

Effect of variation of properties on the performance of 'V-C' cycle -

Case I: Decrease in evaporator pressure -

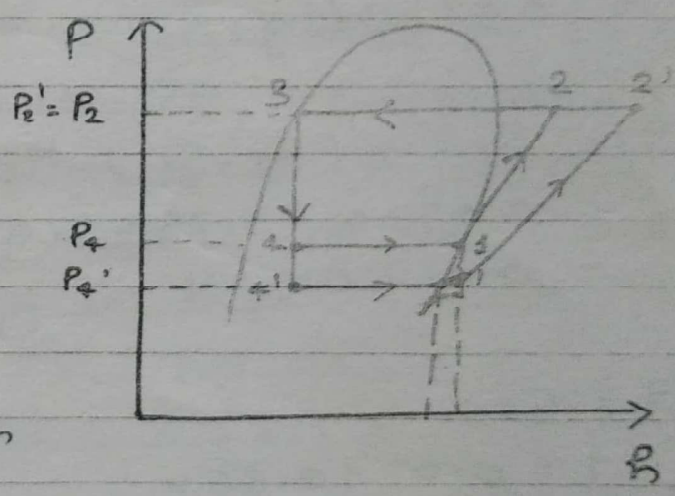
Effects -

I) RE ↓

II) W ↑

III) COP =  $\frac{RE \downarrow}{W \uparrow} = \downarrow$

IV)  $\eta_{vol} \downarrow$



$$\eta_v = 1 + C - C \left( \frac{P_2}{P_1} \right)^{1/n}$$

C = clearance ratio or clearance factor

$$C = \frac{V_c}{V_s}$$

n = polytropic index

Volumetric efficiency decreases due to increase in pressure ratio.

Case 2 - Increase in Condenser pressure! -

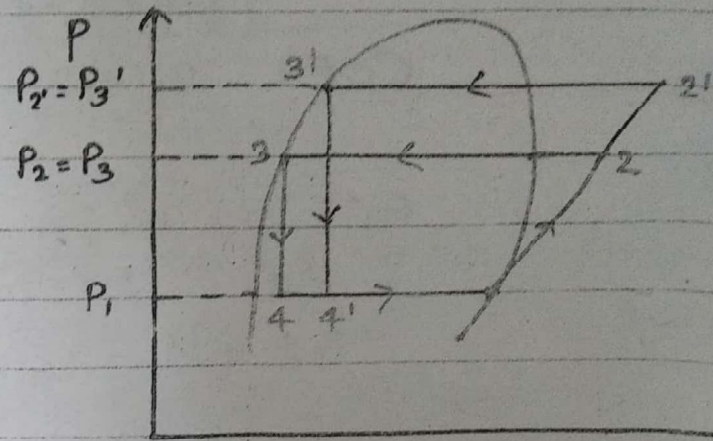
Effects -

I) RE ↓

II) W ↑

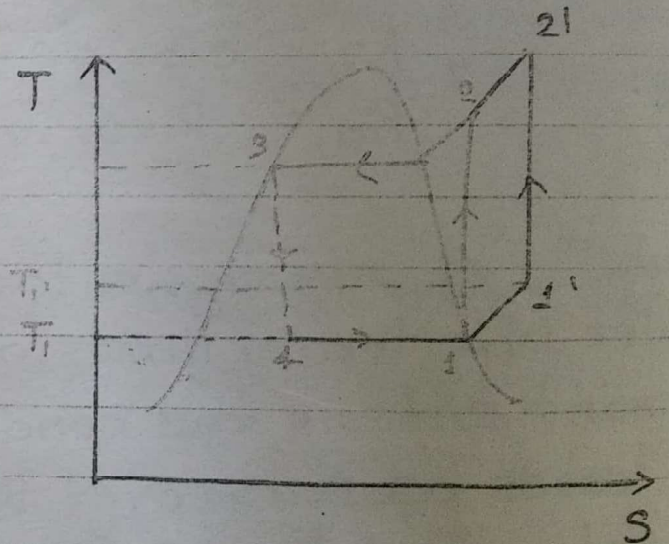
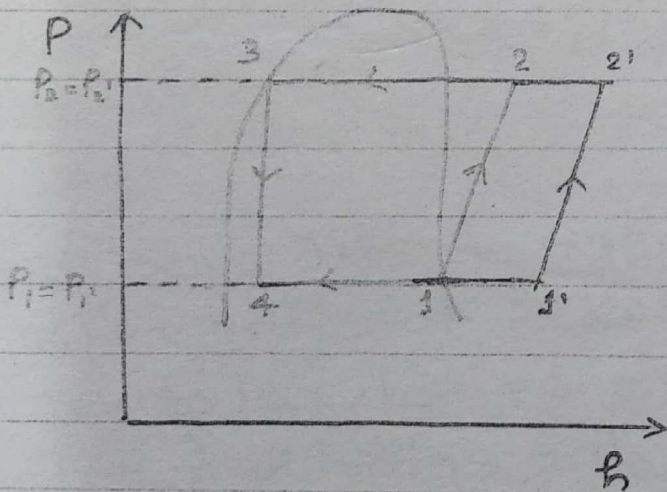
III) COP =  $\frac{RE \downarrow}{W \uparrow} = \downarrow$

IV)  $\eta_v \downarrow$



Imp:

Case 3 - Superheating! -



$$W = \frac{\gamma}{\gamma-1} (P_1 V_1 - P_2 V_2)$$

$$= \frac{\gamma}{\gamma-1} (mRT_1 - mRT_2)$$

$$= \frac{\gamma}{\gamma-1} mRT_1 \left[ 1 - \frac{T_2}{T_1} \right]$$

$$= \frac{\gamma}{\gamma-1} mRT_1 \left[ 1 - \left( \frac{P_2}{P_1} \right)^{\frac{\gamma-1}{\gamma}} \right]$$

$$= f(T)$$

## Effects -

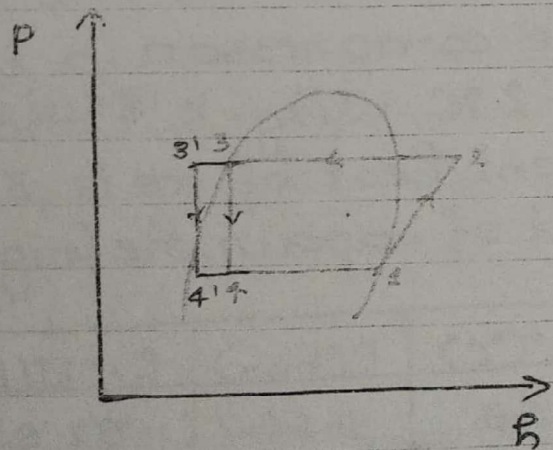
- I) If superheating is done in evaporator, there is an increase in RE.
- II) Work input to the compressor is a function of temp. at the inlet to the compressor. With superheat there is an increase in temp. at the inlet to the compressor & hence this results in increase in work input.
- III) COP may increase or decrease depending on the refrigerant. In case of R-12, superheating results in increase of in COP whereas in case of  $\text{NH}_3$ , it results in decrease in COP.

## Case 4: Subcooling -

I) RE  $\uparrow$

II) W  $\rightarrow$  same

III)  $\text{COP} = \frac{\text{RE} \uparrow}{W \downarrow} = \uparrow$



Designation of refrigerant (Nomenclature of Refrigerant) -

Case 1 - Saturated Hydrocarbon refrigerant :-