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Design of Evaporator Coil and Performance Evaluation of Vapour Compression Refrigeration System with Three Layer Evaporator

Mandave Ganesh[1], Ashutosh Giri[2], Sanket Borole[3] , Amar Hissal[4] , Prof. R S Thombre[5]
[1.2.3.4]*Student,* [5]*Assistant Professor, Department of Mechanical,*
Dr. D. Y. Patil School of Engineering and Technology, Lohegaon, Pune

Abstract - The performance of a vapour compression refrigeration system with a three-layer zigzag evaporator is evaluated in this research. The primary goal of this study is to compare the performance of a household refrigerator with a capacity of 165 litres, R-12as refrigerant, and a three layer zigzag shaped evaporator to that of an existing system. The refrigerant capacity of this evaporator assembly is maximised.

I. INTRODUCTION

The Vapor Compression Chiller (VCR) is a kind of staged air chiller. The ability of safe drinks to absorb large parts of the heat as it evaporates is the premise of this machine. The overall performance of a chiller is the ratio between the impact of the cold and the work of compression; As a result, the total COP can be improved by increasing the cooling capacity or reducing the compression work.Vapor compression refrigeration machine is used for all refrigeration machines today. As a rule, it is used for all operational functions from small household refrigerators to large refrigerators. Air conditioning Basic additives of the video recorder:
Compressor
Condenser
Expansion valve
Evaporator
The cooling effect (power) takes place in the evaporator of the video recorder. There are few techniques that can improve the COP for a household refrigerator powered by a video recorder. Increasing the cooling effect is one of the best ways to improve

A. Compressor

A compressor that could be a problem in a vapor compression refrigerator and is used to draw refrigerant vapor from the evaporator and deliver it to the condenser. One of the most important properties of a cooling compressor is the cooling capacity of the cooling device. Refrigeration technology that is proportional to the volumetric refrigeration capacity for a given refrigerant and below certain temperature situations.Depending on the refrigerants used, the desired volumetric refrigeration capacity and the different positive situations, the following compressor variants are used in refrigeration technology: reciprocating, rotary, screw and radial, In terms of their functional principle, refrigeration compressors are like air and heating oil compressors, but have some functions that relate to the working situations of refrigeration machines and with the result thermodynamic, physical and chemical deities. of the refrigerant vapor used, for example, refrigeration compressors usually run with superheated steam. Certain requirements are placed on refrigeration compressors. These consist of a single-stage compression deformability with significantly better expansion / suction / outlet ratios than air compressors, ie with expansion ratios of up to 10-12 °. the ability to control the volumetric cooling capacity; the deduction of unbalance forces, standard dimensions and weights; and occasional noise levels, mainly with refrigeration compressors in household refrigerators and air conditioning systems. Depending on the volume at which refrigeration compressors are sealed, a distinction is made between semi-airtight compressors and hermetically sealed compressors. Moving back and forth or rotating, they are used with rather low cooling capacities (up to many kilowatts), for example in household refrigerators and air-conditioning units as well as in industrial refrigerators.

B. Condenser

In heat switch related structures, a condenser is a tool or device used to condense a substance as it cools from its gaseous to its liquid state; Latent heat is released by the substance and transferred to the refrigerant of the condenser. Condensers are typically heat exchangers that have numerous designs and come in many sizes, from small (portable) alternative devices to very massive commercial devices used in plant approaches. For example, a refrigerator uses a condenser to dissipate the extracted heat. from inside the unit to outside air condensers are used in air conditioning, commercial chemical approaches consisting of distillation, steam power flowers and various heat exchange structures using cooling water or ambient air, since the refrigerant is not uncommon in batches of these condensing units is as follows: the heat exchange phase envelops the facets of the device with the internal

compressor. In this phase of the heat exchanger, the refrigerant flows through a pair of tube passages, which can be surrounded by fins of the heat switch, through which the cooling air can circulate from the outside into the interior of the unit. There is a motorized fan in the condenser unit near the pinnacle, which is enclosed by some ventilation holes to prevent devices from accidentally falling into the fan. The fan is used to blow the cooling air from outside through the heat. Phase shift at the perimeters and leave the tip through the grating.These condenser devices are placed in the open air of the building to be cooled with pipes between the device and the building, one for the vapor refrigerant and one for the liquid refrigerant leaving the device.

C. Expansion Valve

The thermostatic growth valve, or TEV, is one of the most widely used throttling devices in refrigeration and air conditioning systems. The thermostatic growth valve is the automatic valve that maintains the correct levitation of the refrigerant in the evaporator according to the load on the evaporator. The load on the evaporator enables the refrigerant to float better and while the load reduction enables the refrigerant to settle within the float area, this leads to particularly environmentally friendly operation of the compressor and the entire refrigeration and air conditioning system. The thermostatic growth valve also prevents the refrigerant from flooding to the compressor and ensures that the system can work precisely without the risk of compressor failure due to the liquid compression.The thermostatic growth valve now no longer regulates the temperature in the evaporator and no longer fluctuates the temperature in the evaporator, like Your c all could also suspect additionally. In addition to the capillary tube, the thermostatic growth valve is widely used in refrigeration and air conditioning systems. While the capillary tube is used in the small household structures, the thermostatic growth valve is used in the better capacity structures. It is typically used in commercial refrigeration systems as it can severely disrupt air conditioning systems, compact air conditioning systems, primary air conditioning systems and many different constructions. Growth valve functions • Reduce refrigerant voltage.• Let the refrigerant levitate as required.

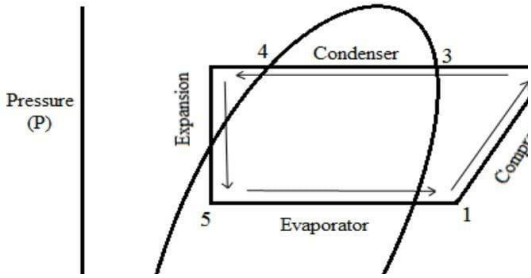
D. Evaporator

The evaporator is a financial institution or a coil in the refrigerated area. The refrigerant is in a low pressure, low temperature liquid as it enters the evaporator. When the refrigerant circulates through the evaporator tubes, it absorbs its heat of evaporation from the environment and substances. The absorption of this heat brings the refrigerant to the boil. When the temperature of the environment (and its contents) drops, the liquid refrigerant will constantly adapt to a vapor. Most evaporators are made of steel, copper, brass, stainless steel, aluminum, or almost any other form of metallic laminate that resists corrosion from refrigerants and the chemical movement of food. Specific of types: dry or flooded. The internal refrigerant of a dry evaporator is fed to the coils more easily and as quickly as it is important to maintain the desired temperature.The coil is generally filled with an addition of liquid refrigerant and vapor. At the inlet side of the coil there is mostly liquid; the coolant flows through the coil (as needed); It evaporates for miles until there is only steam in the end. In the case of a flooded evaporator, the evaporator is usually filled with liquid refrigerant. A slip carries liquid refrigerant on at a constant level. Because the liquid refrigerant evaporates so quickly, it allows more liquid to slip, flooding the entire interior of the evaporator with liquid refrigerant up to a positive level determined by the slip. The primary forms of evaporators are also used in the direct expansion evaporator, the heat is immediately transferred from the cooling area through the pipes and absorbed by the refrigerant, in addition to the air. This secondary or cooling medium continues the preferred temperature of the area. Brine uses a calcium chloride response as a secondary refrigerant.

II. PROPOSED SYSTEM

In this paper , it's far found that the refrigeration impact also can be accelerated through editing the stream of liquid refrigerant withinside the evaporator tube. The association of tube is in six layers in zigzag manner , evaporator. Refrigeration structures check with the exclusive bodily additives that make up the entire refrigeration unit. The exclusive ranges withinside the refrigeration cycle are gone through in those bodily structures. These structures include an evaporator, a condenser, a compressor and an growth valve. The evaporator is the distance that desires to be cooled through the refrigerant; the compressor compresses the refrigerant from the low strain of the evaporator to the strain on the condenser. The warmth won through the refrigerant is rejected on the condenser and the excessive strain refrigerant is improved into the low strain evaporator through the growth valve. This is a completely widespread illustration of the diverse devices in a refrigeration system. The refrigeration structures range in line with the cause and the sort of refrigerant used

III.CALCULATION



T1= Temperature after Evaporation

T2= Temperature after Compression

T3= Temperature after Condensation

T4= Temperature after Expansion

T1=27oC	T2=80oC	T3=45oC	T4=13oC
P1= 80psi	P2=230psi	P3=230 psi	P4=80 psi

1 psi = 0.067 bar

P1= P4 = 80*0.067 = 5.36 bar

P2= P3 = 230*0.067=15.41 bar

Use gas R-12 PH chart and Find out the h1=209 KJ / kg h2=242.5 KJ / kg h3= h4 =80 KJ / kg
Theoretical C.O.P= (h1-h3) / (h2-h1)

= (209-80) / (242.5-209)

= 3.85

IV. RESULT

The performance of vapour compression system by using SIX layer with zig-zag shaped evaporator and compare with the existing system. The existing system coefficient of performance is 3.47 and SIX layer evaporator has been increased with an coefficient of performance is to 3.85 .

A. Effect of Evaporator on Compressor Work

It is observed that compressor work is decreased with the existing system. Because, here the suction pressure is increased and discharge pressure is decreased, so the compressor work and compressor power decrease when compare proposed system with the existing system.

B. Effect on Evaporation on Net Refrigeration

Net refrigeration increased with existing system. When suction pressure is increased and discharge pressure is decreased area of cooling space is increased from p-h chart and experimentally the evaporator surface and length also increased because of this reason net refrigeration effect is increased.

V. CONCLUSIONS

A. In my gift paintings an test set is ready for each current and proposed gadget. In the proposed gadget SIX layer zig-zag formed evaporator is used. The ability of the home fridge is 165Lts.
B. Experiments are performed for current gadget and proposed structures. In each structures R12 refrigerant is used.
C. In the proposed gadget the compressor paintings is much less than compressor paintings of current gadget. The percent of discount in compressor paintings .

D. In the proposed gadget the warmth to be rejected with inside the condenser is extra than the warmth to be rejected in current gadget. The percent of warmth discount in condenser .

E. In the proposed gadget the COP is extra than the COP of the prevailing gadget. The growth in COP is0.38

F. From the above results, It is concluded that, the proposed gadget with R 12 is giving the higher overall performance than the prevailing gadget with R12. Hence the proposed is nice appropriate for the 165lts of home fridge

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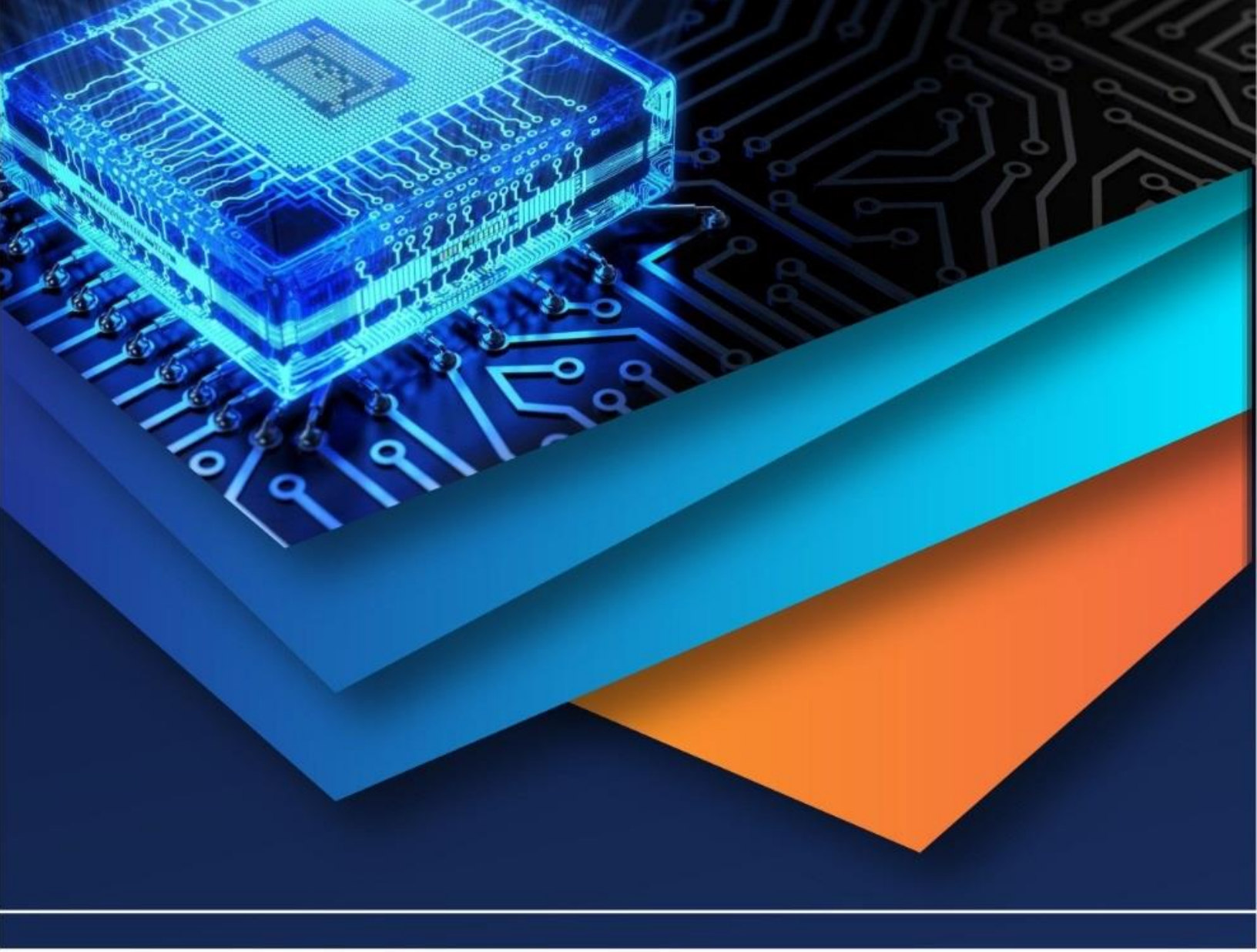

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