

Properties of Steam

1. 1000kg of wet steam at a pressure of 1.6 MPa is generated in a boiler per hour. The temperature of feed water is 30°C and the total amount of heat added in the boiler is 2473MJ/Hr. The steam from the boiler enters the super heater where its temperature is to be raised to 380°C. Determine

(i) Dryness fraction of the steam at the entry point of the super heater?

(ii) Heat absorbed per hour in the super heater?

Assume the specific heat of water as 4.187 kJ/Kg°K and that of super heated steam as 2.25 kJ/Kg°K.

Dryness fraction of the steam at the entry point of the super heater =0.9

Heat absorbed per hour in the super heater= 594.94MJ

2. Dry saturated steam at a pressure of 1.6N/mm² is generated in a boiler. Dry saturated steam leaves the boiler to enter a superheater, before which it loses heat equal to 600 KJ/kg. And in the superheater, steam is superheated to temperature of 380° C. If temperature of feed water is 30° C, Determine a) Total heat supplied to feed water in the boiler b) Dryness fraction of steam at the entry of superheater c) Total heat supplied in the superheater. Assume the specific heat of water as 4.187 kJ/Kg°K and that of super heated steam as 2.25 kJ/Kg°K.

Total heat supplied to feed water in the boiler=2666.1kJ/kg

Dryness fraction of steam at the entry of superheater= 0.6896

Total heat supplied in the superheater= 1001.85kJ/kg

3. 1000kg of steam which is 14.25% wet is produced in a boiler at a pressure of 1.6 N/mm². Steam enters the super heater where its temperature is raised such that the degree of superheat is 180°C. From the super heater steam is led to a heat exchanger for process heating where it loses 66.6% of enthalpy. If the temperature of feed water is 30°C determine

- Total heat added to feed water in the boiler
- Total heat supplied in the super heater
- Condition and related parameter of the steam at the exit point of heat exchanger

Assume the specific heat of water as 4.187 kJ/Kg°K and that of super heated steam as 2.25 kJ/Kg°K.

Total heat added to feed water in the boiler—2390.61MJ-

Total heat supplied in the super heater—680.48MJ-

Condition and related parameter of the steam at the exit point of heat exchanger—Wet steam with $X= 10.82\%$

4. Determine the mass of dry saturated steam that can be produced from water at 30°C by supplying 26354.4KJ of heat at a pressure of 0.9N/mm^2 . If 1668 KJ of heat is added determine the temperature of the steam? Assume the specific heat of of super heated steam as $2.25\text{ kJ/Kg}^{\circ}\text{K}$.

Mass of Dry Steam produced- 9.96kg

Temperature of the steam- 249.83°C

5. Feed water enters the boiler at a temperature of 30°C . It leaves the boiler as 85% dry and enters the super heater where it is superheated to a temperature of 300°C . Determine the heat supplied per Kg of steam in the Boiler and in the super heater if the pressure is 1.5 N/mm^2 . From the super heater if the steam is led to a heat exchanger for process heating where it loses 88.7% of enthalpy, determine the condition and related parameter of the steam at the exit point of heat exchanger Assume the specific heat of water as $4.187\text{ kJ/Kg}^{\circ}\text{K}$ and that of super heated steam as $2.25\text{ kJ/Kg}^{\circ}\text{K}$.

Heat supplied in the boiler= 2372.5kJ/kg

Heat supplied in the superheater= 520.62kJ/kg

Condition and related parameter of the steam at the exit point of heat exchanger— Unsaturated water with $T= 81.47^{\circ}\text{C}$.