Experimental Analysis of VCR Sytem By Varying Diameters of Helical Condenser Coil Comparing With Existing Condenser

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Abstract- *Vapour Compression Refrigeration machine is now a days used for all functions of refrigeration in home in addition to business programs which has excessive coe cient of overall performance. The machine overall performance relies upon at the overall performance of all of the additives of the machine. By converting layout and layout parameters of numerous additives, we will decorate the overall performance of the machine. The gift paintings o ers with experimental evaluation of vapour compression refrigeration machine with helical condenser coil various in diameters the usage of R-600A as refrigerant, that is amendment to ordinary condenser of home fridge operating on vapour compression refrigeration machine the usage of R-134A as refrigerant. An try has been made to growth the overall performance of the refrigeration machine with a alternate in form of condenser coil from grid to helical. The stress gauges and temperature signs are included with the machine at suitable positions. A collection of experiments have been carried out on grid form condenser coil (existing) and helical form condenser coil. Various parameters like Net Refrigeration E ect, Mass glide price, Work of compression, Heat equal of labor of compression in step with TR and so on have been evaluated. It became determined that the helical formed condenser is greater green than the grid kind condenser coil.*

Keywords- Helical Condenser, R600A, Refrigeration, COP, Grid form Condenser coil.

I. INTRODUCTION

Vapor compression Refrigeration machine is an advanced form of air. The cappotential of positive beverages to soak up massive portions of warmth as they vaporize is the premise of this machine. Compared to melting solids (say ice) to attain refrigeration impact, vaporizing liquid refrigerant has greater advantages. To point out a few, the refrigerating impact may be began out or stopped at will, the price of cooling may be predetermined, the vaporizing temperatures may be ruled through controlling the stress at which the liquid vaporizes. Moreover, the vapor may be without problems amassed and condensed again into liquid nation in order that equal liquid may be re circulated again and again once more to attain refrigeration impact. Thus the vapor compression machine employs a liquid refrigerant which evaporates and condenses without problems. The Vapor compression refrigeration machine is now-a- days used for all cause refrigeration. It is usually used for all business functions from a small home fridge to a huge air- conditioning plant.

Basic Components of a vapor compression machine

Basic additives of a vapor compression refrigeration machine are proven in Figure They are,

Compressor: It is motor driven; it sucks vapor refrigerant from evaporator and compresses.

Condenser: High stress vapor refrigerant is condensed into liquid shape withinside the condenser the usage of cooling medium along with water.

Expansion Valve: High stress refrigerant is throttled right all the way down to evaporator stress; price of glide is metered.
Evaporator: A cooling chamber in which products are placed; low pressure liquid refrigerant flows in the coils of evaporator and absorbs heat from products; the refrigerant vaporizes and leaves for compressor.

II. LITERATURE REVIEW

Refrigeration can be described because the system of accomplishing and keeping a temperature beneathneath that of the surroundings, the purpose being to chill a few product or area to the desired temperature. One of the maximum essential packages of refrigeration has been the renovation of perishable meals merchandise with the aid of using storing them at low temperatures. Refrigeration structures also are used notably for presenting thermal consolation to humans by air con. Air

Conditioning refers back to the remedy of air with a purpose to concurrently manipulate its temperature, moisture content, cleanliness, odour and flow, as required with the aid of using occupants, a system, or merchandise withinside the area. The problem of refrigeration and air con has developed out of human want for meals and consolation, and its records dates again to centuries. The records of refrigeration may be very thrilling on the grounds that each component of it, the provision of refrigerants, the high movers and the trends in compressors and the techniques of refrigeration all are part of it.

III. REFRIGERANTS

A distinct look at of those refrigerants has as a result come to be imperative. This unit is supposed to function an introductory manual to the look at of refrigerants.

- Naming conference for refrigerants,
- The exceptional classifications of refrigerants,
- Properties of man or woman refrigerants, and
- Environmental outcomes associated with the usage of those refrigerants.

PRIMARY AND SECONDARY REFRIGERANTS:

Primary refrigerants are the ones which may be at once used for the motive of refrigeration. If the is permitted to go with the drift freely into the gap to be refrigerated and there's no chance of viable damage to human beings, then number one refrigerants are used. The refrigerants utilized in domestic fridges like Freon-12 are number one refrigerants. On the opposite hand, there can be positive conditions wherein we can't permit the refrigerant to are available direct touch with the objects being refrigerated, after which the refrigerant used is called as a secondary refrigerant. As as an example, we can't permit a poisonous refrigerant for use for air con in residential buildings. There are a few refrigerants which might be particularly inflammable and so their direct use is forbidden for protection reasons. Again, it is able to so show up that if direct refrigeration, consisting of in cooling a large bloodless garage, is permitted, then the quantity of refrigerant required can be so huge that its value will become prohibitively excessive. These are a few ordinary conditions for which we desire the usage of secondary refrigerants. Water and brine answers are not unusualplace examples of secondary refrigerants.

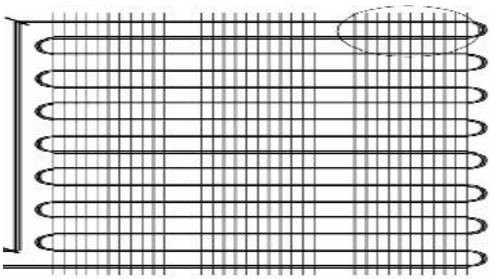
COMMON REFRIGERANTS.

The refrigerants which might be to be had commercially withinside the marketplace are numerous. Some of them which might be in not unusualplace use are stated below: Air: Air (molecular weight 28.97, particular heats cp = 1.04 kJ/kgK and cv = 0.712 kJ/kg-K) is one of the earliest refrigerant for use withinside the refrigeration structures. Its blessings are that it's far to be had freed from value, is non-poisonous and non-flammable and does now no longer have an e ect on the commodity if pure. However, air su ers from some of drawbacks. Air incorporates moisture and this reacts with the fabric of the evaporator and condenser critically a ecting their operating ability. Further, there's a opportunity that the passages can be blocked via way of means of the formation of ice from this moisture. The COP of air is of the order of 0.6 and as a result, now no longer appropriate to be used in refrigeration structures on a business scale. It is specially used for air con in aircrafts in which performance of operation is of secondary significance.

IV. TYPES OF CONDENSERS

Air-cooled condensers:

As the call implies, in air-cooled condensers air is the outside fluid, i.e., the refrigerant rejects warmness to air flowing over the condenser. Air-cooled condensers may be similarly categorized into herbal convection kind or compelled convection kind. i) Natural convection kind: In herbal convection kind, warmness switch from the condenser is with the aid of using buoyancy precipitated herbal convection and radiation. Since the float charge of air is small and the radiation warmness switch is likewise now no longer very high, the mixed warmness switch coe cient in those condensers is small. As a end result a especially huge condensing floor is needed to reject a given quantity ofwarmth.



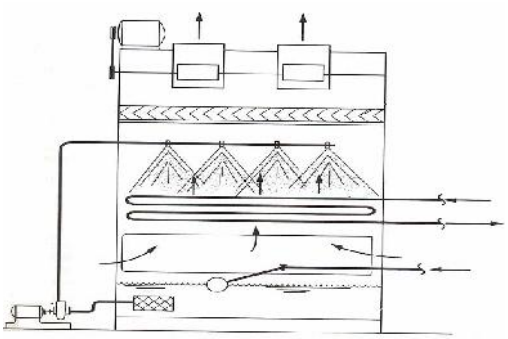
Water cooled condensers:

In water cooled condensers water is the outside fluid. Depending upon the construction, water cooled condensers may be similarly categorized into:

1. Double pipe or tube-in-tube kind
2. Shell-and-coil kind three.

Shell-and-tube kind Double Pipeor tube-in-tube kind: Double pipe condensers are generally used up to ten TR capacities. Figure indicates the schematic of a double pipe kind condenser. As proven withinside the parent, in those condensers the bloodless water flows thru the internal tube, whilst the refrigerant flows thru the annulus in counter float. Headers are used at each the ends to make the period of the condenser small and decrease strain drop. The refrigerant withinside the annulus rejects part of its warmness to the environment with the aid of using unfastened convection and radiation. The warmness switch coe cient is commonly low due to negative liquid refrigerant drainage if the tubes are long. Shell-and-coil kind: These condensers are utilized in structures as much as 50 TR ability. The water flows thru more than one coils, which might also additionally have fins to growth the warmth switch coe cient.

The refrigerant flows thru the shell. In smaller ability condensers, refrigerant flows thru coils whilst water flows thru the shell.



V. EXPERIMENTAL SETUP

The parent indicates the experimental setup of the fridge. In order to realize the overall performance traits of the vapor compression refrigeration gadget the temperature and strain gauges are mounted at every access and go out of the additives. Experiments are carried out on present and helical condenser coils having the fridge ability of 165liters. All the values of pressures and temperatures are tabulated.

PERFORMANCE CALCULATIONS:

Analysis of the condenser:

Thermal evaluation withinside the warmness exchangers may be executed in ways.

1. LMTD Method (Logarithmic Mean Temperature Di erence)
2. NTU Method (Number of Heat switch Units) LMTD Method is beneficial while the inlet and outlet fluid temperatures of condenser and air are known.

NTU Method is beneficial while the warmth exchanger is designed for the specific mass float charge. For the given situations LMTD Method is appropriate. 1. LMTD Method: In a warmness exchanger, the temperature of the heating and cooling fluids do now no longer in general, continue to be regular, however range from factor to factor alongside the period of the warmth exchanger. Since the temperature distinction among the 2 fluids continues changing, the charge of warmth switch additionally adjustments alongside the period of the warmth exchanger as proven.

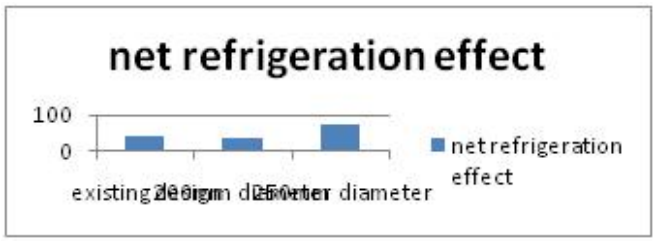
Mixture Information:

Dimensions	Condenser	Evaporator	Expansion valve
Length (m)	9.5	7.62	3.6
Diameter (mm)	6.4	6.4	0.9

VI. RESULTS AND DISCUSSION

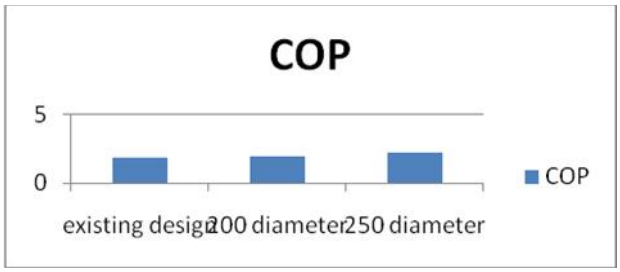
Effect of helical condenser coil diameter (D) on net refrigeration effect. From the calculations it is observed that the net refrigeration effect of condenser is to be varied at different diameters of helical coil condenser is shown in

bellow fig. The net refrigeration effect of helical condenser is more than the net refrigeration effect of existing condenser.



Effect of helical condenser coil diameter (D) on coefficient of performance.

From the calculations it is observed that the performance of the refrigeration system increases as the diameter of the coil increases and it is maximum at the 250 mm. After that the cop of system is stat to decreasing the. Due to more heat transfer sub cooling occurs at the exit of the condenser and hence the performance of the system increases.



VII. CONCLUSION

In the present work, experiments are conducted for the helical design condenser by taking different Diameter (D) of the condenser coil for a domestic refrigerator of 165 liters capacity.

By incorporating the helical condenser in the refrigerator, it was observed that

The COP enhanced by 0.4, as a result of 33 kj/kg increase in refrigeration effect.

Reduction in the compressor work is 2.37kj/kg

Increase in heat rejection 11kj/kg.

The performance of helical condenser is also changed at different diameters so, design of diameter helical condenser coil plays a prominent role. It is advantageous to provide a helical condenser at the inlet of the capillary tube and maintain the condenser pressure and the performance of vapor compression refrigeration system can be enhanced with the help of the helical condenser.

Finally, it is concluded that the change in shape of existing design to helical condenser, the coefficient of performance is increased and heat transfer rate is also increased and maximum value of heat transfer is attain at 250mm coil diameter (D).

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