

LIFE CYCLE TESTING OF HERMETIC COMPRESSOR USING HYDRO-CARBON REFRIGERANT

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Abstract - Now a days the hydro-chlorofluorocarbons (HCFC) and hydro fluorocarbons (HFC) are the mostly used refrigerants in air conditioning sector. These refrigerants have strong influence on global warming and HCFCs impact on the ozone layer. To reduce this effect the refrigerants such as ammonia (NH₃), carbon dioxide (CO₂) and Hydrocarbons (HC), having minimal impact on the environment, are being considered. So far, HCs have only been safely used in domestic refrigeration. Ammonia has been used mainly for industrial refrigeration whereas CO₂ is still under study. The refrigerants like R12 and R22 contain chlorine atoms which are main reasons for the emission of Chlorofluorocarbon. This is responsible for the ozone depletion. Therefore we are using the alternate refrigerants like R-134a and hydrocarbon mixture (R290/R600a). These refrigerants have zero ozone depletion potential and negligible global warming potential. We are doing the experimental analysis of R134a and various ratios of R290/R600a refrigerants. This investigation thermodynamically analyzes a vapor compression refrigeration system which compares R134a and R290/R600a refrigerants.

Key Words: Hydrocarbon Refrigerant, Low GWP & ODP, More COP.

1. INTRODUCTION

We all know that day when temperature of the earth goes on increasing; the ozone layer on the earth decreases and also greenhouse effect decreases so in order to save our earth from ultra violet rays coming from sun on earth we need to take preventive action. Refrigerant is also the responsible for the decreasing of the ozone layer. So we are testing R290, R600a, LPG refrigerants in Air Conditioner this refrigerants having very less greenhouse effect and zero ozone layer depletion. By using this refrigerant the greenhouse

effect is decreases or will not be responsible for the ozone layer depletion. This refrigerant reduces the percentage of depletion. CFCs and HCFCs are the potential contributor to the global warming. There is an urgent need to phase out traditional refrigerants (CFCs and HCFCs). In this project we are going phase out the R134a and R12 by R600a and R290 with proportion in air conditioner. So for that we have to first check the COP and other properties of refrigerants in air conditioned room.

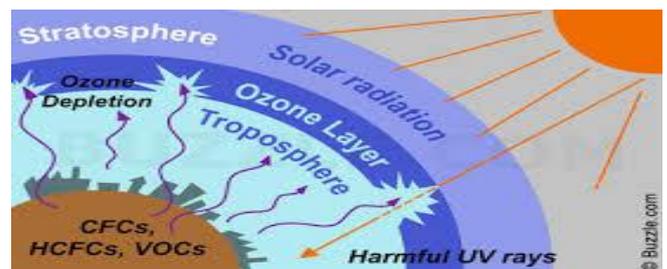


Fig 1. Global Warming Phenomena

1.1 WORKING SETUP OF TEST RIG

The mixture of R600a and R134a refrigerant, is fed into the compressor by using special procedure with the help of charging equipment's in one of the window air conditioner. There are two conditioned rooms, the window air conditioner is placed in each room. In first room air is conditioned by using one AC, so that constant surrounding air condition is maintained. In second room window AC is placed which cools the room air and heat is released to first room. The mixture of R600a and R134a refrigerant, is fed into the compressor of the second AC.

This setup is like a cascade system. The refrigerant in second AC takes the heat from second room through the evaporator and releases this heat to first room air through condenser of second AC. Then this heat is absorbed from first room air by evaporator of first AC and released to the atmosphere through the condenser of the first AC.

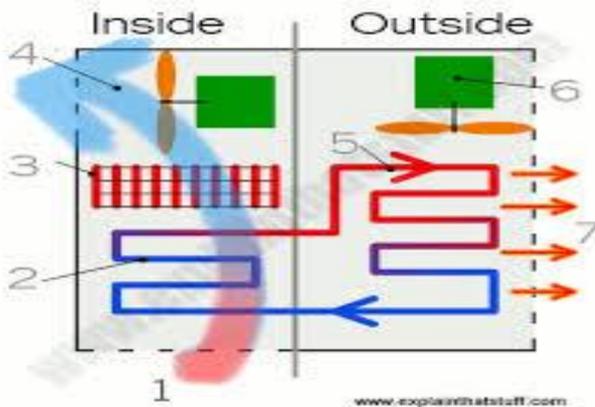


Fig 2. Working of air conditioner

2. LITERATURE REVIEW

In 1986 Pandeya, P. N.[1] This Paper presents on the various aspects of hermetic compressor design and development has been going on for a long period of time. As old questions get answered, new ones keep coming up. So much work has been done that a beginner in the compressor design field could easily get confused, and might not even know where to start. The purpose of this paper is to present a consolidated and simplified design approach that could be used as a guideline to get started with the very complex task of designing a hermetic compressor. Ideas that have proven successful over the years have been discussed. Particular attention has been given to design for performance.

In 2017, NeerajAgrawal [2] This paper presents system performance of an existed 134a domestic refrigerator with propane/isobutene (50/50%) zeotropic blend is measured as a drop-in substitute. An inhouse experimentations test facility was developed. The experiments are conducted under various charge condition to find optimum charge. Experiments were conducted at constant load condition. The optimum charge is measured as 60 g with R290/R600a (50/50%) zeotropic blend and the lowest temperature is recorded as -3.5°C.

In 2015 M. G. ALMEIDA [3] in this paper on The refrigerants being used in vapor compression processes have specific thermodynamic properties, which are decisive for the performance of the

compressor of the system. The Montreal and the Kyoto protocols initiated a discussion of alternative refrigerants, which lead to new requirements of the compressor. The reliability of reciprocal compressors has become a leading field for compressor research. One of the main tools in the reliability field is accelerated degradation/life testing (ADT or ALT). These tests are designed to provide life estimates or to define lower bounds of product/parts reliability at shortened time periods. The objective of this paper is to discuss the literature on accelerated life testing of reciprocating hermetic compressors, focusing on the wear of mechanical components.

In 2011 Dr. K. SUBBAREDDY [4] in this paper Compressor testing, Connecting the compressor, Evacuation and charging Refrigerent The compressor after fixing the thermocouples and pressure gauges has to kept it in the compressor chamber of the calorimeter. The suction and discharge tube connections are to be made, depending upon the capacity of the compressor. Wells are provided for inserting return gas and discharge temperature RTD sensors. The flexible hoses with threaded adaptors are provided for connecting the compressor quickly in the chamber to the refrigeration system.

In 2017, AnushaPeeyala and N V V S Sudhe[5] The aim of this paper is to present the experimental analysis of Coefficient of performance [COP] values using R134a [HFC] & R600a [HC] as Refrigerants in Domestic refrigerator using conventional and nonconventional energy sources. Based on the results, usage of R600a in domestic refrigerators will reduce the ODP and also GWP problems which fulfills the nominal requirements of human beings without any effects.

3. METHODOLOGY

A window AC testing with R600a and R134a methodology has been outlined. Steps of procedure include:

- Selection of refrigerant
- Analyze the properties of refrigerants
- Making of conditioned room
- Installation of window AC

- Charging of R22 and R600a blend
- Running compressor for 200 hr
- Checking of compressor parts
- Testing of compressor
- Plot result of compressor

4. TESTING OF COMPRESSOR PARTS

1. SELECTION OF REFRIGERANT

The refrigerant which replace HFC'S Alternatives that would eventually take the place of halogenated refrigerants would be required to have zero ODP and low GWP. Low toxicity, low price, good chemical stability and good thermal properties would be a definite advantage. Naturally occurring substances like NH₃, HCs and CO₂ could be substitutes to HFCs and HCFCs. Table 1 gives the values of ODP and GWP of frequently used refrigerants.

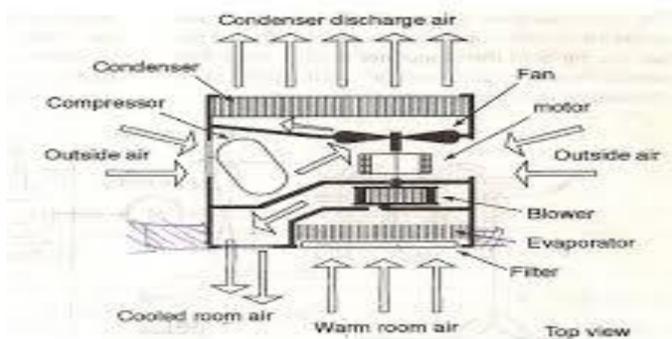


Fig.3 Window AC

(ii) MAKING OF CONDITIONED ROOM :

To maintain air at constant environment condition we have to make two compartments of the room as shown in picture so that one AC maintains the surrounding condition of air and second AC is used for testing cooling refrigerant blend that we have charged. Material used for room is plywood.



Fig 4. Conditioned room

(iii) INSTALLATION OF AC:

One window AC of 1TR in which we have charged refrigerant is installed in one room on support. And other regular window AC 1TR is installed in second room. window air conditioner is placed on the table to install the ac.

(iv) CHARGING OF REFRIGERANTS:

Charging done by special procedure to charge the refrigerants like hydrocarbons,

Procedure:

Blending of two different refrigerant having different operating pressure to a proportionate mixture at common operating pressure in high pressure blender tank... this mixture is then charged into the compressor of one AC. But before that air present in the section line is removed by suction pump.

(V) TESTING THE COOLING PARAMETERS:

PROCEDURE:

- Start the AC.
- Make stable condition of air.
- Record the WBT, DBT in both rooms.
- Calculate humidity in test room.
- Calculate refrigeration effect and work required.
- And repeat this procedure for different proportion of mixture. And conclude.

5, CONCLUSION

The current phase of our project described in this paper is to test the AC refrigerant cooling parameters by using such refrigerant like R600a ,R290 ,R134a which has low GWP and ODP but considerable amount of COP which doesn't impact on environment. Thus we are phasing out the refrigerants like R22, R12 which are danger for environment.

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