EXPERIMENT NO – 1

AIM: To study the basic components of simple vapour compression refrigeration cycle. i.e. compressor, condenser, expansion valve, and evaporator**.**

Theory:

Vapour compression refrigeration cycle

A vapour compression refrigeration system is an improved type of air refrigeration system in which a suitable working substance, termed as refrigerant is used. It condenses and evaporates at temperatures and pressures close to the atmospheric conditions.

The refrigerant used does not leave the system but is circulated throughout the system alternately condensing and evaporating. The vapour compression refrigeration system is now days used for all-purpose refrigeration. It is used for all industrial purpose from a small domestic refrigerator to a big air conditioning plant.

The vapour compression refrigeration cycle is based on the following factor:

- Refrigerant flow rate.
- Type of refrigerant used.
- Kind of application viz air-conditioning, refrigeration, dehumidification etc.
- The operation design parameters.
- The system equipments/ components proposed to be used in the system.

The vapour compression refrigeration cycle is based on a circulating fluid media, viz, a refrigerant having special properties of vaporizing at temperatures lower than the ambient and condensing back to the liquid form, at slightly higher than ambient conditions by controlling the saturation temperature and pressure. Thus, when the refrigerant evaporates or boils at temperatures lower than ambient, it extracts or removes heat from the load and lower the temperature consequently providing cooling.

The super-heated vapour pressure is increased to a level by the compressor to reach a saturation pressure so that heat added to vapour is dissipated/ rejected into the atmosphere, using operational ambient conditions, with cooling medias the liquid from and recycled again to form the refrigeration cycle.

The components used are:

1. **Evaporator**
2. **Compressor**
3. **Condenser and receiver**
4. **Throttling device**

The refrigeration cycle can be explained schematically in the two diagrams i.e.. Pressure enthalpy diagram Temperature entropy diagram

The working of vapour compression refrigeration cycle and function of each above component is given below.

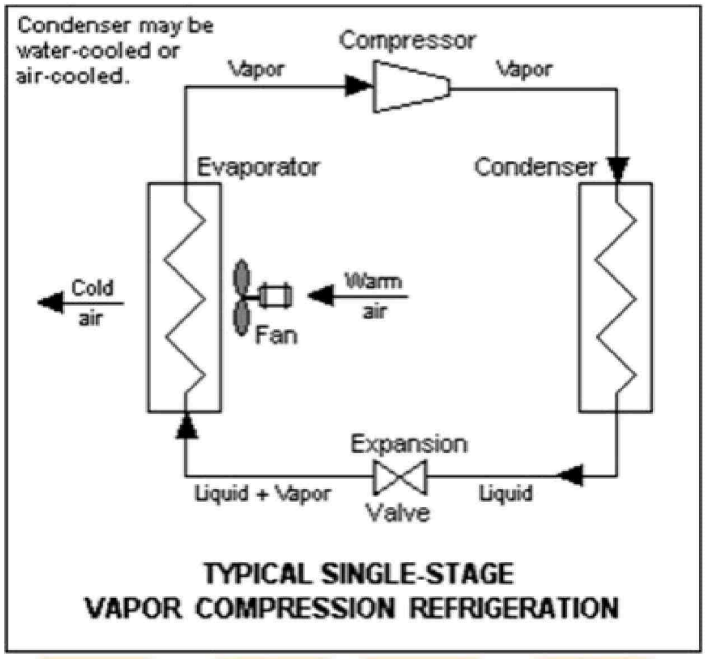

Figure: Components of vapour refrigeration system

(a)Evaporator:

The liquid refrigerant from the condenser at high pressure is fed through a throttling device to an evaporator at a low pressure. On absorbing the heat to be extracted from

Media to be cooled, the liquid refrigerant boils actively in the evaporator and changes state. The refrigerant gains latent heat to vaporizes at saturation temperature/ pressure and further absorbs sensible heat from media to be cooled and gets fully vaporized and super heated. The "temperature-pressure relation chart" table can determine the pressure and temperature in the evaporator.

(b) Compressor

The low temperature, pressure, superheated vapour from the evaporator is conveyed through suction line and compressed by the compressor to a high pressure, without any change of gaseous state and the same is discharge into condenser. During this process heat is added to the refrigerant and known as heat of compression ratio to raise the pressure of refrigerant to such a level that the saturation temperature of the discharge refrigerant is higher than the temperature of the available cooling medium, to enable the super heated refrigerant to condense at normal ambient condition.

Different types of compressors are reciprocating, rotary and centrifugal and are used for different applications.

(c) Condenser The heat added in the evaporator and compressor to the refrigerant is rejected in condenser at high temperature/ high pressure. This super heated refrigerant vapour enters the condenser to dissipate its heat in three stages. First on entry the refrigerant loses its super heat, it then loses its latent heat at which the refrigerant is liquefied at saturation temperature pressure. This liquid loses its sensible heat, further and the refrigerant leaves the condenser as a sub cooled liquid. The heat transfer from refrigerant to cooling medium (air or water) takes place in the condenser. The sub-cooled liquid from condenser is collected in a receiver (wherever provided) and is then fed through the throttling device by liquid line to the evaporator.

There are several methods of dissipating the rejected heat into the atmosphere by condenser. These are water-cooled, air cooled or evaporative cooled condensers.

In the water-cooled condenser there are several types viz. Shell and tube, shell and coil, tube in tube etc. In Evaporative cooled condenser, both air and water are used. Air-cooled condensers are prime surface type, finned type or plate type.

The selecting of the type depends upon the application and availability of soft water.

(d) Throttling device

The high-pressure liquid from the condenser is fed to evaporator through device, which should be designed to pass maximum possible liquid refrigerant to obtain a good refrigeration effect. The liquid line should be properly sized to have minimum pressure drop.

The throttling device is a pressure-reducing device and a regulator for controlling the refrigerant flow. It also reduces the pressure from the discharge pressure to the evaporator pressure without any change of state of the pressure refrigerant.

The types of throttling devices are:

- Capillary tubes
- Thermostatic expansion valves
- Hand expansion valves
- Hand valves.

The most commonly used throttling device is the capillary tube for application upto approx. 10 refrigeration tons. The capillary is a copper tube having a small dia-orifice and is selected, based on the system design, the refrigerant flow rate, the operating parameters (such as suction and discharge pressures), type of refrigerant, capable of compensating any variations/ fluctuations in load by allowing only liquid refrigerant to flow to the evaporator.

Result: Various components of the vapour compression system have been studied.

Viva-voce:

Experiment No – 3

Aim: To study the vapour absorption (domestic electrolux refrigerator) system.

Theory:

The vapour absorption refrigeration system is one of the oldest method of producing refrigerating effect. The principle of vapour absorption was first discovered by Michael Faraday in 1824 while performing a set of experiments to liquefy certain gases. A french scientist Ferdinand carre developed the first vapour absorption refrigeration machine in 1860. This system may be used in both the domestic and large industrial refrigerating plants. The refrigerant, commonly used in a vapour absorption system, is ammonia.

The vapour absorption system uses heat energy, instead of mechanical energy as in vapour compression systems, in order to change the conditions of the refrigerant required for the operation of the refrigeration cycle.

In the vapour absorption system, an absorber, a pump, a generator and a pressure-reducing valve replace the compressor. These components in vapour absorption system perform the same function as that of a compressor in vapour compression system. In this system, the vapour refrigerant from the evaporator is drawn into an absorber where it is absorbed by the week solution of the refrigerant forming a strong solution. This strong solution is pumped to the generator where it is heated by some external source. During the heating process, the vapour refrigerant is driven off by the solution and enters into the condenser where it is liquefied. The liquid refrigerant then flows into the evaporator and thus the cycle is completed.

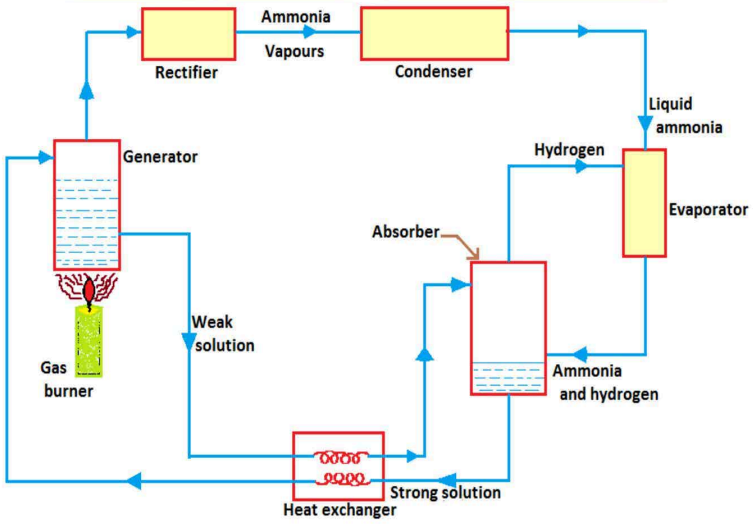

Figure: Electrolux vapour absorption system

Working:

The domestic absorption type refrigerator was invented by two Swedish engineers **Carl Munters and Baltzer Van Platan in 1925** while they were studying for their under-graduate course of royal institute of technology in Stockholm. The idea was first developed by the **'Electrolux Company' of Luton, England.**

This type of refrigerator is also called **three- fluids absorption system**. The main purpose of this system is to eliminate the pump so that in the absence of moving parts, the machine becomes noise-less. The three fluids used in this system are **ammonia, hydrogen and water.**

- The ammonia is used as a refrigerant because it possesses most of the desirable properties. It is toxic, but due to absence of moving parts, there are very little changes for the leakage and the total amount of refrigeration used is small.
- The hydrogen being the lightest gas is used to increase the rate of evaporation of the liquid ammonia passing through the evaporator. The hydrogen is also non-corrosive and insoluble in water. This is used in the low-pressure side of the system.
- The water is used as a solvent because it has the ability to absorb ammonia readily.

The strong ammonia solution from the absorber through heat exchanger is heated in the generator by applying heat from an external source usually a gas burner. During this heating process, ammonia vapour are removed from the solution and passed to the condenser. A rectifier or a water separator fitted before the condenser removes water vapour carried with the ammonia vapour, so that dry ammonia vapour are supplied to

The condenser. These water vapour, if not removed, they will enter into the evaporator causing freezing and choking of the machine. The hot weak solution while passing through the exchanger is cooled. The heat removed by the weak solution is utilized in raising the temperature of strong solution passing through the heat exchanger. In this way, the absorption is accelerated and the improvement in the performance of a plant is achieved.

The ammonia vapour in the condenser is condensed by using external cooling source. The liquid refrigerant leaving the condenser flows under gravity to the evaporator where it meets the hydrogen gas. The hydrogen gas which is being fed to the evaporator permits the liquid ammonia to evaporate at a low pressure and temperature according to Dalton's principal. During the process of evaporation, the ammonia absorbs latent heat from the refrigerated space and thus produces cooling effect.

The mixture of ammonia vapour and hydrogen is passed to the absorber where ammonia is absorbed in water while the hydrogen rises to the top and flows back to the evaporator.

The main disadvantage of electrolux refrigerator is:

It can not be used for industrial purpose as the COP of the system is very low.

Result: Vapour refrigeration refrigeration system.

Viva voce Questions

Q1 What is the function of water in this system?
Q2 What is the function of the hydrogen in this system?
Q3 What is the function of the generator in this system?
Q4 What is the function of the rectifier/dehydrator in the system?
Q5 Is there is compressor is present in this type of system?

Experiment No.-5

Aim: To study various components of room air conditioning system.

Apparatus: Window air conditioning trainer.

Theory:

Window air conditioner is sometimes referred to as room air conditioner as well. It is the simplest form of an air conditioning system and is mounted on windows or walls. It is a single unit that is assembled in a casing where all the components are located.

This refrigeration unit has a double shaft fan motor with fans mounted on both sides of the motor. One at the evaporator side and the other at the condenser side.

The evaporator side is located facing the room for cooling of the space and the condenser side outdoor for heat rejection. There is an insulated partition separating this two sides within the same casing.

Front Panel

The front panel is the one that is seen by the user from inside the room where it is installed and has a user interfaced control be it electronically or mechanically. Older unit usually are of mechanical control type with rotary knobs to control the temperature and fan speed of the air conditioner.

The newer units come with electronic control system where the functions are controlled using remote control and touch panel with digital display.

The front panel has adjustable horizontal and vertical(some models) louvers where the direction of air flow are adjustable to suit the comfort of the users.

The fresh intake of air called VENT (ventilation) is provided at the panel in the event that user would like to have a certain amount of fresh air from the outside.

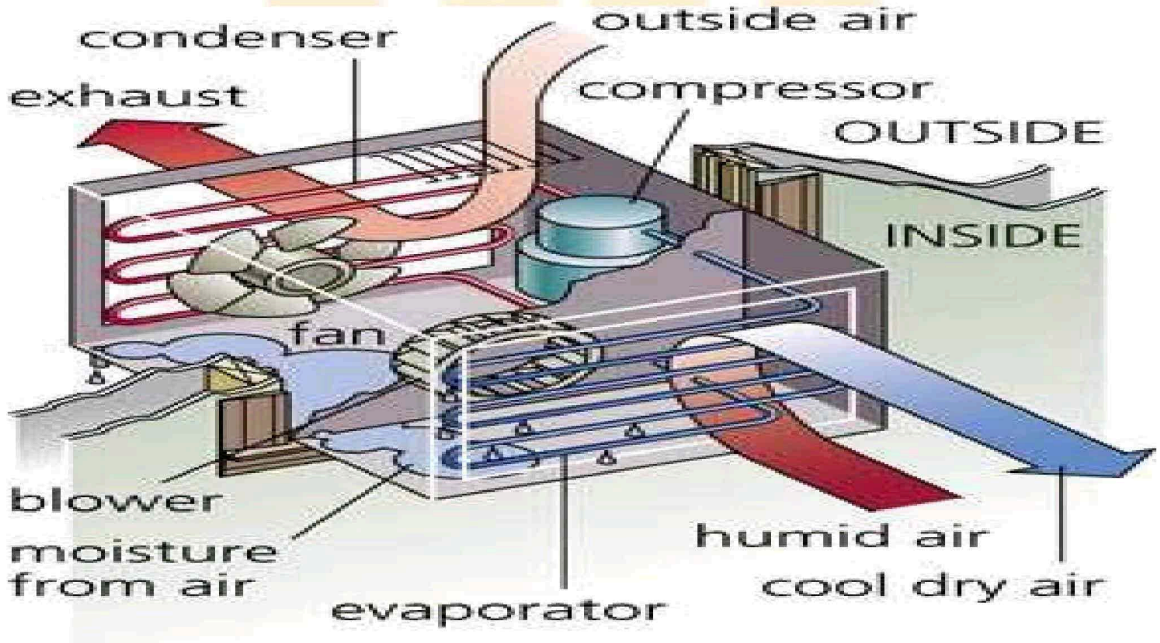

Figure: Components of air conditioning system

Indoor Side Components

The indoor parts of a window air conditioner include:

- **Cooling Coil** with a air filter mounted on it. The cooling coil is where the heat exchange happen between the refrigerant in the system and the air in the room.
- **Fan Blower** is a centrifugal evaporator blower to discharge the cool air to the room.
- **Capillary Tube** is used as an expansion device. It can be noisy during operation if installed too near the evaporator.
- **Operation Panel** is used to control the temperature and speed of the blower fan. A thermostat is used to sense the return air temperature and another one to monitor the temperature of the coil. Type of control can be mechanical or electronic type.
- **Filter Drier** is used to remove the moisture from the refrigerant.
- **Drain Pan** is used to contain the water that condensate from the cooling coil and is discharged out to the outdoor by gravity.

Outdoor Side Components

The outdoor side parts include:

- **Compressor** is used to compress the refrigerant.
- **Condenser Coil** is used to reject heat from the refrigeratn to the outside air.
- **Propeller Fan** is used in air-cooled condenser to help move the air molecules over the surface of the condensing coil.
- **Fan Motor** is located here. It has a double shaft where the indoor blower and outdoor propeller fan are connected together.

Operations

During operation, a thermostat is mounted on the return air of the unit. This temperature is used to control the on or off of the compressor. Once the room temperature has been achieved, the compressor cuts off.

Usually, it has to be off for at least 3 minutes before turning on again to prevent it from being damaged. For mechanical control type, there is usually a caution to turn on the unit after the unit has turned off for at least 3 minutes. For electronic control, there is usually a timer to automatically control the cut-in and cut-out of compressor.

The evaporator blower fan will suck the air from the room to be conditioned through the air filter and the cooling coil. Air that has been conditioned is then discharge to deliver the cool and dehumidified air back to the room. This air mixes with the room air to bring down the temperature and humidity level of the room.

The introduction of fresh air from outside the room is done through the damper which is then mixed with the return air from the room before passing it over the air filter and the cooling coil. The air filter which is mounted in front of the evaporator acts as a filter to keep the cooling coil clean to obtain good heat-transfer from the coil. Hence, regular washing and cleaning of the air filter is a good practice to ensure efficient operation of the air conditioner.

Heat Pump Window Air Conditioner

In temperate countries, heating of the room is required. A heat pump window air conditioner unit is able to cool the room during summer and heat the room during winter. A reversing valve (also known as 4-Way-Valve) is used to accomplish this.

During heating operation, it reverses the flow of the refrigerant which results in the evaporator to act as a condenser and the condenser as evaporator.

Result: Various components of room air conditioner have been studied.

Viva Questions:

1. What do you mean conditioning of air?
2. Explain the working principle of air conditioning system?
3. What are different types of air conditioning systems?
4. What is the function of the blower?
5. What is the function of the filter in front of the evaporator coil?

Experiment No.-6

Aim: To find performance of various types of expansion devices on Refrigeration test Rig.
Apparatus: Refrigeration trainer containing different expansion devices.
Theory:

Capillary tubes expansion devices

Though the capillary tube is not a valve, it does the purpose of expansion valve in, domestic units and in some small commercial units such a refrigerator, water cooler, cooling equipments. It is a coil or a length of a fine tubing that a very small orifice, usually 0.30 to 0.10 inch in diameter. The high pressure is dissipated in forcing the liquid through this small orifice and a predetermined amount of liquid of at a reduced pressure is allowed to flow to the evaporator. The capacity is determined by the diameter and length of tubing used. The operation of capillary tube is simple and full proof. It is simple in construction and no maintenance is required. System using this device does not require receiver. The disadvantages associated with this device, the refrigerant must be free from moisture and dirt otherwise it will chock the tube and stop the flow of refrigerant. It cannot be used with high fluctuating load conditions.

Hand expansion valve/ needle valve

A hand expansion valve is a globe valve with a needle seat in a smaller sizes and a plug type tapered seat in the longer sizes. The chief advantages of a hand expansion valve is simple construction, there is very little can get out of order. The main disadvantage is that an operator must available at all the times to make the necessary adjustments to met changing load conditions. At one time it was the only expansion valve available, but it rapidly being replaced by automatic devices. This valve is still used in large system as by pass valve around automatic control valve to allow operation in case of automatic valve failure and during repairs. Some flooded evaporator control system also has a hand expansion valve, for liquid control. These have a float switch and solenoid as the over riding control.

Thermostatic expansion valve

The thermostatic expansion valve controls the flow of refrigerant through the evaporator will always in super heated condition. Its operation is used on maintaining a constant degree of super heat at the evaporator outlet. The valve motion is to allow less refrigerant to maintain constant degree of super heat at the evaporator outlet is controlled by the processes (1) pressure in the bulb (2) spring tension (3) pressure in the evaporator. Under normal operating condition the pressure exerted by vapour in the controlling bulb on the diaphragm is balanced by the spring tension and the pressure in the evaporator.

Viva Question:

1. What are expansion devices used in refrigeration?
2. What is capillary tube?
3. What is hand expansion valve?
4. What is thermostatic expansion valve?
5. What is the function of the evaporator?

Experiment No.-7

Aim: To study various control devices used in refrigeration system.

Theory:

Over load protector

The basic function of an over load protector is to protect compressor motor from damaged, due to over current draw and overheating over its operating range and under over load conditions of temporary valve which might occur occasionally. It is always try to select an overload protector which will cut off compressor supply before it reaches the critical winding temperature level and the sometime ensuring that the over load does not interfere at the acceptable winding temperature over its entire operating range.

High pressure control / cut off

A high pressure cut out is a pressure control device used as a safety control on the discharge line of a compressor or a group of compressor. In case of condenser failure, or other

operating conditions that cause the discharge pressure to rise above a set point the high pressure cut out, opens the compressor motor controls circuit to prevent further pressure increase. The control can also be wired to actuate an alarm circuit.

Low pressure control cut / out

A low pressure cut out is a similar type pressure controller. It is so arranged that the contact are opened when the pressure falls below a given point. It is sometimes used a safety control to prevent the suction pressure from falling to a point where the compressor ratio will be too great for the compressor design. It also prevents the suction pressure from falling to a point where other damage can occur from low temperature such as freezing up of a water cooler. This cut out is often used as the control device to stop the compressor when pressure (and therefore temperature) conditions have been satisfied. These controls also have an adjustable range and differential.

Relay for starting of motors in refrigerant

At the time of starting, the motor takes heavy passes through the coil which pulls up the plunger and the controls are closed bringing the starting winding into current. Once the motor catches the speed, the current is reduced which automatically release the plunger and the starting winding is cut off. Only running winding is kept in the circuit. Over current element which is a bimetallic strip disconnect the supply to the motor when excessive current is taken by the motor. Bimetallic strip and the contacts are broken.

Thermostat

It is used to control the temperature of the refrigeration. The bulb of the thermostat is clamped to the evaporator or freezer. The thermostat bulb is charged with few drops of refrigerant. The thermostat can be set to maintain different temperature at a time. When the desired temperature is obtained, the bulb of the thermostat senses it, the liquid in it compresses and operates the bellows of the thermostat and open compressor motor contacts. The temperature at which the compressor motor stops called cut out temperature.

Viva Questions

1. What is thermostat?
2. What is overload protector?
3. What is starting relay?
4. What is low pressure cut off?
5. What is high pressure cut off?

Experiment No.-8

Aim: To study various type of compressors.

Theory: The compressors are one of the most important parts of the refrigeration cycle. The compressor compresses the refrigerant, which flows to the condenser, where it gets cooled. It then moves to the expansion valve, and the evaporator and it is finally sucked by the compressor again

Types of compressors:

Mainly following type of compressors are used.

1 Reciprocating, 2 Rotary, 3 Screw, 4 Centrifugal and 5 Scroll. All these have been described below briefly:

The reciprocating and screw compressors are best suited for use with refrigerants which require a relatively small displacement and condense at relatively high pressure, such as R-12, R-22, Ammonia, etc.

The centrifugal compressors are suitable for handling refrigerants that require large displacement and operate at low condensing pressure, such as R-11, R-113, etc.

The rotary compressor is most suited for pumping refrigerants having moderate or low condensing pressures, such as R-21 and R-114; this is mainly used in domestic.

1) Reciprocating Compressors:

The reciprocating compressors are one of the most widely used types of the refrigerating compressors. They have piston and cylinder arrangement like the automotive engine. The reciprocating motion of the piston due to external power compresses the refrigerant inside the cylinder. There are three types of reciprocating compressors: hermetically sealed, semi-hermetically sealed and open type. The open of reciprocating compressors can be of single cylinder type or multi-cylinder type.

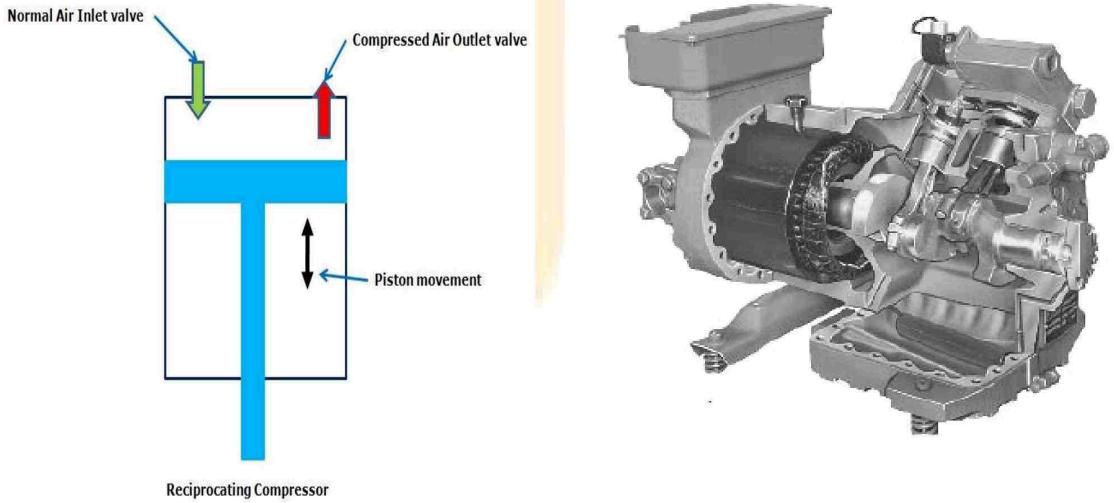

Figure: Reciprocating air compressor

2) Screw Compressors:

The screw compressors comprise of the pair of meshing screws between which the refrigerant gets compressed. They can produce high pressure for small quantity of gas. They consume less power than the reciprocating compressors and are being used widely. It can be used with refrigerants like R12, R22, and others.

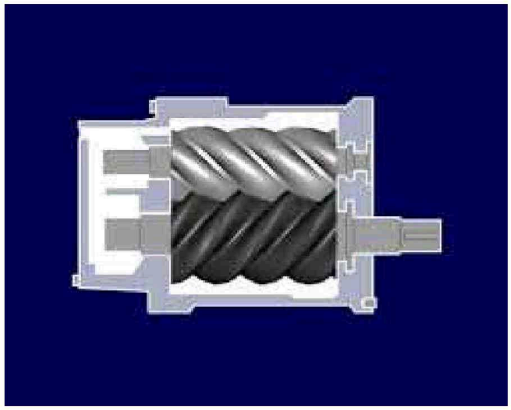

Figure: Screw compressor

3 Rotary Compressors:

The rotary compressors have two rotating elements, like gears, between which the refrigerant is compressed. These compressors can pump the refrigerant to lower or moderate condensing pressures. Since they can handle small volume of the gas and produce lesser pressure, they are used in fewer applications.

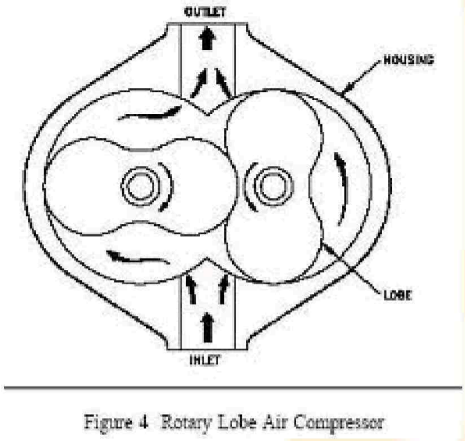

Figure: Rotary compressor

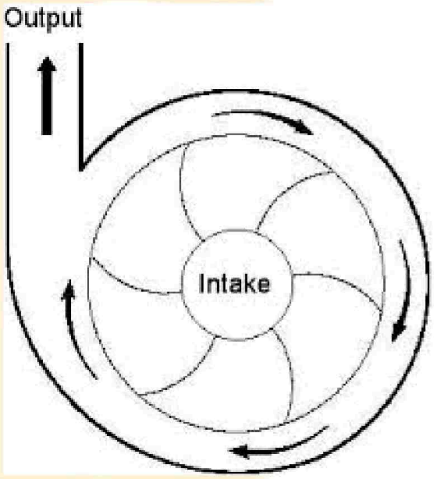

Figure: Centrifugal compressor

4) Centrifugal Compressor:

The centrifugal compressors comprise of the impeller or the blower that can handle large quantities of gas but at relatively lower condensing pressure

5) Scroll Compressors:

The scroll compressor comprises of two interleaved scrolls of which one is fixed and the other orbits eccentrically without rotating. During its motion small gaps are created between the scrolls where the refrigerant gets compressed. The scrolls can have different shapes like involute, Archimedean spiral or hybrid curve. In another arrangement both the scrolls may be rotating eccentrically to produce the compression.

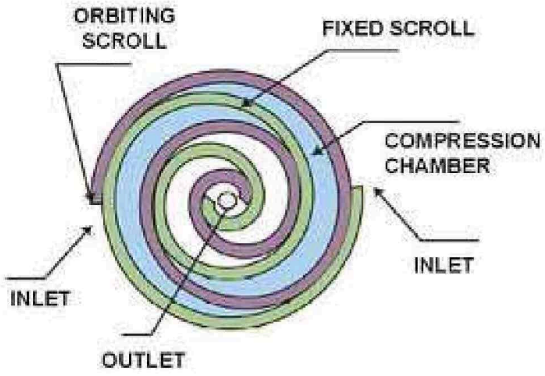

Figure: Scroll compressor

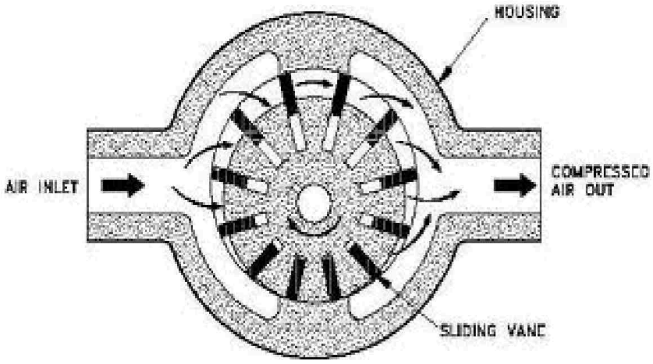

Figure: Vane compressor

6. Vane pump: In vane pump there are sliding vanes which slides along the slots and compress the fluid.

Result: Various types of compressors have been studied.

Viva-voce:

Q1 What is the function of the compressor?
Q2 What is multi stage compressor? What is its advantage?
Q3 What is reciprocating compressor?
Q4 Write down the formula for work done in compressor when the compression is polytropic.
Q5 What is the compression ratio of compressor?

Experiment NO – 9

Aim: To study the basic components of ice plant trainer. i.e. Compressor, condenser, expansion valve, and evaporator.

Theory:

Introduction to ice plant

In early days, ice was the only means for producing cold, although mechanical refrigeration have replaced many of usages of ice now a days, still ice is used for many purpose e.g. Short term preservation of foods in cold beverage etc. Hence, manufacture of ice occupies a large portion of refrigeration applications.

Commercially, ice is manufactured by two methods as

1. Can ice 2. Plate ice

But the plate ice system has become now a day almost obsolete and most of the ice plants use cans systems.

Unicool ice plant tutor also uses ice can system. The cans filled with fresh water are kept in a tank, in which brine is circulated. The brine is cooled by the refrigerant, which in turn cools the water in cans and ice formation takes place.

Commercial ice is produced by freezing potable water is standard cans placed in rectangular tanks. The tanks are filled with chilled brine, which is kept in constant motion by an agitator. The agitation helps in increasing the heat transfer from the water in the can to the chilled brine. Brine temperature is maintained by the refrigeration plant, at - 11^0 to -10^0c. To get clear transparent ice, water in the can is agitated by the use of low pressure air through the tubes suspended from the top. Ice of potable water (treated or untreated) frozen at a temperature lower than - 12^0c can crack. Therefore brine temperature is kept at a higher level, say -11^0 to - 10^0c. Water in the ice cans placed in the brine cools rapidly up to a temperature of about 3^0 to 4^0c. Thereafter it takes more time for the water to touch 0 c.

Preparation of brine: All the ice plants use indirect refrigeration system. In this some refrigerating medium, called secondary refrigerant or brine is cooled down by direct expansion of refrigerant and it is then pumped to the space to be cooled. These systems are used where danger due to leakage of refrigerant is important and in locations of fluctuating temperatures. In addition to acting as a heat carrying medium brine should have certain other properties also. The freezing point of brine should be low enough so that it will not freeze at the lowest temperature in the cycle. Also it should be non-corrosive and should not be subject to precipitation when contaminated with refrigerant through accidental leakage.

For preparation of brine, the ice cans filled with water are placed over the ice can frames and fresh water is filled in the main tank to the required level. Put about 7-10 kg of nacl in main tank start the stirrer so that water is circulating in the tank. One of the disadvantages of brine is, it readily attacks the material of construction. To prevent corrosion, the main freezing tank is already coated with fiberglass lining inside. To prevent the further effect of corrosion brine should be drained after performing the experiment.

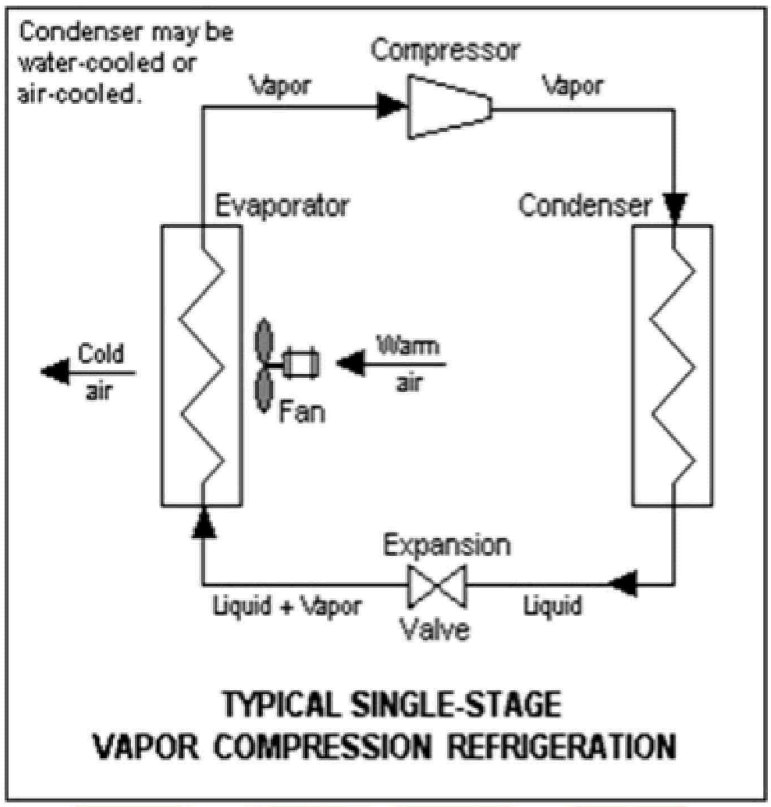

Figure: Various components of ice plant

Result: Various components of ice plant have been studied.

Viva-Voce:

EXPERIMENT No: 1

AIM:
Study on parts of refrigerator.

THEORY:

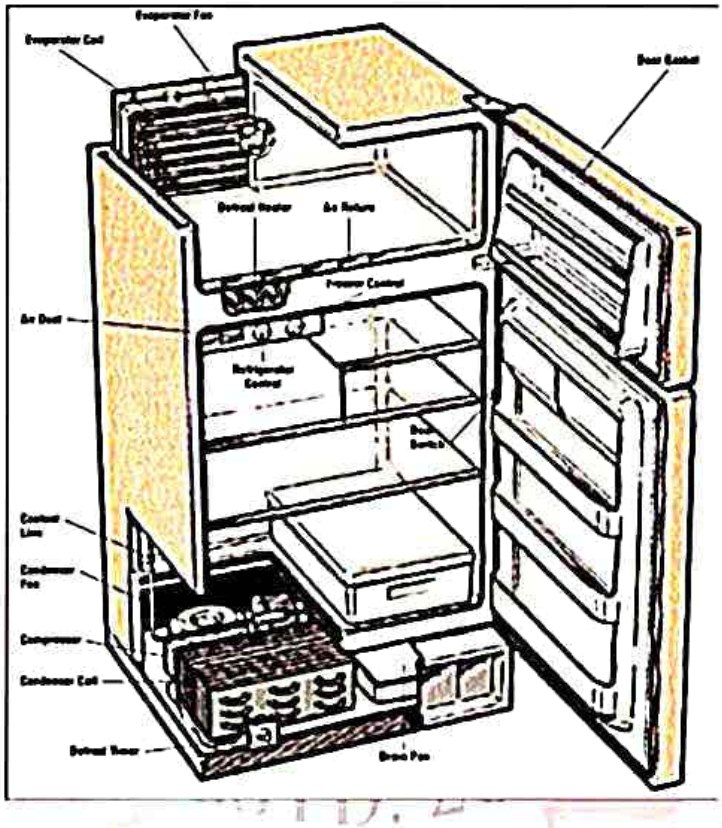

Figure 1: Vapor Compression Test Rig

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The refrigeration cycle can be explained schematically in the two diagrams i.e.. Pressure enthalpy diagram Temperature entropy diagram.

The working of vapour compression refrigeration cycle and function of each above component is given below.

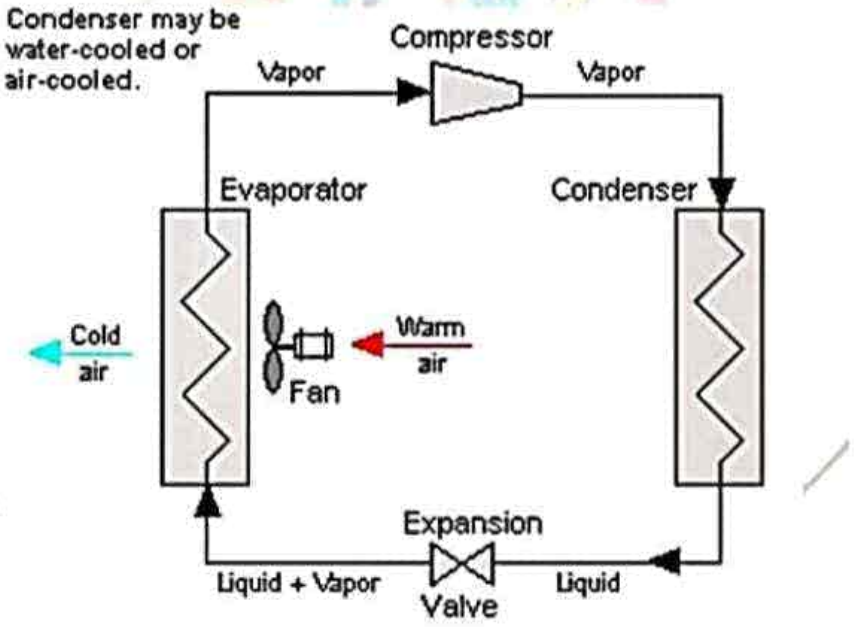
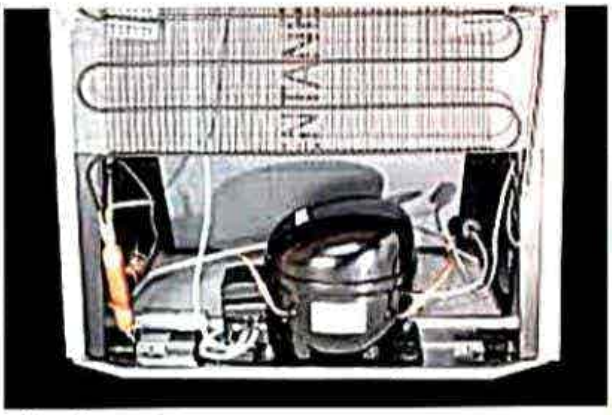


Figure 2: Components of vapour refrigeration system

Evaporator:
The liquid refrigerant from the condenser at high pressure is fed through a throttling device to an evaporator at a low pressure. On absorbing the heat to be extracted from Media to be cooled, the liquid refrigerant boils actively in the evaporator and changes state. The refrigerant gains latent heat to vaporize at saturation temperature/ pressure and further absorbs sensible heat from media to be cooled and gets fully vaporized and super heated.

Compressor:
The low temperature, pressure, superheated vapour from the evaporator is conveyed through suction line and compressed by the compressor to a high pressure, without any change of gaseous state and the same is discharge into condenser. During this process heat is added to the refrigerant and known as heat of compression ratio to raise the pressure of refrigerant to such a level that the saturation temperature of the discharge refrigerant is higher than the temperature of the available cooling medium, to enable the super heated refrigerant to condense at normal ambient condition. Different types of compressors are reciprocating, rotary and centrifugal and are used for different applications.



Condenser:
The heat added in the evaporator and compressor to the refrigerant is rejected in condenser at high temperature/ high pressure. This super heated refrigerant vapour enters the condenser to dissipate its heat in three stages. First on entry the refrigerant loses its super heat, it then loses its latent heat at which the refrigerant is liquefied at saturation temperature pressure. This liquid loses its sensible heat, further and the refrigerant leaves the condenser as a sub cooled liquid. The heat transfer from refrigerant to cooling medium (air or water) takes place in the condenser. The sub-cooled liquid from condenser is collected in a receiver (wherever provided) and is then fed through the throttling device by liquid line to the evaporator.

There are several methods of dissipating the rejected heat into the atmosphere by condenser. These are water-cooled, air cooled or evaporative cooled condensers.
In the water-cooled condenser there are several types viz. Shell and tube, shell and coil, tube in tube etc. In Evaporative cooled condenser, both air and water are used. Air-cooled condensers are prime surface type, finned type or plate type. The selecting of the type depends upon the application and availability of soft water.

Throttling device:
The high-pressure liquid from the condenser is fed to evaporator through device, which should be designed to pass maximum possible liquid refrigerant to obtain a good refrigeration effect. The liquid

line should be ~~properly sized to have minimum pressure drop.~~

The throttling device is a pressure-reducing device and a regulator for controlling the refrigerant flow. It also reduces the pressure from the discharge pressure to the evaporator pressure without any change of state of the pressure refrigerant.

The types of throttling devices are:

1.Capillary tubes 2. Hand expansion valves 3. Thermostatic expansion valve

The most commonly used throttling device is the capillary tube for application upto approx. 10 refrigeration tons. The capillary is a copper tube having a small dia-orifice and is selected, based on the system design, the refrigerant flow rate, the operating parameters (such as suction and discharge pressures), type of refrigerant, capable of compensating any variations/ fluctuations in load by allowing only liquid refrigerant to flow to the evaporator.

CONCLUSION:

Various components of the vapour compression system have been studied