Design & Fabrication of Double Condensing Vapor Compression System

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Abstract— First time innovatively i introduced with my project double condensed refrigeration system this project deals with the design of a cooling system condenser efficiency doubled by with new artificial arrangements of refrigeration system. In this project advanced technical design arrangements of double condenser draw air through the condenser coils will be higher than that of existed cooling systems and also heat has to flow from the condenser to the air increases. The condensation temperature must be higher than that of the air between - 12°C and -1°C have taken less time compared to the nowadays cooling systems. Start of my project with the initial conditions is considered and accordingly the design will be modified. In this project I calculate the effective area of fixed cooling rate and the effective area of heat transfer of condenser is calculated. My project design is suggestible to a commercial business place and cold storages for fast heat recovered and dissipated to the environment at less time provided as input to the designed absorption system.

Key words: Vapor Compression System

I. INTRODUCTION

The main aim of project is to perform high efficient refrigeration system to use individually as per the need arises from the users in rural and urban areas of all over country. Nowadays in the area of urban and rural areas so many peoples in their houses use the Refrigerator according to users ratio comparing to the urban area very less people use refrigeration system in to rural area people only the reason of high price and system occupies large place next all the people commonly facing problem is highly electricity consumption and large space required. Even in to some of house it's seen that they use their refrigerator only for one hour and two hours only after switch off the refrigerant. So considering this all facts we I am going to fabricate such device which can be easily affordable as well as less space required unit. The device designed to perform the function of a refrigerator with less space and less electricity consumption. Refrigerator body is used to fabricate the complete setup. Here the cycle flows from compressor to condenser to expansion valve and then to the evaporator which is provided with the more ventilation with artificial arrangements to increasing system performance and to reduce power consumption From the evaporator, a tube is provided which highly cooling to the refrigeration for more effect. At the back side of the body one cooling fans is provided. The fan is used to provide the cool air to the condenser. The cooling is obtained by the generation of cooling effect outside the refrigerator body which is transmitted with the help of fan. There is empty space which is useful for preservation of food inside container of the system. 25% of total energy consumption, therefore unquestionably with a major impact on energy demand. The need of proper energy consumption is a worldwide concern and the big question arises for reducing energy wasting included proper used of energy and also how to lower power consumption. The aim must be achieved without compromising comfort and other advantages brought using energy, and with same efficiency and quality of installations. However, benefits such as a better temperature control and a lower response time for abrupt thermal load changes were also mentioned. In the pharmaceutical field, refrigerating units are used to store, process and test many chemical and biological materials. Refrigeration as a quick cooling process, speeds production, cuts moisture losses in foods and other engaged in the preparation, marketing and purchasing of foods, all depend on refrigeration, Important studies of exact nature of electron movement slow down to a point where it may be deserved has also wide application in submarine ships, aircraft and rockets. Component design is another important area. There is scope for improving all aspects, including developing more efficient condensers and evaporators. Expansion valves motor drives and fan controls.

II. DESIGN FABRICATION OF DOUBLE CONDENSED REFRIGERATION SYSTEM

A. *Specifications*

Materials	Application
Compressor	1/2 HP
Relay connections	for electrical
5/6' copper tube	for evaporator
Capillary tube feet)	for expansion (12
Condenser Air-cooled;	for condensing the liquid
Filter drier	Dehydrator
Thermostat	Automatic defrost control
¼ tubes	Joining the tubings (4 feet)
Oil	for lubrication
Brazing rod	for brazing the tubings
Lead	For soldering
Wooden planks	For making the outer cabine
Wires	For electrical connections insulating the wires

Table 1:

B. *Designing of Container & Assembling Parts*

The sheet of 8mm gauge wooden sheet was used for making of container for refrigeration system. The sheet of 6 feet ×3 feet was made use of and the development calculations are evolved. Now as the sheet is not big enough to take the center of 30*45 cm, hence the point was taken base of the container. The point was marketed making use of a string and marker pin. The angle was 90^0 after wards the height of 135 cm and width 35 cm was marked and cutting the sheet and to attached to the base using of pins and hammer. From top of the container to marketed the box for placing the evaporator with

dimension of 45x25x35 cm arranging with help on hack saw, hammer and pines attachments as shown in fig

Fig. 1: Container Back View

Fig. 2: Container Front View

Fig shows the arranging parallel cooling fan on back side of the condenser and bobbled plastic sheet pasted back side of the condensing coil the sheet help the pasting of the cooling lubricant to the condensing fines and fan will cool and dissipating heat from the coil will help the attached lubricant to the condenser.

C. Assembling Process of Double Condensing Cooling System

Brazing Process it is process of joining metal pieces by means of hard solder. Brass is mainly the main constituent of this solder. The brazing solder used in modern practice is commercially known as smelter, which is mixture of Cu, Zn and Sn. The most important phenomenon in this that the pieces to be joined are heated instead of the tube. Winding of Cu Tubes Once the internal container is repaired, it is soldered at its ends. Now 5/6" copper tubes of length one feet was wound around the outer surface of the sheet metal internal container, with equal spacing between them. These "Cu" tubes were positioned in their place firmly and rigidly with the help of soldering at place. Now these assembly functions as our Evaporator and these coils are called as "Evaporator Coils."

Both the ends of the Cu tubes Viz, the top and bottom of the internal container, where left free or unwound the upper portion of the tube was taken below along the external surface of the container and finally taken out of the bottom of the plastic bucket through a small boring. The other end of the coil was connected to the accumulator which is placed in between the bottoms of the bucket and the container. Ten this end was also taken out of the same boring and connected to the capillary tubes.

D. Capillary Connection

One end of the capillary was brazed inside the accumulator to prevent leakage. The total length used for the purpose was 12feet. Initially, some portion of the capillary was wound around the 5/16' tube coming out from the lop surface of the container. Then, this capillary is made in from of a uniform coil and was suspended freely. This capillary tube acts as an expansion valve.

E. Dehydrator

The dehydrator or the filter drier is located in the fluid line at the outlet end of the condenser. Its purpose is to filter, trap minute particles of foreign materials and absorb any moisture which may be in the system. Fine mesh screens filter out foreign particles and the desiccant absorbs the moisture. The one used in this refrigerator desiccants is silica gel (silicon dioxide).

F. Condenser Connections

Now a small piece of copper tubes id again brazed to the free end of the filter drier, which is then connected to the condenser. The condenser used in this unit is of air cooled type. In this the tube is bent in the shape of U and placed in conjunction with the fins are responsible for holding the air in their gaps that extract heat from the hot refrigerant flowing in the tubes of the condenser.

The evaporator coils surrounding the internal container absorb the heat from the hot boy inside the container and this heat is taken by the refrigerant. This refrigerant which is ultimate passing through the condenser radiates heat to the atmosphere with help of the condenser fins.

In our unit the condenser is fixed to the rear side of the cabinet, facing the atmosphere air.

G. Compressor Connection

The 5/6' copper tube of the evaporator oil is connected to one end the compressor with the help of brazing. The outgoing end of the compressor is brazed to the condenser to complete the circuit.

The compressor used in this case is reciprocating type sealed unit. The horsepower of the compressor is 1/6 HP. Compressor is used to establish a pressure difference and thus cause the refrigerant to flow from one part of the system to the other. At the same time the compressor raises the refrigerants pressure above the condensing pint.

At the temperature of the room air, so it will condense. It is this difference in pressure between the high low sides forces liquid refrigerant through the capillary tube into the evaporator.

III. RESULT & ANALYSIS

A. Heat Transfer through Condenser

1) Operational Conditions

Refrigerant Mass Flow Rate (g/s) 0.35
Air Mass Flux (kg/m2 s) 5
Refrigerant Inlet Pressure (MPa) 1.3177
Air Inlet Temperature 28ºC
Refrigerant Inlet Temperature 60 ºC
Refrigerant Condensation Temperature 55 ºC
Thermal conductivity of,
Convective heat transfer cofficient,
Inside film h_i = 15 W/m_2k
Thus,
Heat conducted inside the evaporator due to infiltration
$Q = (T_1 - T_o)\ 2\pi\ rh$
Approximately
=2.2174Watt
=2.2174j/s
=8kj/hr
Qact for one tone 3516.85kj/hr
Total cooling load on the unit,
Q total =2(Q infiltare+ Q actual)
=2(8+3516.85)
=2(3318.6) kj per hour
=6637.2Kj/h
=1.844 Kwatt
= 0.512 TR
=0.5 TR
Mass of refrigerant required
From p-h chart at 5ºC of refrigerant HFC404A
h_1 = 183 KJ/Kg
h_4=189Kj/Kg
55ºC, h_2 =205kj/kg
h_{f3}=76 kj/kg
For cylindrical eater,
m= 210Q / (183- 76) = 0.588 kg/ min.

2) Power Required for Compressor

Work done by compressor per kg of refrigerant,
$W = (0.589)\ (h_2 - h_1)$
= (0.589+0.377) (205-185.36)
=18.49kj/min
=0.3165kw

3) Coefficient of Performance of Refrigeration Unit

Cop = (Q_c/W_c)
= 1.844/0.3165
= 5.82

1) Above result shows the more efficient by artificial arrangements to the VCS as to increasing COP as compare to the domestically usage VCS and minimizing power consumption to increasing condenser performance.
2) By the test of Arranging the artificial arrangements of cooling fan and spraying lubricant to the condenser fines to decreasing the over heat to minimizing the greenhouse effect.
3) By this arrangements to develop eco-friendly VCS
4) Minimizing the methane production to the VCS and also increasing the performance of the VCS
5) Up to 15% saved the energy by condensing performance was doubled at a time in to the condenser.

IV. CONCLUSION

In the Domestically usage VCS it is to be stated of further developments are done by additional arrangements in the present fabricated refrigerator then the cost of the refrigerator and energy saving with artificial arrangements of existed systems also simple design modification of refrigeration system to decreasing the energy savings and new refrigeration systems modification of design to increasing the performance of refrigeration system to decreasing the heat produced by the condenser by continuous usage of system by spraying wd20 cooling oil and arrangements of cooling fan to the condenser fines to decreasing over heat production easily heat dissipation condensing was doubled . Keeping in view of economic aspects we have tried to fabricate a refrigerator which would energy saving and function highly well. In this the main part of interest is the body which is easy to fabricate and at less prices. Now with this the capacity of refrigerator has high. Then the prices would go down so as to suffice our needs. For such unit the condenser also can be a made small and of smaller gauge which would further curtailed the prices. The linear container is also fabricated in such a way that if is cheap and serves the purpose of deep freezer as cooling water bottles. Hence seeing the above mentioned improvements if possible then it would serve the ideal. Refrigerator for a middle class family because low maintenance, eco-friendly and be within reach of all general people.

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