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Experiment No. 1.

Aim: To find COP of vapour compression refrigeration system.

Description:

The refrigeration tutor works on vapour compression cycle. The basic component of VCR system are.

(i) Compressor: The high temperature refrigerant comes into compressor where it is compressed to high pressure and it is transfered to condensor.

(ii) Condensor: The condensor condensate refrigerant where it looses heat energy to atmospheric air and the temperature of refrigerant is decreased. The low temperature refrigerant is transferd to expansion valve.

(iii) Expansion Valve: The refrigerant is entered into thermostatic expansion valve where its pressure is reduced. The low pressure and low temperature refrigerant is transfered to evaporation.

(iv) Evaporator: The refrigerant absorb heat energy from hot water which is heated of using heater. So because of absorption of heat energy the temp. of water is decreased and temperature of refrigerant

is increased. The high temp. refrigerant is entered in compressor and same cycle is repeated.

Procedure :

Before putting switch on the supply, confirm that all switches on panel are in offposition. Put on heater switch and give power to heater switch and give power to heater. This will heat water in evaporator and this can power to heater. This can be seen on dial thermometer. Heat water up to temperature of 25°C to 30°C. After attendin temperature of 25°C to 30°C, the temperature put off the heater switch. Now put on the condenser fan and compressor. The refrigerent flow will start. Now ammeter voltmeter show the current and voltage for 10 revolution of energy meter for compressor. After some time we will see that temperature of water in evaporator slowly goes down.

Calculation :

$$\text{Theoretical COP, } COP_{tha} = \frac{H_{eo} - H_{ei}}{H_{ei} - H_{eo}}$$

Plot refrigeration system on P-h chart and obtain enthalpy value to calculate theoretical COP.

$$\text{Actual COP} = \frac{\text{Power consumed in heater}}{\text{Power consumed by compressor}}$$

$$\text{Power consumed in heater} = \frac{\text{No of flashes} \times 3600}{tf \times EMC}$$

$$\text{Power consumed by compressor} = \frac{\text{No. of flashes} \times 3600}{tf \times EMC}$$

Where,

tf - Time for flashes
EMC - Energy meter capacity

Observation Table :

Sr No.	Description	Symbol	Readings
01.	Condensing pressure	P_c	
02.	Evaporator pressure	P_e	
03.	Condensing inlet temp.	T_1	
04.	Condensing outlet temp.	T_2	
05.	Evaporator inlet temp.	T_3	
06.	Evaporator outlet temp.	T_4	
07.	Water temperature in tank	T_5	
08.	Compressor energy-time for 10 flashes	sec	
09.	Heater energy-time for 10 flashes.	sec	

Result :

With the help of given or determining data we can determine,

Actual COP =

Theoretical COP =

Precautions :

- Make proper earthing for the unit.
- Make sure that the storage tank carries sufficient quantity of water.
- Do not start the equipment if
  i) Pressures on H.P and L.P side not equilised.
  ii) Condensor and evaporator, flow rate are not maintained.
- The charging valve provided should not be opened unless required for charging.
- Do not increas the water flow rates beyond limit.
- For restarting the plant wait for some time.
- Drain the water from tank when not in use.

Experiment No 02

Aim : Study of different types of condensor in refrigeration system.

Theory :

A condensor in simple terms is a cooling device. Every refrigeration system and power plant use condensers, to condense refrigerant vapours or steam and is known as heat rejector. Actually, it turns superheated and highly-pressurized vapour into a subcooled liquid." A condenser parts, function and types".

There are three types of condensors, depending on the condensing medium used to extract heat from the system. Neither of the three types of condensers has a district advantage over the others. Each should be utilized correctly depending on the scenario. In the next sections, we'll go through the function of these three different type of condensors. Condensers are available from a variety of suppliers and companies as well as various manufactures and distributors and there are several condensers for sale on linquip.

There is a complete selection of condeser services on the linquip platform that meets all of your needs.

Linquip can connect you with a number of condenser service suppliers and experts who can help us. Linquip can connect with condenser specialists and subject matter experts who can help you test your equipment.

- How does a condenser work?

Before we get acquainted with the different type of condensers, let's have a brief look at how a condenser works. Again, we have to mention that a full description of the section was devoted to the topic of functions of a condenser in another article. Just in case you haven't read that article, we deliver a gist of how a condenser works to make it easier for you to understand what different types of this equipment are.

Three different phases happen in every condenser. The first phase is caused the desuperheating. The vapor entering into the condenser is already superheated and super pressurized in the evaporator and compressor. Desuperheating means to eject the heat from the vapour and turns it into liquid. The next level is changing or condensation state: losing more heat continues in this state where we reach into 10% of refrigerant as vapour and 90% as liquid.

The third and last phase is a sub cooling state. The sub-cooling state is there so as to be sure that not even rising temperatures can bring the liquid refrigerant into vapour again.

Now that you have a general insight into how a condenser works. We can move safely forward to the next sections where we are going to get familier with types at condenser step by step.

Conclusion :

Knowing the types of condensers help you have a better choice at the time of purchase. In this article we tried to inform you about the difference kinds of condenser, their unique functions, pros and cons.

If you have any experiences of using different type of condensers or want to share.

Experiment No 3

Aim: Study of evaporator used in refrigeration system.

Apporatus Required:

- Evaporator Models.

Theory:

The evaporator is an important device used in the low pressure side of a refrigerant from the expansion valve enters into the evaporator is to a where it boils and changes into vapour. The function of an evaporator is to absorb heat from the surrounding location or medium which is to be cooled by means of a refrigerant the temperature of the boiling refrigerant in the evaporator must always be less than that of the surrounding medium so that the heat flows to the refrigerant.

Working of an evaporator:

The working of an evaporator may be best understood the simple refrigerating system. The corresponding P-h diagram. The point is represents the entry of liquid refrigerant into the expansion valve receives pure liquid

refrigerant with no vapour present to restrict the flow of through the expansion valve.

The liquid refrigerant at low pressure enters enters the evaporator at point , As the liquid refrigerant passes through the evaporator coil it continually absorbs heat through the coil walls from the medium being cooled. During this the refrigerant continues to boil and evaporate.

Since the vapour refrigerant at point , is steel colder than the medium being cooled; therefore the vapour refrigerant continues to absorb heat, the vapour temperature the heat absorption causes an increase in the sensible heat the vapour temperature continuous to rise untill the vapour leaves the evaporator to the suction line at point . At this the temperature of the vapour is above the saturation temperature & the vapaur refrigerant is superheated . The variation of refrigerant temperature within the evaporator.

Experiment No 04

Aim: Study of sling psychrometer.

Objectives:

To measure DBT and WBT of different locations.

Observation Table:

Sr. No.	DBT	WBT
01.	20°/ 293K	4°/ 278K
02.	22°/ 295K	6°/ 280K
03.	21°/ 294K	3°/ 276K

Computation:

Using psychrometric chart calculate —
Partical pressure of water vapour,
Relative humidity
Density of water vapour
Dew point temperature
Degree of saturation
Partical pressure of air
Density of air
Specific humidity & Enthalpy of mixture.

Specific volume
Verify results by calculating also.

Sling psychometer

Siling psychrometer is a device with two thermometer one a wet bulb and one a dry bulb, used for checking air conditions wet-bulb and dry bulb. The sling psychrometer uses wet bulb-dry bulb principle to obtain relative humidity reading quickly Before you use the psychrometer, be sure that the wick is clean and wet (with pure water, if possible)

Working:

Sling psychrometer is rotated in the air for approximetly one minute and then reading of both thermometers are noted. This process is repeated several times to assure that the lowest possible wet bulb temperature is recorded. Relative humidity is determined from these two temperature readings by plotting them on psychrometric chart, At any ambient condition relative humidity decreases if temperature difference between DBT & WBT increases.

Application :

- Sling or motorized psychrometer is used in metero-logical observations.
- Sling psychrometer are also used in the cooling industry.
- For checking and setting hair hygrometers.
- It is used in the HVAC industry for selecting and charging proper refrigerant in residential and commercial air conditioning systems.

Experiment No 5

Aim : To detect the refrigerant leakage.

Prior knowledge : Different types of commonly used refrigerants along with their properties (i.e physical chemical or thermodynamic), the effect of undercharge and overcharge of refrigerant, the effect of non-condensable on the performance of the system.

Theory :

It is well known that the moisture, air and other non-condensable are very harmful for the refrigerantion system. The moisture present may chock capillary tube and also it moisture is combined with hydrochloric and hydrofluoric acids they are having its effects on the system, the presence of air and non condensable increases the head pressure of the system. As the head pressure goes higher, the compressor motor draws more current. Also higher head pressure reduces the refrigerant capacity of the unit appreciably. The temperature rise of the compresor accelerates the chemical action inside the system.

From the above point it is clear that the moisture, air and non-condensable should be removed

from the refrigeration system to the maximum possible extent. Hence before system can be charged with a refrigerant it should be throughly evacuated and dehydrated by drawing a high vaccume. If this is not done at the initial stage itself, a clean system can near be attained after the completion of erection the plant should be checked and the refrigerant should be charged into the system during working also their is a chance of leakage in a refrigeration system. Finding the leakage is the job of patience. The approach should be to find leak rather than concluding there are no leaks on a cursory check apart from the cost of charging refrigerant into a leaky system, a shortage of refrigerant can cause real danger to the plant. Therefore leak testing should be done periodically without fail in all seriousness and with full concentration.

Leak Test Methods:

Different leak testing methods are employed for different type of refrigerants.

1. Ammonia R12, R22:

(i) Sulphur test method:-

Burning sulphur stick shows a dense white smoke if ammonia is prescent. The burning sulphur stick

The burning sulphur stick is passed around all the joints and suspected leaky point for the appearance of smoke. This test is applicable for tracing minute leakage only.

(ii) Soap bubble test :

This test may not be very effective to trace very minute ammonia leak as it is soluble in water, Fortunately, ammonia is having plugment order a heavy leak can be easily detectable.

(iii) Litmus Test :

Wet litmus paper (phenolphthalene paper) which turns red in contact with ammonia can also be used to detect leaks.

2. Halogenatic Refrigerants :

Soap solution, Halogen leak detector, Halide torch and electronic leak detectors are the methods used to trace leaks in halogenated refrigerators.

i). Halogen Torch :-

A halogen torch can detect minute leaks, which are not possible to trace of refrigerant can change the light blue colour of the detector flame to green or deep blue. The end of the explorer tube of the detector is carefully passed over the joint and suspected leakage points if there is a leak, the refrigerant can be drained in with the suction effect at the end of the explorer tube to the hot copper or brass portion of the burning torch. The refrigerant reacts with the metal to form copper chloride, which produces the color chang in the flame.

A well maintained halogen torch is claimed to detect leaks of the order of about 15 gm per year.

ii). Electronic leak detector :—

This is an electrical instrument. In this also on explore tube is used to suck the refrigerant from the leaky points to the instrument suck. A vibrator is provided to suck the refrigenat through the explore tube. A filter is also provided at the tip of the tube to prevent atmospheric dirt entering the instrument.

A heating elements in the tube heats the refrigerant drawn and the refrigeration creates a vibration in the current flow of the instrument. The extent of variation of the current is on vibration in read on the dial of the instrument. The charge of current actuates a relay which operates on indicating light.

These detectors are capable of detecting refrigeran leaks of the order of about 0.3 gm per year. The electronic leak detector is a very sensitive instrument and should be handeled and stored carefully.

Conclusion :

The refrigeration system must be free from non-condensable and correct quantity of refrigerant must be there in the system for good performance. At the time of charging of refrigerant the lubricating oil of required grade must be added to the compressor.