What is choked flow?

- The flow condition under which the mass flow rate through nozzle is found to be maximum is called ckooked flow.

Scanned with CamScanner

Rankine cycle?

er:- (A) Rankine Cycle:-

① It is thermodynamic cycle derived from Carnot vapour power cycle for overcoming its limitations.

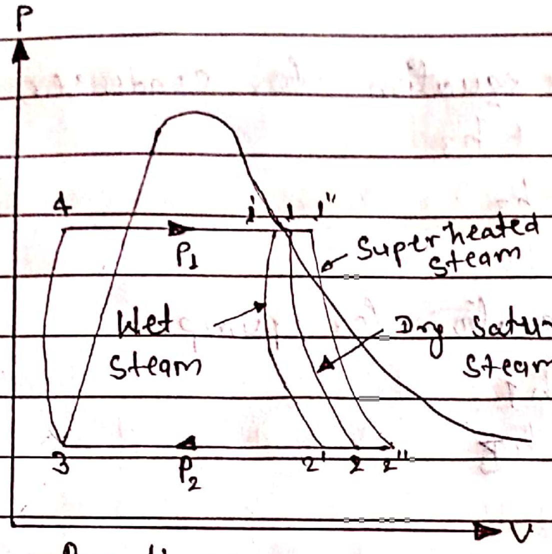
② In fig. (A) Rankine cycle is show on p-v and T-s diagram. It consists of the following processes:

(i) Process 1-2:- It is reversible adiabatic expansion process in turbine.

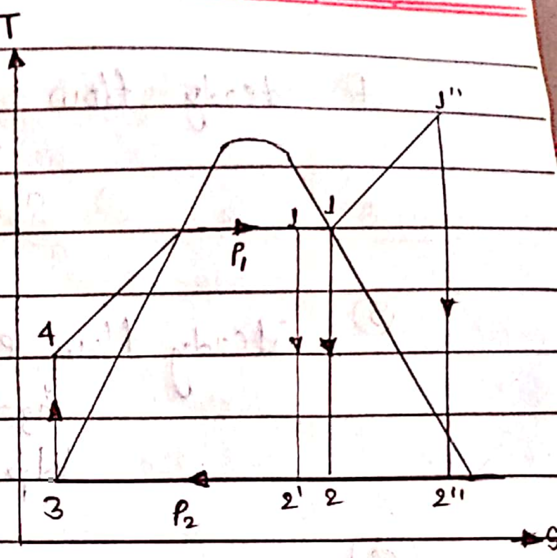
(ii) Process 2-3:- It is constant pressure heat rejection process in condenser.

(iii) Process 3-4:- It is reversible adiabatic pumping process in feed water pump.

(iv) Process 4-1:- It is constant pressure heat addition process in the boiler.



P-v diagram



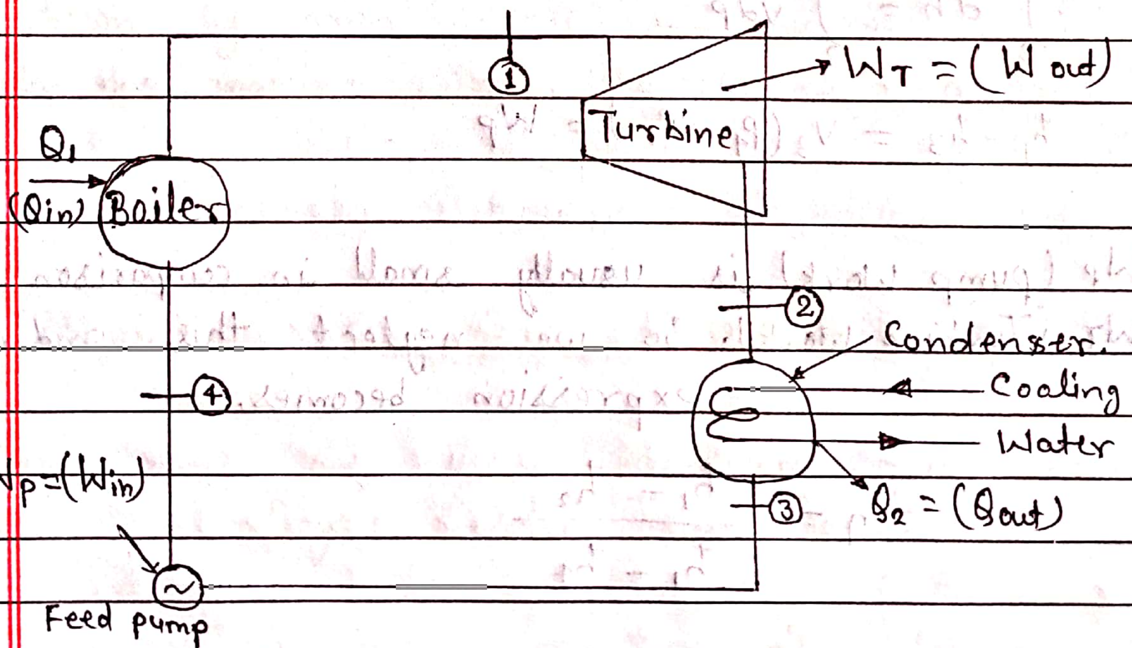
T-s diagram

[B] Work Done :- ① Rankine cycle is theoretical cycle for steam power plant.

② Steady flow energy equation for boiler,

$$h_4 + Q_1 = h_1$$

$$Q_1 = h_1 - h_4$$



③ Steady flow energy equation for turbine,

$$h_1 = W_T + h_2$$

$$W_T = h_1 - h_2$$

(4) Steady flow energy equation for condenser,

$$h_2 = Q_2 + h_3$$

$$Q_2 = h_2 - h_3$$

(5) Steady flow energy equation for pump,

$$h_3 + W_p = h_4$$

$$W_p = h_4 - h_3$$

[C] EFFICIENCY:

(i) Efficiency, $\eta = \dfrac{W_{net}}{Q_1} = \dfrac{W_T - W_p}{Q_1} = \dfrac{(h_1 - h_2) - (h_4 - h_3)}{h_1 - h_4}$

(ii) Now for addiabatic ~~expan~~ compression,

$$Tds = dh - vdp$$

Since, $ds = 0$

$$dh = vdp$$

$$\int_3^4 dh = \int_3^4 vdp$$

$$h_4 - h_3 = V_3(P_4 - P_3) = W_p$$

(iii) W_P (pump work) is usually small in comparison to W_T (Turbine work). So we neglect this and efficiency expression becomes,

$$\eta = \frac{h_1 - h_2}{h_1 - h_4}$$

Nozzle efficiency:-

① It is defined as the ratio of actual drop to the isentropic enthalpy drop between the same pressure

$$\eta_{nozzle} = \frac{h_1 - h_2'}{h_1 - h_2}$$

② If the actual velocity at exit from the nozzle is C_2' and the velocity at exit when the flow is isentropic is C_2 then,

$$\eta_{nozzle} = \frac{C_2'^2 - C_1^2}{C_2^2 - C_1^2}$$

③ When the inlet velocity C_1 is negligible then,

$$\eta_{nozzle} = \frac{C_2'^2}{C_2^2}$$