

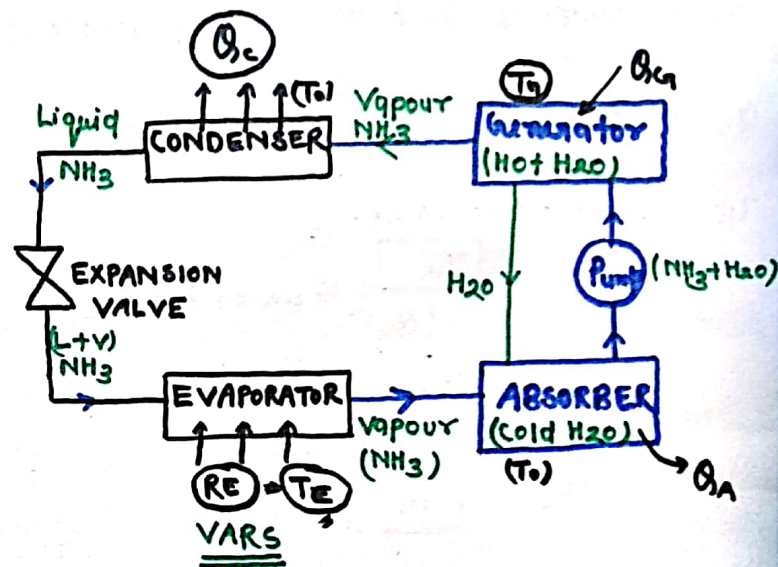
"VAPOUR ABSORPTION SYSTEM" (B.P. SINGH)

(1)

Introduction:-

- Oldest Method of Refrigeration.
- Used for low refrigeration capacity.
- Due to very less moving parts the operation is Noiseless.
- Heat energy is used instead of Mechanical Work.
- Absorber, pump and Generator is used in place of compressor.
- Combination of Ammonia-water.
($\text{NH}_3 \rightarrow \text{Refrigerant}$; $\text{H}_2\text{O} \rightarrow \text{Absorber}$)
- In larger equipment combination of Water and Lithium bromide is used.
($\text{H}_2\text{O} \rightarrow \text{Refrigerant}$; $\text{LiBr} \rightarrow \text{Absorber}$)

principle and Working of Simple VARS:-



$$\left\{ \text{COP} = \frac{\text{Heat absorbed in evaporator}}{W_{\text{pump}} + W_{\text{generator}} (Q_g)} \right\}$$

$$\boxed{\text{COP}_{\text{Ref.}} = \frac{RE}{Q_g}}$$

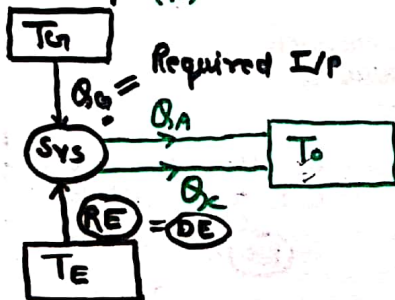
Let:

Q_G = Amt. of heat Supplied at generator temp. (T_G)

Q_A = Amt. of heat rejected by absorber at room temp. (T_o)

Q_c = Amt. of heat rejected at condenser at Room temp. (T_o)

T_E = evaporator temp. (K)



T_E = Evaporator temp. (K)

T_o = Ambient temp. (K)

T_G = Generator Temp. (K)

W.K.T.

from 1st Law of T.O.

$$\sum E_{input} = \sum E_{out}$$

$$Q_G + RE = Q_A + Q_c \quad \text{--- (1)}$$

$$\text{COP} = \frac{RE}{Q_G} \quad \text{--- (2)}$$

Clausius Inequalities -

$$\sum \frac{Q}{T} \leq 0$$

$$\text{①} \int \frac{dQ}{T} < 0 \quad \text{irreversible}$$

$$\text{②} \int \frac{dQ}{T} = 0 \quad \text{Reversible}$$

$$+\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{Q_A}{T_o} - \frac{Q_c}{T_o} \leq 0$$

(H. Rejected)

$$\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{1}{T_o} [Q_A + Q_c] = 0$$

from ① -

$$\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{1}{T_o} [Q_G + RE] = 0$$

$$\frac{Q_G}{T_G} - \frac{Q_G}{T_o} = \frac{RE}{T_o} - \frac{RE}{T_E}$$

$$Q_G \left(\frac{1}{T_G} - \frac{1}{T_o} \right) = RE \left[\frac{1}{T_o} - \frac{1}{T_E} \right]$$

$$\left\{ \text{COP}_{\text{vars}} = \frac{RE}{Q_G} = \frac{\left(\frac{1}{T_G} - \frac{1}{T_o} \right)}{\left(\frac{1}{T_o} - \frac{1}{T_E} \right)} = \left(\frac{T_G - T_o}{T_G} \right) \times \left(\frac{T_E}{T_o - T_E} \right) \right\}$$