

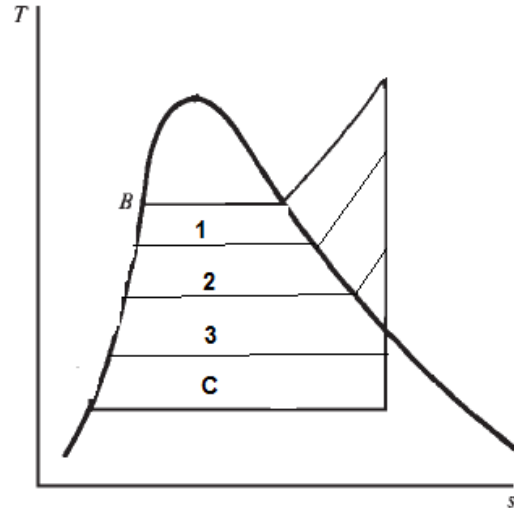
3)CLOSED TYPE WITH DRAINS PUMPED FORWARD:

ENERGY BALANCE:

$$\text{H.P.F.W.H: } \dot{m}_2(h_2 - h_{11}) = (1 - \dot{m}_2)(h_9 - h_8)$$

$$\text{L.P.F.W.H : } \dot{m}_3(h_3 - h_{13}) = (1 - \dot{m}_2 - \dot{m}_3)(h_7 - h_6)$$

h_7 & h_9 are found at t_7 & t_9 where



EX: Steam is supplied to an ideal Rankine cycle turbine at (70 bar) and (500°C) ,the cycle has one closed type feed water heater with drains pumped forward at (7 bar),yhe condenser pressure is (0.7 bar),use TTD of (5°C) ,calculate W_p , η_{th} , $W.R$, q_{rej} ?

THE PLACEMENT OF FEED WATER HEATERS:

The role of feed water heaters is to bring the temperature of feed water as close as possible to that of the steam generator before the feed water enters that steam generator. If we were assume first for simplicity that only one feed water heater (the type is not important) is to be used, we may consider placing it positions 1,2 or 3 with respect to the cycle. In position (1) we see that heat transfers to the feed water are caused by (ΔT_{B-1}) and (ΔT_{1-C}) where T_B and T_C are the boiler and Condenser temperature ,respectively. In position (3) the corresponding heat transfer are the result of $(T_B- T_3)$ and $(T_3- T_C)$.It is obvious that in both these cases one of these (ΔT_s) is very large. The one position that would minimize both temperature difference is in the middle position (2), where $(T_B- T_2) = (T_2- T_C)$ thus the optimum, from an efficiency point of view, of the pressure at which the one feed water heater is to be placed is obtained

the saturation pressure corresponding to that temperature .Note that the temperature at which steam is actually bled from the turbine may be in superheat region at that pressure and thus higher than (T_2) .

If two feed water heaters are to be used, the optimum placement is at temperature that would divided ($T_B - T_C$) into three equal parts. In general ,then for (n) feed water heater, the optimum temperature rise per heater would be given by

$$\Delta T_{\text{opt}} = \frac{T_B - T_C}{n+1}$$

EX: Steam is supplied to an ideal Rankine cycle turbine that operates between (68 bar) and (538 °C) and (0.068 bar).It has seven feed water heaters. Find the optimum pressure and inlet temperature for high and the low pressure feed water heaters.