DEVELOPMENT OF HIGHER COOLING CAPACITY REFRIGERATION UNIT WITH HOT CHAMBER

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ABSTRACT

The aim of our project is to improve coefficient of performance of system. To improve the coefficient of performance, it is to require that compressor work should decrease and refrigerating effect should increase. Modifications in condenser are meant to increase degree of sub-cooling of refrigerant which increased refrigerating effect or more cooling water is required in condenser. A vapour compression cycle that is used in most household refrigerators, freezers and cold storages. In this cycle a circulating refrigerant enters a compressor as low pressure vapour at or slightly above the temperature of the refrigerator interior. The vapour is compressed and exits the compressor as high-pressure superheated vapour. Generally Brines are secondary refrigerants and are generally used where temperature are required to be maintained below the freezing point of water that is 0^0C.In this case the temperature involved is above the freezing point of water(0^0C), then the water is commonly used as secondary refrigerant. The brines commonly used are calcium chloride($CaCl_2$),sodium chloride that is common salt (NaCl) and glycols such as ethylene glycol, propylene glycol, etc. But In our project we are using Ethylene glycol (R22R36) ($C_2H_4(OH)_2$) as a secondary refrigerant

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I. INTRODUCTION

Refrigeration may be defined as the artificial withdrawal of heat, producing in a Substance or within a space a temperature lower than that which would exist under the Natural influence of surrounding ASHRE , it is defined as the science of providing and Maintaining temperature below that of refrigeration which are equivalent to production of cooling. However, for the places where surrounding are at a temperature lower than the required condition, it has to be heated up. As every product require deferent storage temp for maintaining the quality of eatable or potable material. Keeping that aspect in view a low temp generating refrigeration system has been designed to maintain -22 °C. It is the process of removing heat from an enclosed space, or from a substance, and rejecting it elsewhere for the primary purpose of lowering the temperature of the enclosed space or substance and then maintaining that lower temperature. The term cooling refers generally to any natural or artificial process by which heat is dissipated. The process of artificially producing extreme cold temperatures is referred to as cryogenics. Cold is the absence of heat, hence in order to decrease a temperature, one "removes heat", rather than "adding cold." In order to satisfy the Second Law of Thermodynamics, some form of work must be performed to accomplish this. This work is traditionally done by mechanical work but can also be done by magnetism, laser or other means. However, all refrigeration uses the three basic methods of heat transfer: convection, conduction, radiation.

II.WORKING PRINCIPLE

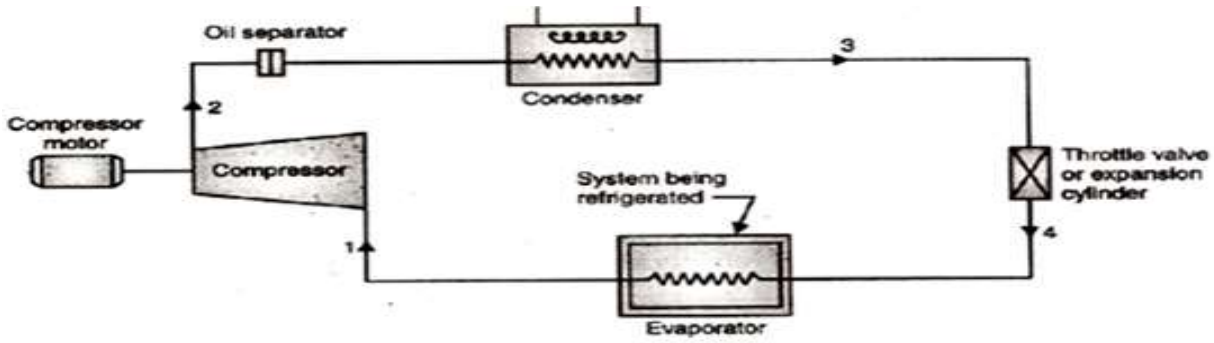


FIG.SINGLE STAGE VAPOUR COMPRESSION REFRIGEARTION SYSTEM

A vapour compression cycle that is used in most household refrigerators, freezers and cold storages. In this cycle a circulating refrigerant enters a compressor as low pressure vapour at or slightly above the temperature of the refrigerator interior. The vapour is compressed and exits the compressor as high-pressure superheated vapour. The refrigerant, while passing through the condenser, gives up its latent heat to the surrounding condensing medium which is normally air or water. The condenser cools the refrigerant vapour, which then liquefies. This liquid refrigerant is forced through a metering or throttling device, also known as an expansion valve (essentially apin-hole sized constriction in the tubing) to an area of much lower pressure. The sudden decrease in pressure results in explosive-like flash evaporation of a portion(typically about half) of the liquid. During evaporation, the liquid vapour refrigerant absorbs its latent heat of vaporization from the product which is to be cooled. This phenomenon known as "auto-refrigeration". The typically out of the Vapour compression system in shown in above Fig.

III.EXPERIMENTAL SETUP

IV.TECHNICAL DATA OF Q SERIES REFRIGERATION COMPRESSORS

(Low Back Pressure, Refrigerant : R134a)

ASHRAE Test Condition:

Evaporating temperature: -23.3 ^{0}C

Condensing temperature: 54.4 ^{0}C

Subcooling temperature: 32.2 ^{0}C

Suction temperature: 32.2 ^{0}C

Ambient temperature: 32.2 ^{0}C

Tolerance:

Capacity: no less than 95%

Input Power: no more than 115%

Current: no more than 110%

COP: no less than 93%

V.Theoretical Calculation:-

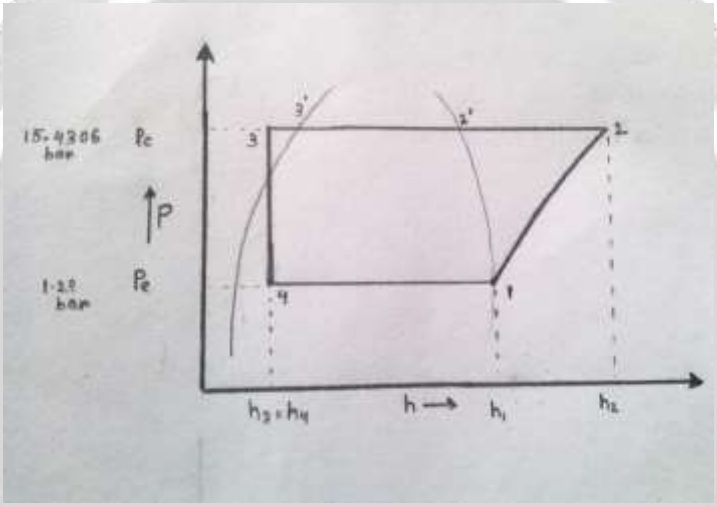
Condensing temperature (T_c)= 54.4^{o}C

Evaporative temperature ($T_{e)}$ = -23.3^{o}C

Sub-cooling temperature = 32.2^{o}C

On solving,

h_{f1} = 171.33 KJ/Kg



On solving,

h_{f2} = 278.496 KJ/Kg

h_{g2} = 425.16 KJ/Kg

S_{f2} = 1.2581 KJ/Kg

S_{g2} = 1.7059 KJ/Kg.

Here, process 1-2 is isentropic process,

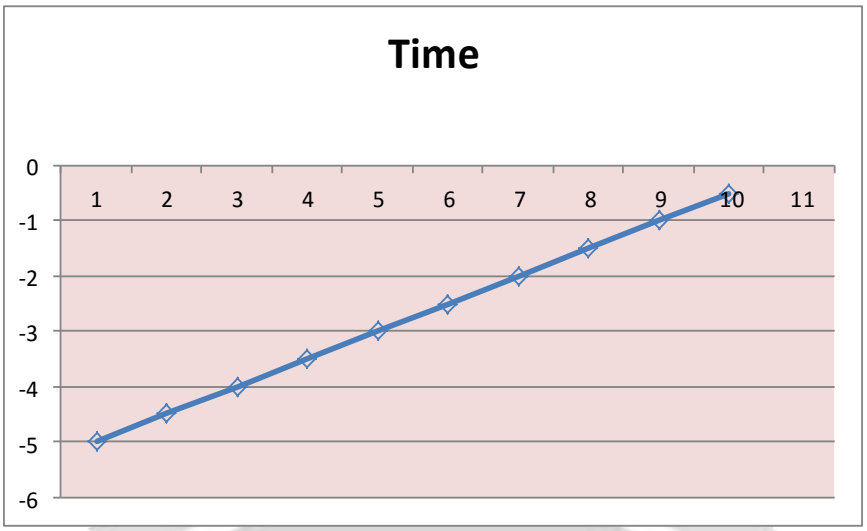
$S_1 = S_2$

$$COP = \frac{h_1 - h_4}{h_2 - h_1}$$

$$COP = \frac{385.46 - 242.84}{437.64 - 385.46}$$

COP = 2.73

VI.RESULT AND ANALYSIS



Here:- Time is in minutes
Freezing Temperature in ^{0}C
Theoretical cop=2.73
Actual cop=2.691

VII.ADVANTAGES:-

1)By using R-134a as a primary refrigerant condenser size should be reduced

2)Water required for the condense is less as compared to use in conventional ice plant.

3)Ice can be manufacture in shorter time

4)Less effect on environment when primary refrigerant is leak.

5)Hot water obtained in hot chamber can be used for various purpose like for removing of ice from ice cans etc.

VIII.APPLICATIONS:-

1)In automobile

2)In industrial Application where instant cooling required.

3)Fisheries

4)Chemical

5)Pharmaceutical

IX.CONCLUSION:-

Now that we have known how the technology works, we believe that refrigeration systems can be researched further to be used in advanced applications and refrigeration technologies are high in demand due to it being environmentally friendly. Finaly we conclude that by using refrigerant R134a as primary refrigerant and ethylene glycol as a secondary refrigerant we improve the COP of the refrigerator and we make ice within few minutes. In this project the refrigerant we are using is less toxic, eco-friendly and low cost.

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