

$$m = m_f + m_g \quad (\text{mass of liq.} + \text{mass of vapour})$$

$$x = \frac{m_g}{m} \quad 1-x = \frac{m_f}{m}$$

$$V = V_f + V_g \quad \text{Sp. } v = \frac{V}{m} = \frac{V_f + V_g}{m}$$

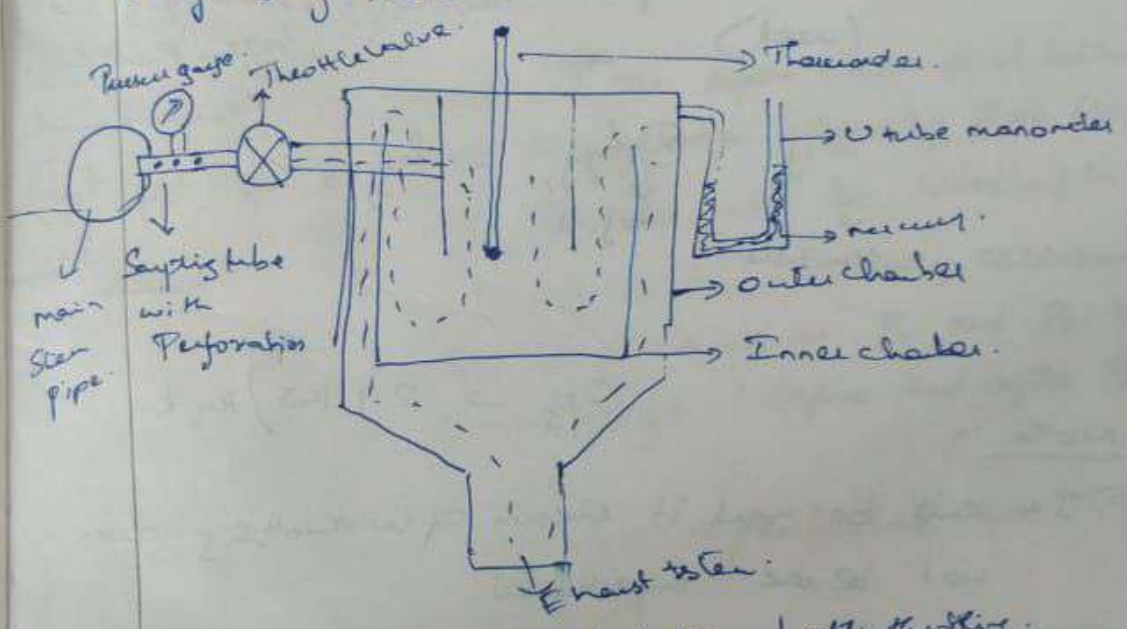
Sp. Volume:-

$$V = V_f + x v_{fg}$$

$$v_{fg} = v_g - v_f$$

### Throttling Calorimeter.

It is used to measure the dryness fraction of very dry steam.



Enthalpy remains constant before and after throttling.

The sample of steam at pressure  $P_1$  is taken from main steam pipe.

The steam is passed through the throttle valve, where it is throttled.

In throttle valve the pressure drops which is nearly equal to the atmospheric pressure, which is  $P_2$ .

$P_1$  → measured by pressure gage

$P_2$  → measured by manometer.

As enthalpy in throttling <sup>Process</sup> device is constant, the pressure drop ~~does not matter~~. They are converted into heat regardless of pressure drop.

After throttling steam gets superheated.

Enthalpy of steam before throttling = Enthalpy of steam after throttling  
(wet) (superheated)

$$h_{f1} + x h_{fg1} = h_{g2} + c_p (t_{sup} - t_{sat})$$

↓  
see table      ↓  
to find      ↓  
manometer      ↓  
steam table

Note :-

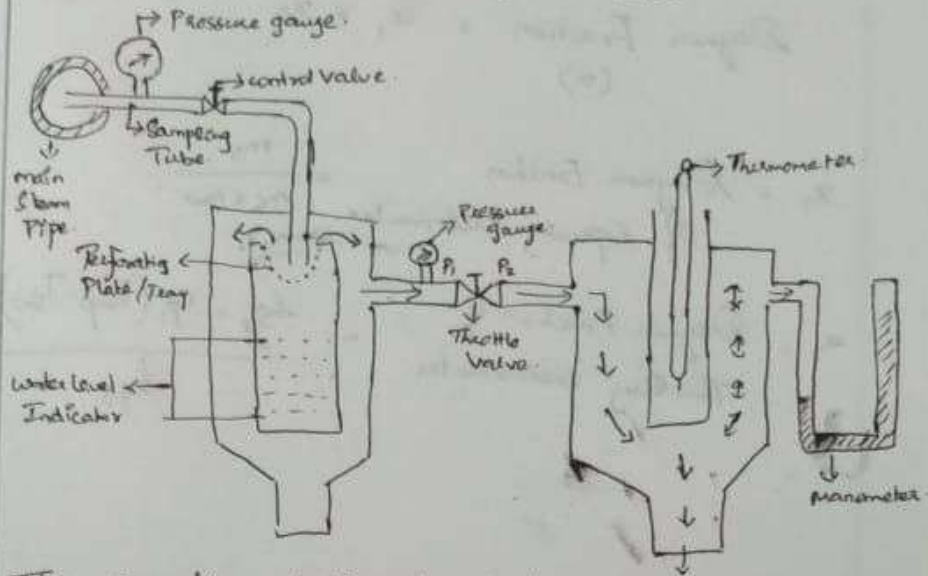
$$c_p \rightarrow 2.1 \text{ kJ/kg K}$$

1) It can't be used if steam after throttling does not become superheated.

It is not possible to find  $x$  for very wet steam.

It gives accurate value compared to others.

## Combined Separating and Throttling Calorimeter.



- The separating Calorimeter and Throttling Calorimeter are Placed in a serial order.
- The steam is first Passed through separating calorimeter to the throttling calorimeter.
- The pressure of the main steam pipe is measured with Pressure gauge.
- The steam is passed into the super water level indicators by sampling tubes through the Perforating plate (separating device). So the wet particles will be collected in the chamber.
- Only steam is passed to the Throttling calorimeter. and the pressure is measured as  $P_1$  and  $P_2$  with the help of Pressure gauge (before and after throttling process).
- So the steam will be superheated and it fills the chamber.
- The thermometer is used to measure the temperature of superheated steam.
- The pressure  $P_2$  is measured with the manometer.

18	CT19FT023	PON MARI	L
19	CT19FT024	POOJA	RM
20	CT19FT026	SAVITHA SANGAMI	K
21	CT19FT027	STANLY SUNNY THOMAS	
		TOTAL	

Calculation:-

$$\text{Deynes Fraction} = \alpha_1 \times \alpha_2$$

(x)

$\alpha_1$  = Deynes Fraction  
of separating calorimeter

$$= \frac{m_s}{m_s + m_w}$$

$\alpha_2$  = Deynes Fraction of  
Throttling calorimeter

$$= \frac{h_{g2} + c_p (T_{\text{sup}} - T_{\text{sat}}) - h_{f2}}{h_{g1}}$$

