h_{2s} = h_g(p_2)x_{2s} + h_f(p_2)(1-x_{2s}) \rightarrow h_{2s} = 2376.4 \text{ kJ/kg}$

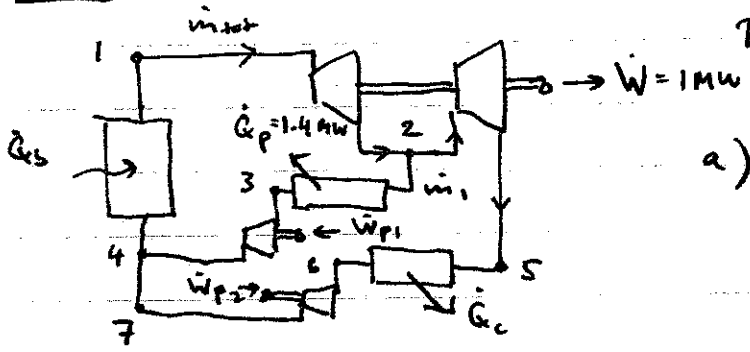
$h_1 - h_2 = \eta_T(h_1 - h_{2s})$ $\dot{m} = \frac{\dot{W}_s}{h_1 - h_2}$, $\dot{m} = 2.45 \text{ kg/s}$

c) $h_2 = 2448.3 \text{ kJ/kg}$, $x_2 = \frac{h_2 - h_f(p_2)}{h_g(p_2) - h_f(p_2)}$, $x_2 = 0.88$

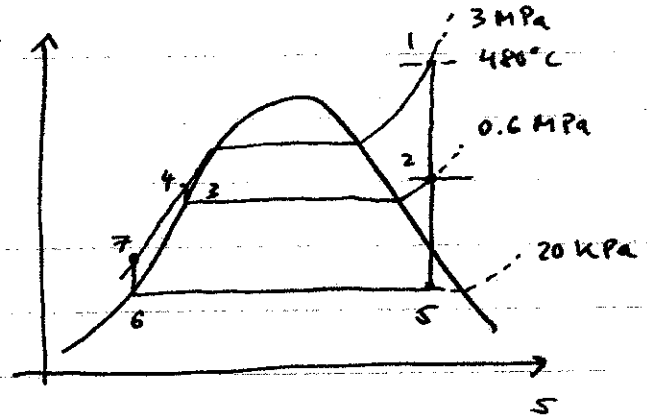
d) $s_2 = s_g(p_2)x_2 + s_f(p_2)(1-x_2)$, $s_2 = 6.455 \text{ kJ/kgK}$

$\dot{S}_{gen} = \dot{m}(s_2 - s_1)$, $\dot{S}_{gen} = 412.2 \text{ W/K}$

T11



16. Unified Sp 09 25



b) $\dot{Q}_p = \dot{m}_1 (h_2 - h_3)$ $h_3 = h_f(P_3) = 670.56 \text{ kJ/kg}$
 table: $T_1, P_1 \xrightarrow{\text{isup.}} h_1 = 3411.5 \text{ kJ/kg}, s_1 = 7.1736 \text{ kJ/kg-K}$
 $s_2 = s_1, \text{ isup. } @ P_2 \rightarrow h_2 = 2953.2 \text{ kJ/kg} \rightarrow \dot{m}_1 = 0.613 \text{ kg/s}$

c) $s_1 = s_5 = s_g(P_5) x_5 + s_f(P_5) (1 - x_5)$ $x_5 = \frac{s_1 - s_f}{s_g - s_f}, x_5 = 0.896$
 $h_5 = h_g(P_5) x_5 + h_f(P_5) (1 - x_5) \rightarrow h_5 = 2364.4 \text{ kJ/kg}$

$\dot{W} = \dot{m}_{tot} (h_1 - h_2) + (\dot{m}_{tot} - \dot{m}_1) (h_2 - h_5)$, $\dot{m}_{tot} = \frac{\dot{W} + \dot{m}_1 (h_2 - h_5)}{h_1 - h_5}$
 $\dot{m}_{tot} = 1.3 \text{ kg/s}$

d) $\dot{Q}_c = (\dot{m}_{tot} - \dot{m}_1) (h_5 - h_c)$, $h_c = h_f(P_5) = 251.4 \text{ kJ/kg}$

$\dot{Q}_c = 1.451 \text{ MW}$

e) $\eta_{th} = \frac{\dot{W}_{net}}{\dot{Q}_b} = \frac{\dot{W} - \dot{W}_{p1} - \dot{W}_{p2}}{\dot{Q}_b}$ 1st law: $0 = \dot{W}_{p1} + \dot{W}_{p2} - \dot{W} + \dot{Q}_b$
 liquid: $dh = v dp$ - $\dot{Q}_c - \dot{Q}_{proc}$

$\eta_{th} = \frac{\dot{W} - \dot{W}_{p1} - \dot{W}_{p2}}{\dot{Q}_c + \dot{Q}_{proc} + \dot{W} - \dot{W}_{p1} - \dot{W}_{p2}}$, $\dot{W}_{p1} = \dot{m}_1 v_3 (P_1 - P_3), v_3 = 0.001 \text{ m}^3/\text{kg}$
 $\dot{W}_{p2} = (\dot{m}_{tot} - \dot{m}_1) v_c (P_1 - P_c), v_c = v_3$

$\dot{W}_{p1} = 1.47 \text{ kW}, \dot{W}_{p2} = 2.05 \text{ kW} \rightarrow \eta_{th} = 25.9\%$