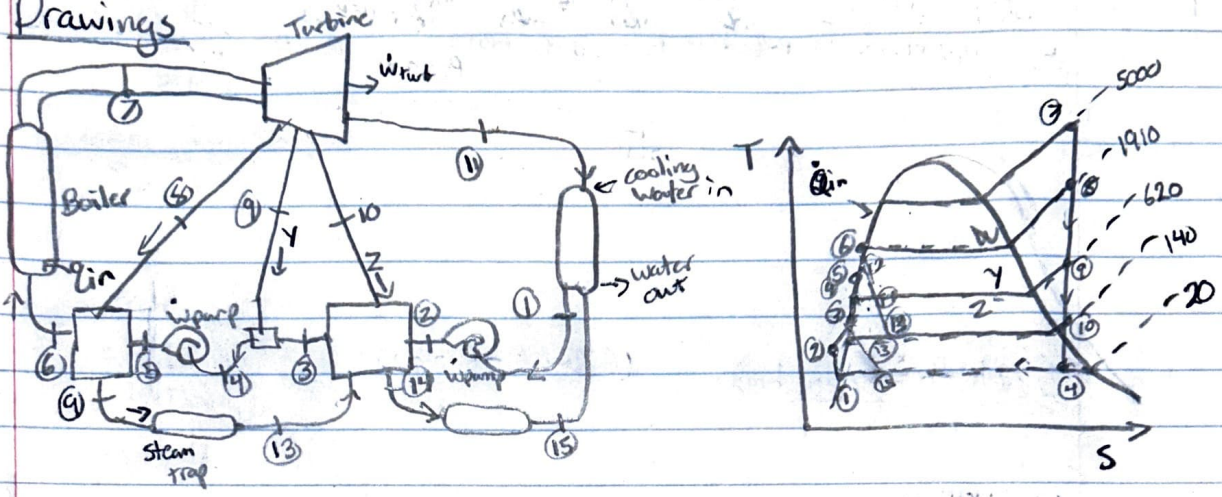
MET 350 Michael O'Brien 3/23/2025

Exam 2

Q1) Purpose: Determine the fraction of removed mass that ensures correct operation of the feedwater heater. Also find the temperature of cooling water after heating in the condensor. Lastly find the rate of heat rejected in the condensor.

Drawings



Design Considerations: I Assume,

- No heat loss across pipes and no friction loss
- Isentropic efficiency of turbine is 0.8
- Isentropic efficiency of compressor is 1.0

Data/Variables

- $\dot{m}_{steam} = 100$ kg/s
- State information in tables
- $C_p = 4.18$ kJ/kg·K

Materials: Steam

Procedures

Fist step is to find all the states in the cycle. I will then use them to answer the questions.

used Interpolation App

States

Isentropic comp ① Pconst ② Pconst ③ Isent comp ④ Pconst ⑤ Pconst ⑥ Isen Turb ⑦ Isen turb ⑧ Isen turb ⑨ Isen Exp ⑩ Pconst ⑪ Pconst ⑫ Pconst ⑬ ⑭ ⑮

$P_1 = 20$ kPa $P_2 = 620$ kPa $P_3 = 620$ kPa $P_4 = 620$ kPa $P_5 = 5000$ kPa $P_6 = 5000$ kPa $P_7 = 5000$ kPa $P_8 = 1110$ kPa $P_9 = 620$ $P_{10} = 140$ $P_{11} = 20$

$V_1 =$

$h_{3c} = 675.86$ kJ/kg

$h_2 = 675.86$

$T_7 = 700°C$

$h_7 = 3900$

$S = 7.514$

$h_8 = 3515$ $h_9 = 3154$ $h_{10} = 2599$ $h = 2478$

$$z = \frac{(h_3 - h_2) + y(h_{11} - h_{10})}{h_8 - h_{11}} \qquad z = \frac{(675.86 - 675.85) +}{}$$

$$y\,h_3 = (1-y)\cdot h_2 + y \cdot h_9$$

$$\dot{m}_8 h_8 + \dot{m}_{w4} h_{w4} + \dot{m}_{11} h_{11} = \dot{m}_9 h_9 + \dot{m}_w h_{w2}$$

Q2 Purpose: Determine the new values for the fraction of mass extracted, cooling water temps in the condensor, and rate of heat rejected in the condensor once the second heat trap malfunctions.

Drawings:
See Q1

Design Considerations:
- No heat loss accross pipes

Data and Variables
- $C_p = 4.18$ kJ/kg·k
- $\dot{V} = 4200$ kg/s
- $\dot{m} = 100$ kg/s

Materials
- Steem

Procedures
Find all states for the cycle, then find y.

1 Isen comp $P_1 = 20$ kPa
2 P const
3 P const $h_3 = h_4$ 675.86
4 Isen comp h_4 ? h_3
5 P const
6 P const
7 Isen
8 Isen
9 Isen $h_9 = h_8$
10 P const $h_{10} = 895.86$
11 P const
12 P const
13
14
15

$y = (1 - \frac{\dot{m}_2}{\dot{m}_1}) + \frac{\dot{m}_2}{\dot{m}_1} q$