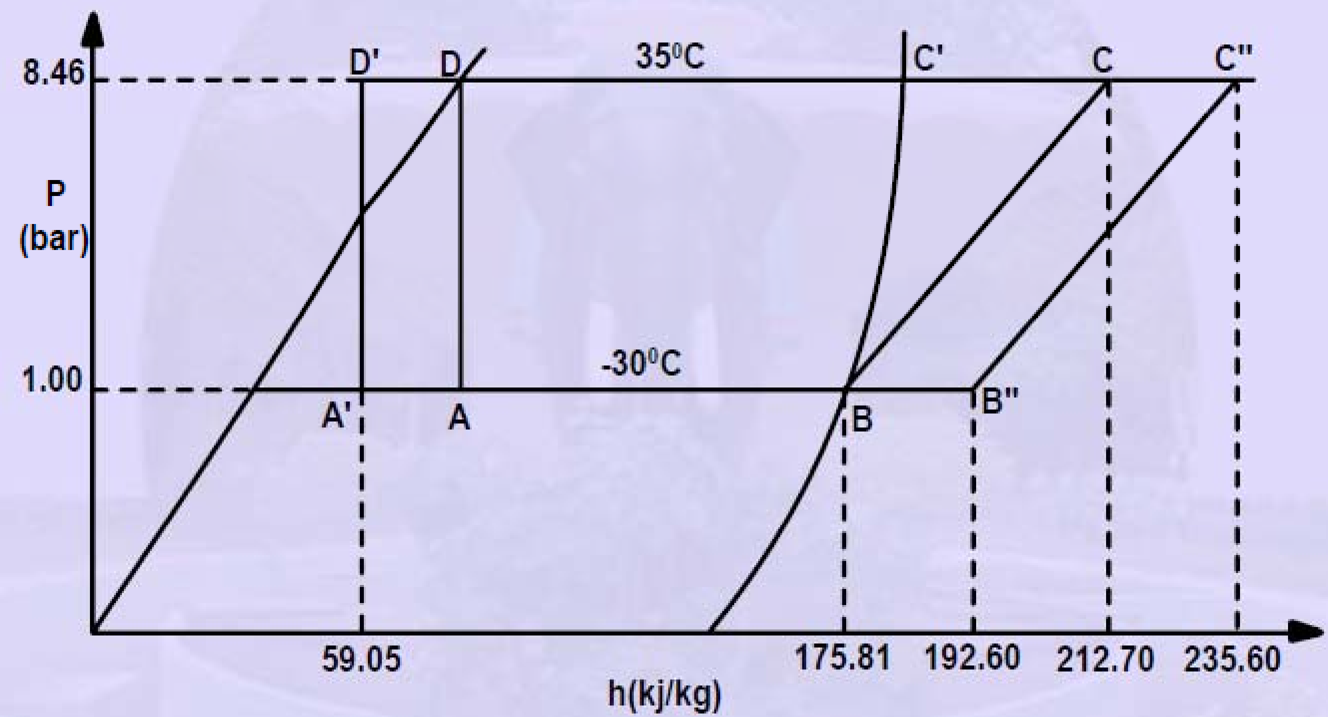

Fig.6.5.4(a). Subcooling and superheating of refrigerant

(i) *By passing the liquid refrigerant from condenser through a heat exchanger through which the cold vapor at suction from the evaporator is allowed to flow in the reversed direction. This process subcools the liquid but superheats the vapor. Thus, COP is not improved though refrigeration effect is increased.*

(ii) *By making use of enough quantity of cooling water so that the liquid refrigerant is further cooled below the temperature of saturation. In some cases, a separate subcooler is also made use of for this purpose. In this case, COP is improved.*

(b) Superheating of Vapor:

If the vapor at the compressor entry is in the superheated state B", which is produced due to higher heat absorption in the evaporator, then the refrigerating effect is increased as $(h''_B - h_A) > (h_B - h_A)$. However, COP may increase, decrease or remain unchanged depending upon the range of pressure of the cycle.

(c) Change in suction pressure (P_S):

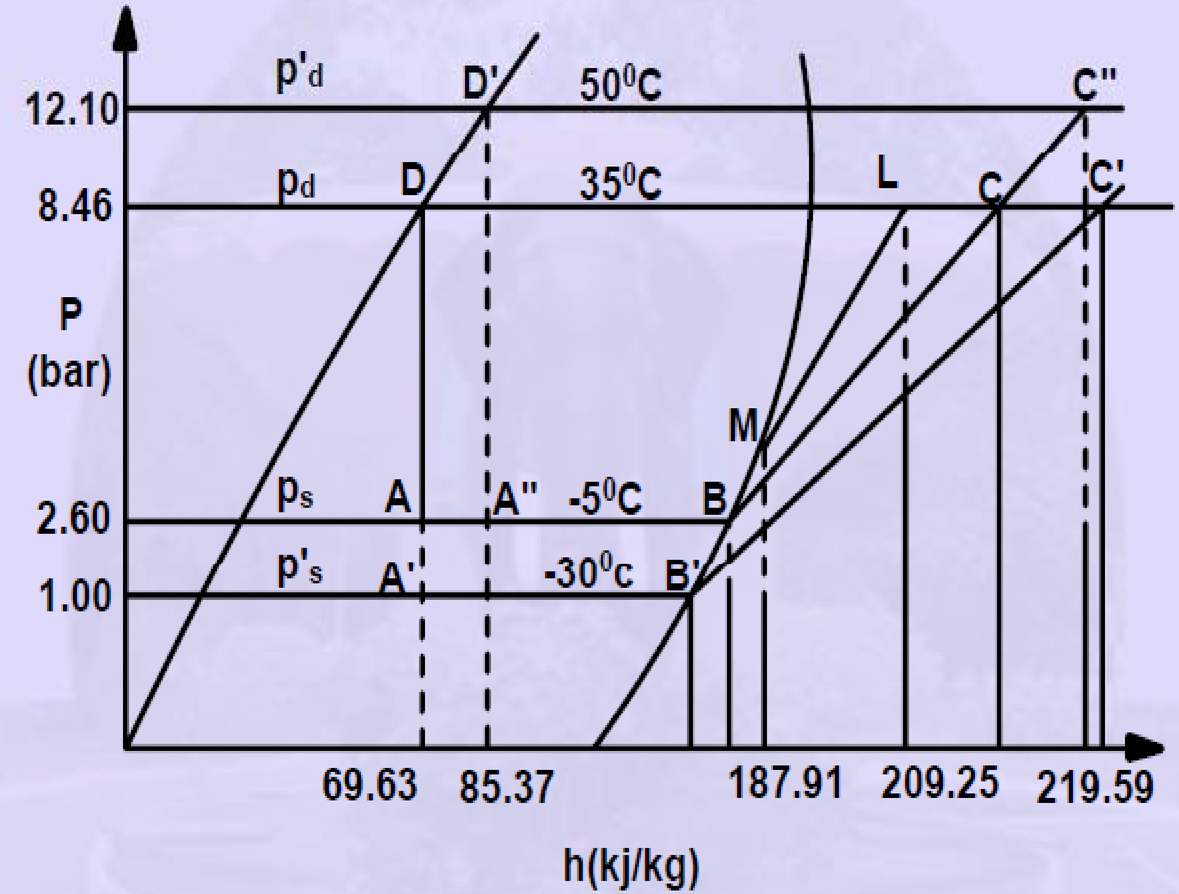

Fig.6.5.4(c). Effect of change in evaporator and condenser pressure

Let the suction pressure or the evaporating pressure in a simple refrigeration cycle be reduced from P_S to P'_S. It will be clear from the figure that:

The refrigerating effect is reduced to: $(h'_B - h'_A) < (h_B - h_A)$

The work of compression is increased to: $(h''_C - h''_B) > (h_C - h_B)$

Hence, the decrease in suction pressure decreases the refrigeration effect and at the same time increases the work of compression. But, both the effects tend to decrease the COP.

(d) Change in discharge pressure (P_d):

In Fig.6.5.4(c), let us assume that the pressure at the discharge or the condensing pressure is increased from P_d to P'_d. It will have effects as follows:

The compressor work requirement is increased to: $(h''_C - h_B) > (h_C - h_B)$

The refrigerating effect is reduced to: $(h_B - h''_A) < (h_B - h_A)$

Therefore, the increase in discharge pressure results in lower COP. Hence, the discharge pressure should be kept as low as possible depending upon the temperature of the cooling medium available.

(e) Effect of Volumetric Efficiency of Compressor:

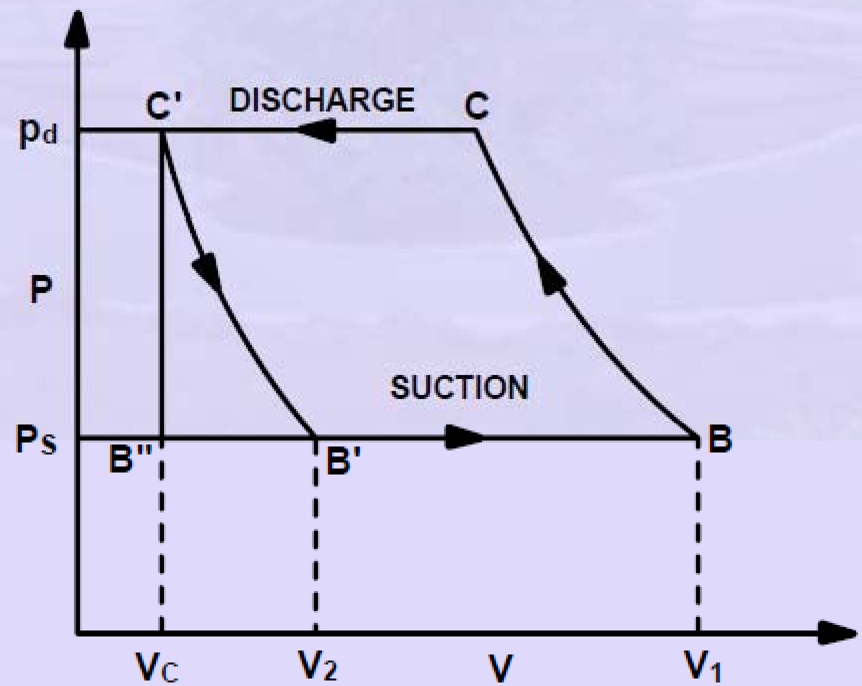

Fig.6.5.4(e). Effect of volumetric efficiency

The factors like clearance volume, pressure drop through discharge and suction values, leakage of vapor along the piston and superheating of cold vapor due to contact with hot cylinder walls, affects the volume of the vapor actually pumped by the compressor. The volumetric efficiency of a compressor is defined as;

$$\eta_{vol} = \frac{\text{Actual mass of vapor drawn at suction conditions}}{\text{Theoritical mass that can be filled in the displacement volume}}$$

Figure 6.5.4(e) represents the p-v diagram of a compressor. Now, during suction stroke B"–B, the vapor filled in clearance space at pressure P_d expands along C'-B' and the suction valve opens only when the pressure has dropped down to p_S. Therefore, the actual amount of vapor sucked during the suction stroke is $(v_1 - v_2)$ while the stroke volume is $(v_1 - v_c)$. Volumetric efficiency decreases the refrigeration effect.