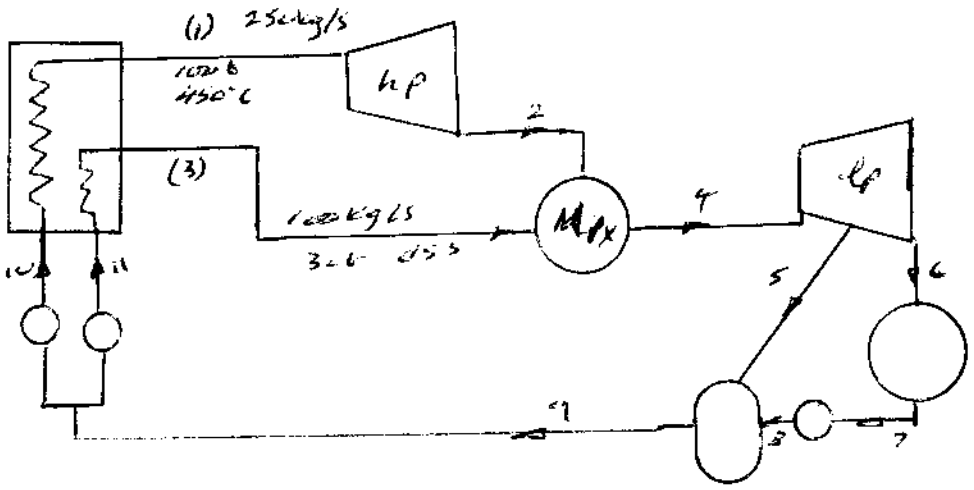
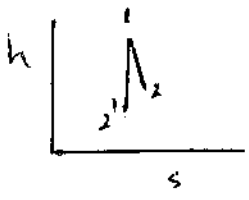
Q4 2000



$h_1 = 3241$ kJ/kg

$h_3 = 2803$ kJ/kg



hp Turbine

From h-s chart $h_2' = 2920$ kJ/kg

$\eta_{is} = .85 = \dfrac{3241 - h_2}{3241 - 2920}$ $\quad h_2 = 2968$ kJ/kg

$P_{out} = 250\,(3241 - 2968) = 68.25$ MW

ADIABATIC MIXING $\quad 250\,h_2 + 100\,h_3 = 350\,h_4$

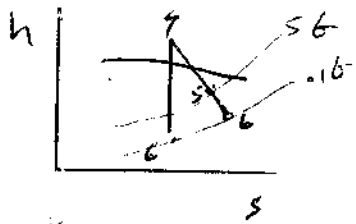
$250 \times 2968 + 100 \times 2803 = 350\,h_4$

$h_4 = 2921$ kJ/kg

lp Turbine

$p_4 = 3.6$ $\quad h_4 = 2921$

From chart $\quad h_6' = 2050$ kJ/kg



$\eta_{is} = .82 = \dfrac{2921 - h_6}{2921 - 2050}$ $\quad h_6 = 2190$ kJ/kg

Assume straight Line 4 to 6

$h_5 = 2650$ kJ/kg

Q4 2000

P_{4-5} $\quad P = 350(2921 - 2650) = 94.85\,MW$

P_{5-6} $\quad P = 290(2650 - 2190) = 133.4\,MW$

Total Power out $= 68.25 + 94.85 + 133.4 = 296.5\,MW$

Pumps Ideal Power $= Vol \times \Delta p$

7-8 $\quad P = 290 \times .021 \times (5 - .1) \times 10^3 = 142.1\,kW$

9-10 $\quad P = 102 \times .021 \times (30 - 5) \times 10^3 = 250\,kW$

9-11 $\quad P = 250 \times .021 \times (102 - 5) \times 10^3 = 2.375\,MW$

Nett Power out $= 296.5 - 0.142 - 0.25 - 2.375$

$P_{nett} = 293.7\,MW$

Condenser Assume $h_7 = h_f @ .1b = 192.45\,kJ/kg$

$\dot{Q}_{out} = 290(h_6 - h_7) = 290(2190 - 192)$

$\dot{Q}_{out} = 579.42\,MW$

$\dot{Q}_{in} = \dot{Q}_{out} + P_{nett} = 876.92\,MW$

$\eta_{th} = P_{nett} / \dot{Q}_{in} = 293.7 / 876.42 = 33.5\%$