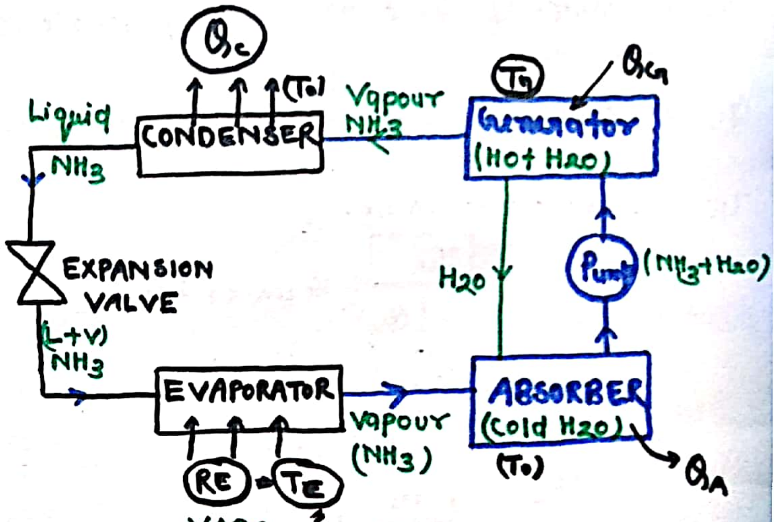
"VAPOUR ABSORPTION SYSTEM"

(B.P. SINGH)

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. (NH_3 → Refrigerant : H_2O → Absorber)
- → In larger equipment Combination of Water and Lithium bromide is used. (H_2O → Refrigerant : LiBr → Absorber)

principle and Working of Simple VARS :-



VARS

$$\left\{ COP = \frac{\text{Heat absorbed in evaporator}}{W_{pump}^{0} + W_{Generator}\,(Q_G)} \right\}$$

$$\boxed{COP_{Ref.} = \frac{RE}{Q_G}}$$

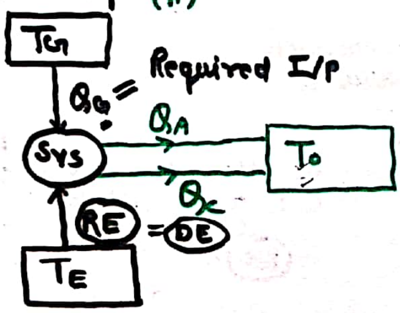
Let:

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

Q_A = Amt. of heat rejected by absorber at ~~room~~ temp. (T_0)

Q_c = Amt. of heat rejected at condenser at Room temp. (T_0)

T_E = evaporator temp. (K)



T_E = Evaporator temp. (K)

T_0 = Ambient temp. (K)

T_G = Generator Temp. (K)

W.K.T.

from 1^{st} Law of T.D.

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

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

$$\boxed{COP = \frac{RE}{Q_G}} \quad \text{— (*)}$$

Clausius inequalities -

$$\boxed{\Sigma \frac{Q}{T} \leq 0}$$

(i) $\oint \frac{dQ}{T} < 0$ irreversible

(ii) $\oint \frac{dQ}{T} = 0$ Reversible

$$+\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{Q_A}{T_0} - \frac{Q_c}{T_0} \leq 0$$

(H. Rejected)

$$\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{1}{T_0}\left[Q_A + Q_c\right] = 0$$

from (1) -

$$\frac{Q_G}{T_G} + \frac{RE}{T_E} - \frac{1}{T_0}\left[Q_G + RE\right) = 0$$

$$\frac{Q_G}{T_G} - \frac{Q_G}{T_0} = \frac{RE}{T_0} - \frac{RE}{T_E}$$

$$Q_G\left(\frac{1}{T_G} - \frac{1}{T_0}\right) = RE\left[\frac{1}{T_0} - \frac{1}{T_E}\right]$$

$$COP_{VARS} = \frac{RE}{Q_G} = \frac{\left(\frac{1}{T_G} - \frac{1}{T_0}\right)}{\left(\frac{1}{T_0} - \frac{1}{T_E}\right)} = \left(\frac{T_G - T_0}{T_G}\right) \times \left(\frac{T_E}{T_0 - T_E}\right)$$