



Fundamentals of HVAC

Psychrometrics



What you will Learn in this Lesson

- Basics of the psychrometric chart
- Four basic process'
- Air heating
- Air cooling and dehumidifying
- Heat recovery

History of Psychrometrics

1904 W.H. Carrier called his chart a hygrometric chart but by 1911 the name was changed to psychrometric chart

1926 Claude A. Bulkeley proposed a chart with a log scale of water vapor and a non-uniform dry bulb to change the lines on the chart

Gibbs-Dalton Law

- The Gibbs-Dalton law states that in a mixture of ideal gases the gas and vapor molecules share the same volume and the pressure of the mixture is equal to the sum of the partial pressures of the individual component gases. The equation is in the form of:

$$P_m = P_a + P_w$$

P_m = pressure of mixture

P_a = pressure of dry air

P_w = pressure of water vapor

What is my Name?

- A mixture of dry air and water vapor is assumed to follow this relationship, what am I?

$$PV = nRT$$

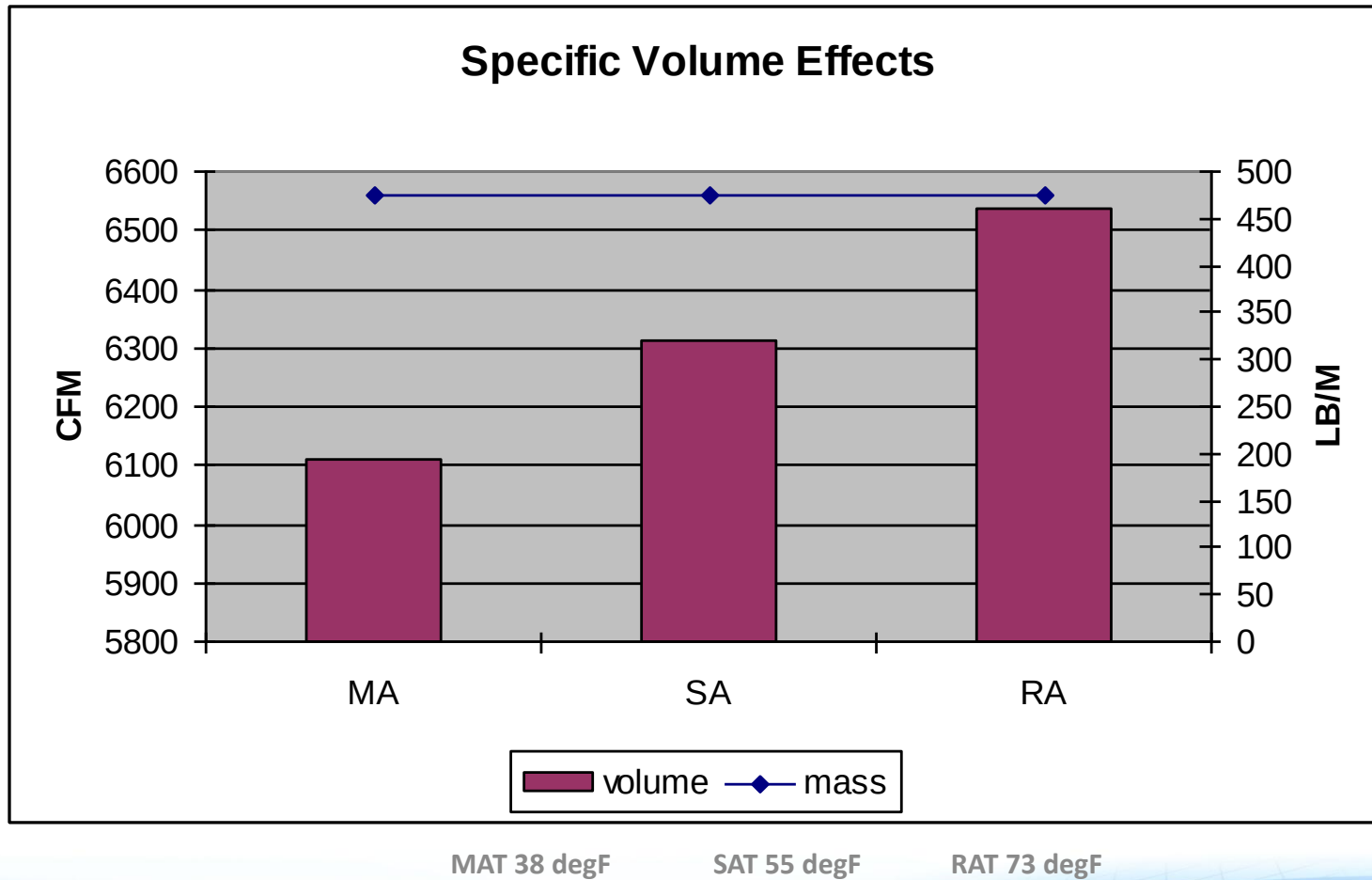
P = vapor pressure of mixture

n = moles of gas

R = gas constant = ?

T = absolute temperature

Mass Flow rate vs Volumetric Flow Rate



Heat Transfer in Air

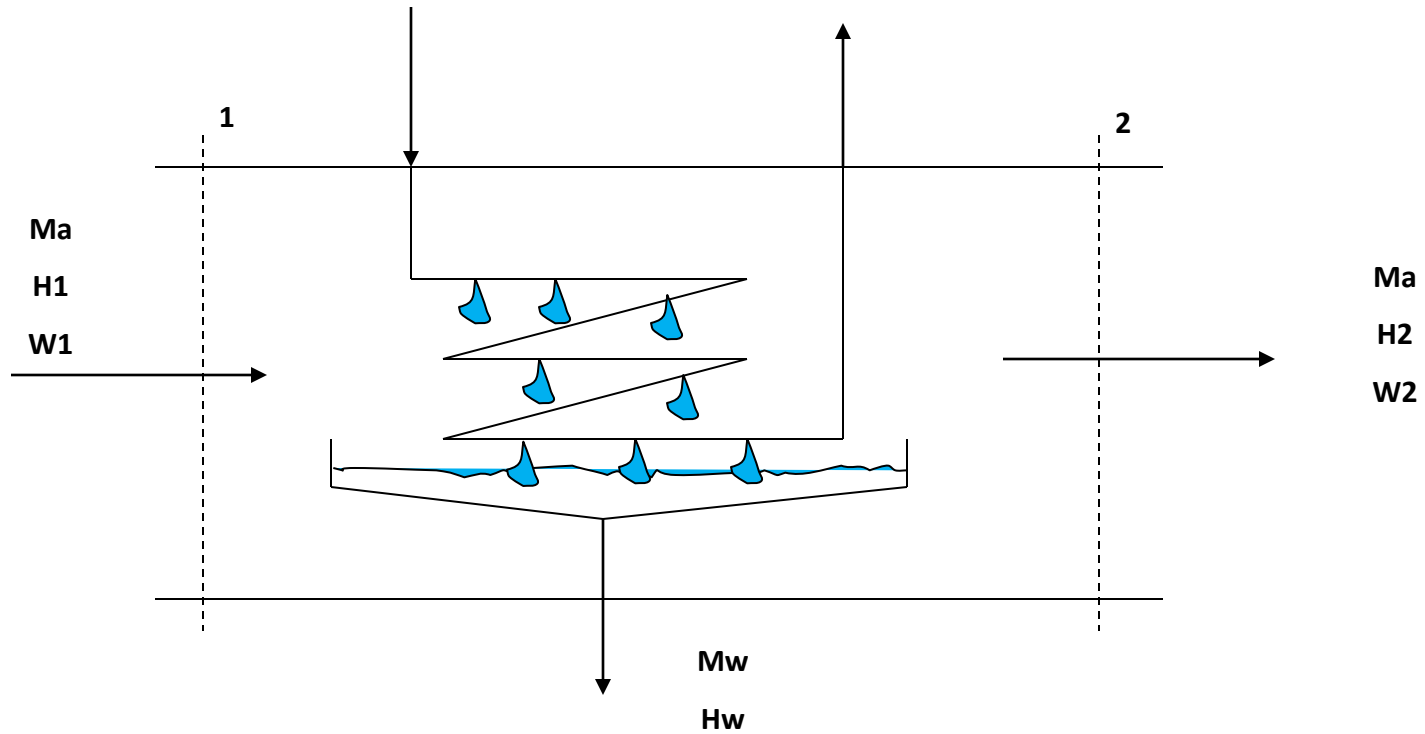
$$h = u + (P * v)$$

$$Q \text{ (Btu/hr)} = 4.5 * \text{CFM} * (h_1 - h_2)$$

$$Q = m_a * [(h_1 - h_2) - ((W_1 - W_2) * h_{w2})]$$

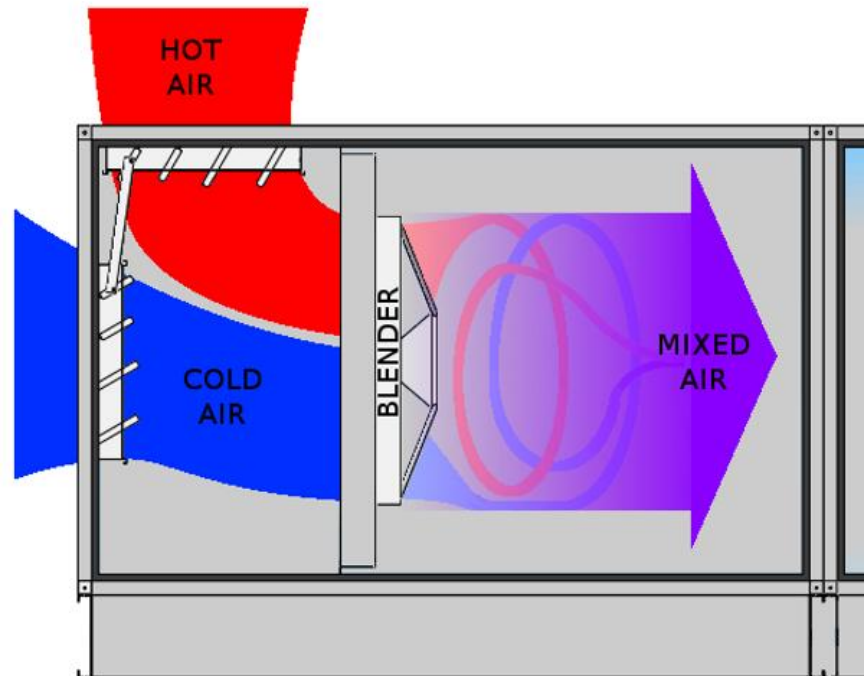
- Where:
 - u = specific molecular energy
 - $P * v$ = flow work energy
 - h = enthalpy (Btu/lb)
 - W = humidity ratio
 - m = mass flow rate

Cooling Coil Process



Mixing of Two Air Streams

- It is -16 F outside
- It is 68 F inside
- What is the mixed dry bulb air temperature?



Heat Recovery Danger

- It is -16 °F outside
- You have an enthalpy wheel
- The bypass dampers are closed
- There is no preheat
- The return air is 75 °F db and 50% RH
- What happens?

What you have Learned in this Lesson

- Basics of the psychrometric chart
- Four basic process'
- Air heating
- Air cooling and dehumidifying
- Heat recovery

End of Lesson

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