© 2018 IJSRST | Volume 4 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Experimental Investigation of Performance of VCRS System by Using Air Cooled and Water Cooled Condenser

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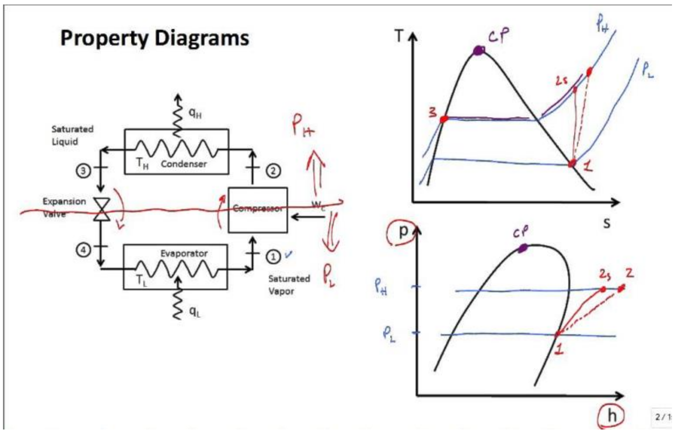
ABSTRACT

The present project report is based on Vapour Compression refrigeration. The cooling unit i .e.condenser is primary component on which the whole project is based upon. The project is carried out in 4steps. Refrigerator is one of the home applience utilizing mechanical vapour compression cycle in the process. Performance of the system become main issue and many researcher are still on going to evaluate and improve efficiency of any used system. Therefore this paper presentan experimnntal investagation of the performance of refrigeration cycle the COP is studeid by using dfferent condenser like water cooled and air cooled condenser.

Keywords: Refrigeration and air conditioning, VCRs system, condenser, air cooled, water cooled, evaporator, compressor, COP.

I. INTRODUCTION

Vapor compression refrigeration system is an improved type of air refrigeration system in which a suitable working system, termed as refrigerant, is used. It condenses and evaporates at temperatures and pressures close to the atmospheric condition. The refrigerants, usually, used for this purpose are ammonia, carbon dioxide and sulphur dioxide. The refrigerant used, does not leave the system, but is circulated throughout the system alternately condensing and evaporating. In evaporating, the refrigerant absorbs its latent heat from the brine (salt water) which isused for circulating it around the cold chamber. While condensing, it gives out its latent heat to the circulating water of the cooler.In this project we have concentrated our study on water cooled and air cooled condenser VCR systems and found out experimentally the performance improvement in COP.



II. CONSTRUCTION

In the present work we have concentrated our study on the water cooled and air cooled condenser for the domestic VCRs system to have higher COP than the air cooled condenser. The performance of the water-cooled condenser is elevated by immersing the full condenser in the water tank. In case of air cooled condenser the cellulose pads are used to get the cool air which is further used to cool the condenser.The experimental setup consists of a single stage vapour compression system with the basic components i.e.

evaporator, compressor, expansion device and two condensers one fully dipped in the water tank and other in open atmosphere air.

set-up of vapour compression refrigeration conditioning system has been built and is coupled with the Air cooled and water cooled condenser. The two condensers i.e. air cooled and water cooled condenser are placed in parallel to each other with a proper arrangement of handset valve to guide the flow of refrigerant as required. The effects of these two condensers on the cycle performance at different ambient conditions have been measured. Experimental results show that the use of water cooled condenser and air cooled condenser improves the COP as well as reduces the power consumption as compare to the air cooled condenser. The COP increase in case of water cooled condenser is about 25% whereas in evaporatively cooled condenser the COP improvement is of 20%.

III. WORKING OF EACH COMPONENT

Compressor: The low pressure and temperature vapor refrigerant from evaporator is drawn into the compressor through the inlet or suction valve, where it is compressed to a high pressure and temperature. This high pressure and temperature vapor refrigerant is discharged into the condenser through the delivery or discharge valve.

Condenser: The condenser or cooler consist of coils of pipe in which the high pressure and temperature vapor refrigerant is cooled and condensed. The refrigerant, while passing through the condenser, gives up its latent heat to the surrounding condensing medium which is normally air or water.

Expansion Valve: It is also called throttle valve or refrigerant control valve. The function of the expansion valve is to allow the liquid refrigerant under high pressure and temperature to pass at a controlled rate after reducing its pressure and temperature. Some of the liquid refrigerant evaporates as it passes through the expansion valve, but the greater portion is vaporized in the evaporator at the low pressure and temperature.

Evaporator: An evaporator consists of coils of pipe in which the liquid vapor refrigerant at low pressure and temperature is evaporated and changed into vapor refrigerant at low pressure and temperature. In evaporating, the liquid vapor refrigerant absorbs its latent heat of vaporization from the medium which is to be cooled.

MAIN FIGURE OF VCR SYSTEM

Figure 1

A) Water cooled condenser:

1. Tube in tube condenser
2. Shell in coil condenser
3. Shell in tube condenser

B) Air cooled condenser:

1. Natural Convection air cooled condenser
2. Force Convection air cooled condenser

IV. SPECIFICATIONS AND DIAMENSION

Compound	**Specifications**	**Diamension**
Evaporator (15 lit.)	–	16*5.5*10.5
Compressor	265 watt, 1/8 HP	–
Condenser	–	10200*15.87
Capillary	–	*0.31mm - 0.35mm*

V. CALCULATION AND EQUATION

Based on the experimental results, thermodynamic properties of the refrigerant at different points in the cycle are obtained using the P-H chart of refrigerant R-134a and the parameters such as mass flow rate, cooling capacity and COP of the system are calculated from the equations:

a. Compressor Work $W_c = V * I = m_{ref} * (h_2 - h_1)$

b. Mass flow rate of refrigerant = m_{ref} $W_c/(h_2-h_1)$

c. Cooling effect produce $Q_r = m_{ref} * (h_1-h_4)$

d. COP Q_r/W_c

where ,

h1 = enthalpy of refrigerant at inlet of compressor in kj/kg

h2 = enthalpy of refrigerant at exit of compressor in kj/kg

h3 = enthalpy of refrigerant at exit of the condenser. kj/kg

h4 = enthalpy of refrigerant at entry of evaporator in kj/kg

h1=348 Kj/Kg

h2= 374 Kj/Kg

h4= 230 Kj/Kg

COP= Qr/Wc= h1-h4/h2-h1

COP= 348-230/374-348

COP= 4.54 .

VI. APPLICATION

- ✓ Storage and transportation of food.
- ✓ Preservation of medicine and syrups.
- ✓ Manufacturing of ice,photographic films.
- ✓ Liquefaction of glass like N,O,H.

VII. CONCLUSION

COP is studied by using different condenserand under varying evaporator loads.And the COP improves water cooled condenser more than air cooled condenser.

VIII. ACKNOWLEDGEMENT

Though perseverance and enthusiasm combined with effort in the right direction can bring forth the thing called success, but the realization of the harsh reality that the path towards the success is full of myriads, temptations impediments and pitfalls often Proves to be disheartening in such situation.It is able guidance of knowledgeable person that steers one through difficulties and help them to achieve success.

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