

Subject Name - Basic Mechanical Engineering

Subject code - MEE10513

Name - Shreerang Mhatre

Division - II

Roll no - 111056

Batch - K3

Experiment No - 9

* Name of the experiment - Demonstration of Refrigeration Test rig

* Aim - To study and understand the working principle and components of refrigerator

* Objective - To understand the different parts and working of refrigerator.

Summary

* Theory -

Refrigeration is defined as an art of producing and maintaining temperature in a space below atmospheric temperature. A refrigerator is equipment used to remove the heat continuously from space (sink) & maintain the temperature below atmospheric temperature and reject heat to the atmosphere (source).

* Artificial methods of obtaining refrigeration can be enumerated as-

- Vapour compression cycle
- Vapour absorption cycle
- Air or Gas cycle refrigeration
- Steam jet refrigeration
- Non-conventional methods.

* Refrigeration Effect -

Refrigeration effect is the removal of heat from a body or space at low temperature. This occurs in evaporator. The amount of heat extracted at low temperature in the evaporator is called the refrigeration effect.

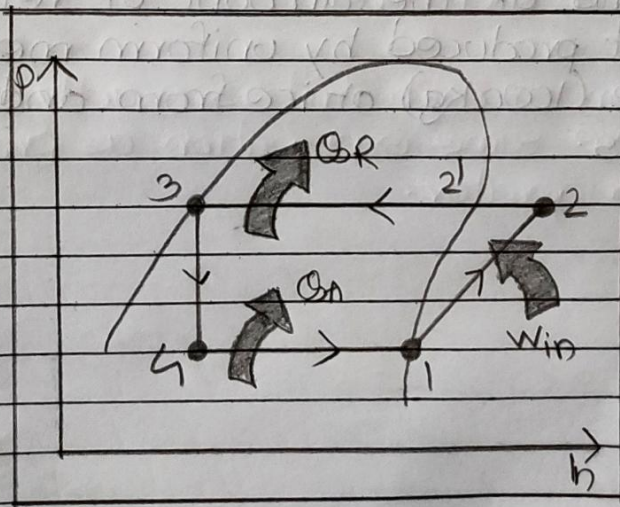
* Coefficient of Performance (COP) -

work is required to be done on the refrigerant to compress it. The net work input is the net work required for the compression. The performance of a refrigeration system can be evaluated by taking a ratio of refrigeration effect to net work input. This is termed as Coefficient of Performance or COP.

* Theoretical Simple saturated Vapour Compression cycle -

The four processes involved are -

- 1-2: Reversible adiabatic or isentropic compression of refrigerant vapour.
- 2-3: Reversible heat rejection at constant pressure (Condensation from vapour to liquid).
- 3-4: Irreversible expansion at constant enthalpy - (Throttling)
- 4-1: Reversible heat absorption at constant pressure (Evaporation from liquid to vapour)



Questions

Q1) Define: Refrigerant, COP, Tons of Refrigeration

Ans: ① Refrigerant -

A refrigerant is a working fluid used in the refrigeration cycle of air conditioning systems and heat pumps where in most cases they undergo a repeated phase transition from a liquid to a gas and back again.

② COP -

The Coefficient of Performance (COP) is defined as the ratio of refrigeration effect to the net work input. It is used to evaluate the performance of a refrigeration system.

③ Tons of Refrigeration -

A tons of Refrigeration (TR) is expressed in terms of the amount of refrigeration effect produced by uniform melting of one tonne (1000 kg) of ice from and at 0°C in 24 hrs.

Q2) Explain with neat sketch the principle and working of household Refrigerator.

Ans → *working & Principle-

① The evaporator where the refrigerant evaporates absorbs the latent heat of vaporization. In modern frost free refrigerators, the evaporator is located outside the cabinet as fan circulates air from evaporator to the freezer.

② The cold air being heavier flows down from the freezer to the bottom.

③ The warm air being lighter flows upward from vegetable box to freezer gets cooled and flows down again.

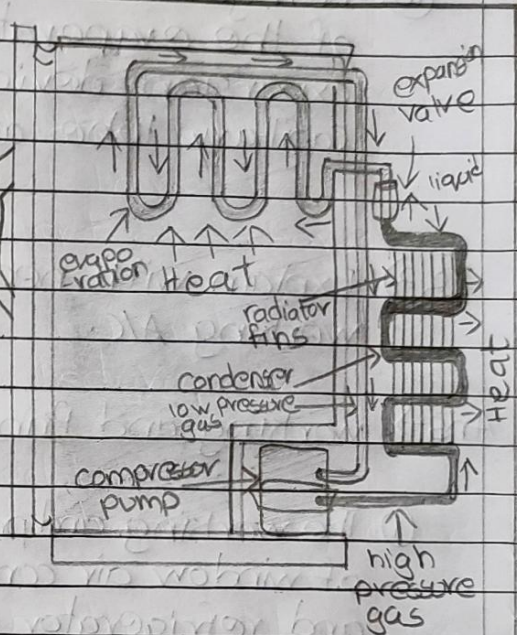
④ This natural convection current is set up which maintains a temperature gradient between top & bottom of refrigerator.

⑤ The temperature maintain in the freezer is -15°C .

⑥ The condenser is usually a wire & tube type mounted at the back of the refrigerator.

⑦ Having no fan, the refrigerator vapor is condensed with the help of surrounding air which rises above by natural convection as it gets heated after absorbing the latent heat of condensation from refrigerant.

⑧ After condensation, the high pressure liquid



refrigerant is reduced to the low pressure of the evaporator by passing through liquid.

- (10) Refrigerant is reduced to the low pressure of the evaporator by passing through an expansion device (throttle) valve or capillary tube and cycle is completed.

Q3) Explain with neat sketch the principle and working A/C.

Ans → working and Principle -

- (1) The working and principle of window air conditioner and refrigerator is same just construction is different.

- (2) Condenser and evaporator are separated from each other by a partition so that hot and cold air don't mix with each other.

- (3) Function of each unit is exactly same and student can give same explanation as provided in case of refrigerator.

