

Experimental Analysis of By-Passing Refrigerant In A Desert Cooler From Vapour Compression Refrigeration System

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Abstract- Now a days many people as using domestic refrigerators and air conditioning for household purposes, which are individual costly equipments. The main objective is to merge a domestic refrigerator with a cooler (desert) by by-passing 10% refrigerant before entering into evaporator to desert cooler. The purpose of this may be solution for both refrigerator and air cooling in a single equipment .

I. LITARATURE REVIEW

HIMANSHU SINGH and S.K.GUPTHA,(2014) .This paper is about our attempt to merge Domestic Refrigerator and Air conditioner into a combined system such that an ordinary man can have a sound sleep which automatically increases his working productivity for the next day. Refrigerator has become a necessity of all households in 21st Century. As the country's GDP is 8 to 9% and is likely to be 10%, hence the standard of living of common man is bound to be better. In all metropolitan cities, environment degradation due to automobile & other factors is on the rise, therefore the requirement of air -conditioner has already been felt. The motivation for the project comes from rising energy demands and hence its cost. As we all know that we are lacking of power resources, so this product will help us in tackling this problem as we are trying to make a personalized cooling system which will run at a very low cost that can be afforded by a common man. In minimum construction, maintenance and running cost, this attempt is quite useful for domestic purpose so that our ultimate aim of the project that is those who cannot afford an Air Conditioner can have the comfort of Air Conditioner could be completed. Since all energy cost are on a rise, therefore this project is a way forward in realizing the economic as well as environmental demands . As it is said "the energy saved is the energy produced". On the other hand the common man can have the comfort of Air conditioner.

The refrigerator's defrost function is utilized to extract excessive coolness and is fed to an AHU to work like an Air conditioner which is used for personalized cooling. After this paper we conclude that a common man can have

comfort of air conditioner at very low running cost or zero cost, which would prepare him for better productivity for the next day.

II. INTRODUCTION

The most alarming environmental disorder namely "Global Warming" refers to the rising temperature of Earth's atmosphere and ocean and its projected continuation. The heat from the Sun is entrapped in the Earth and thus increases the temperature of the atmosphere by Greenhouse Effect. Refrigeration system is directly and invisibly responsible for Global Warming problem. For the typical home of the early 1990s, a frost-free refrigerator or freezer was the second most expensive home appliance to operate besides the water heater. Appliance makers were required to include labels listing an estimate of the annual cost of running each appliance so consumers could compare costs and energy usage. A refrigerator (colloquially fridge) is a common household appliance that consists of a thermally insulated compartment and a heat pump (mechanical, electronic, or chemical) that transfers heat from the inside of the fridge to its external environment so that the inside of the fridge is cooled to a temperature below the ambient temperature of the room. Domestic refrigerators are among the most energy demanding appliances in a household due to their continuous operation. The domestic refrigerator is one found in almost all the homes for storing food, vegetables, fruits, beverages, and much more. Materials that can store thermal energy reversibly over a long time period are often referred to as latent heat storage materials. It also helped in heat transfer via conduction.

Desert cooler is a device that cools air through the evaporation of water. Evaporative cooling differs from typical airconditioning systems which use vapour-compression or absorption refrigeration cycles. Evaporative cooling works by employing water's large enthalpy of vapourisation. The temperature of dry air dropped significantly through the phase transition of liquid water to water vapour which can cool air using much less energy than refrigeration. Extremely dry climates evaporative cooling of air has the added benefit of

conditioning the air with more moisture for the comfort of building occupants.

The objectives of the performance of the domestic refrigerator by using By- passing 10% of refrigerant from the domestic refrigerator to the desert cooler.

1. To fabricate the experimental set up by modifying the domestic refrigerator with the By passing refrigerant to the desert cooler.
2. To observe the difference on the Coefficient of performance (COP) of the refrigerator cycle with air cooling.

III. EXPERIMENTAL SETUP

A conventional household refrigerator is joined with the desert cooler by the by-pass valve arrangement at the exit of the expansion valve. An evaporative coils of the air condition setup is fixed in-front of the desert cooler fan. These evaporative coils are joined to the refrigerator by the By-pass valve arrangement. Some part of refrigerant is by-passing through the copper tube into evaporator coils. An experimental setup is comprised with the refrigerator, pressure gauges, evaporative coils, desert cooler and By-pass valve.

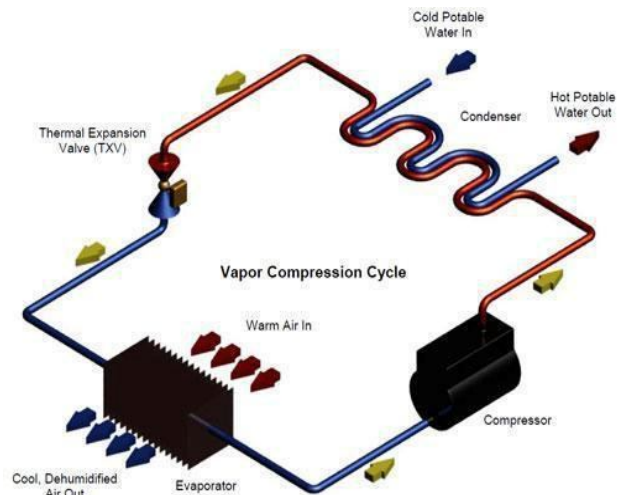


Fig 1: Conventional Vapor compression Refrigeration System

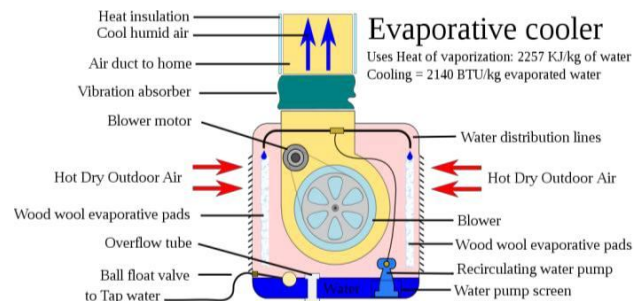


Fig 2: desert cooler

Conventional Vapor Compression Refrigeration system

The vapor-compression uses a circulating liquid refrigerant as the medium which absorbs and removes heat from the space to be cooled and subsequently rejects that heat elsewhere. The main heat transfer part is done via convection method between evaporator coil and environment. Figure depicts a typical, single-stage vapor- compression system. All such systems have four components: a compressor, a condenser, a Thermal expansion valve (also called a throttle valve or Tx Valve), and an evaporator. Circulating refrigerant enters the compressor in the thermodynamic state known as a saturated vapor and is compressed to a higher pressure, resulting in a higher temperature as well.



Photograph Of Actual Experimental Setup

Data Collection

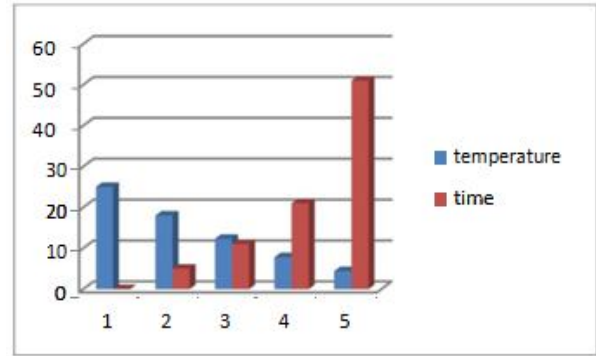
The following data have been collected for each test run at the steady state condition of the system.

1. P1=Compressor suction/Evaporator outlet pressure(bar)
2. P3=Evaporator Inlet Pressure(bar)
3. T1= Compressor suction Temperature (°C)
4. T2=Compressor discharge/condenser Inlet

1. Temperature(°C)
5. T4= Evaporator Inlet Temperature(°C)
6. t=time

Table 1 Experimental Data without by pass refrigerant

T1(°C)	T2(°C)	T3(°C)	P1(bar)	P2(bar)	T(min)
32	35	22	1.2	14	0
30	37	17	1.1	14.4	3
28.6	38.2	10	0.8	14.6	6
27.8	39.4	5	0.9	15	11
27.8	39.4	-2	0.9	15	19

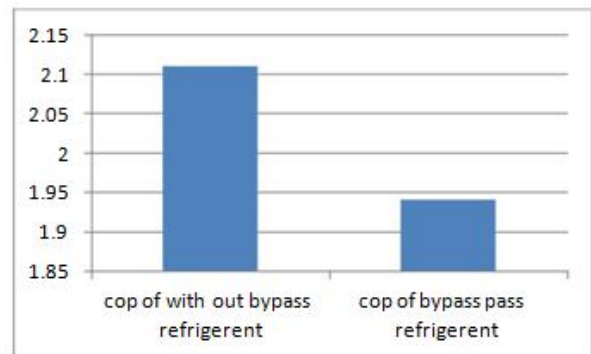


National conference on Emerging Trends in Mechanical Engineering (e-TIME'16), 14th July 2016, JNTUACE- Ananthapuramu.

Table 2 Experimental Data with By pass refrigerant to the air cooler from the refrigerator

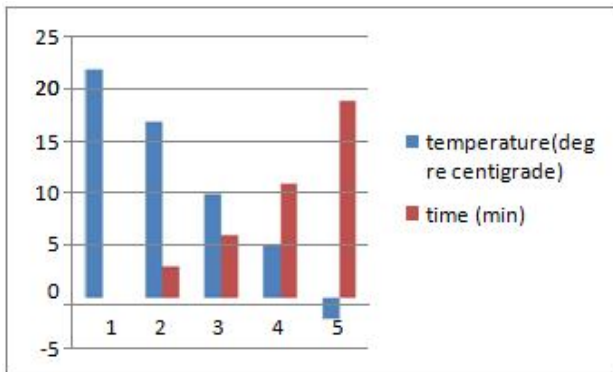
T1(°C)	T2(°C)	T3(°C)	P1(°C)	P2(°C)	t(min)
29	39	25	1.2	22	0
30.9	47.8	12.3	0.9	22	5
33.1	53.3	7.8	0.7	19	15
33.7	53.7	4.4	0.8	18	30
33.6	54.2	3.8	0.8	18	35

Comparison of COP chart



IV. RESULTS

Graph between evaporator temp.Vs time Without By pass refrigerant



Graph between evaporator temp.Vs time with By pass refrigerant to the air cooler from the refrigerator

V. CONCLUSION

Use of by-passing refrigerant into air cooler from vcr system imposes a great impact on the solution for both refrigerator and air cooling in a single equipment..using this setup cop =1.94 with out using this COP of the refrigerator 2.11.The COP of the total system is decreased by 8-10% of the refrigerator. The power consumption experiment without by-passing refrigerant takes 0.11KW. Using by-passing refrigerant to the cooler takes 0.14KW of power consumption. tests have been carried out to investigate the performance of a household refrigerator at different loads. Depending upon investigations the little amount of cop of domestic refrigerator is decreases but the purpose of air cooling was achieved with small amount of power consumption..now a days many people using domestic refrigerator and air coolers for household purposes, which are individual costly equipments. So using this bypassing setup is solution for multi purposes of both air cooling and cost reduction.

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