

Fabrication of A Domestic Refrigerator Without Compressor Running With Liquefied Petroleum Gases

Budamoddule Veeresh¹, G Md Javeed Basha², M Ravi Sankara Varaprasad³

¹Dept of ME

²Assistant Professor, Dept of ME

³Associate Professor, Dept of ME

^{1,2,3}St.Johns College of Engineering & Technology, Yemmiganur, India

Abstract- The aim of the project is Fabrication of a refrigeration system without compressor running with lpg. Supply of continuous electricity is still not available in several areas of the country and in the world where the refrigeration of Food and Medicines can be preserved. LPG comprises of 24.4% propane (C₃H₈),(R-290), 56.4% butane (C₄H₁₀)(R-600) and 17.2% isobutene which have very low boiling point (lower than 0 °C).The LPG is cheaper and possesses an environmental friendly nature with no Ozone Depletion Potential (ODP) and no Global Warming Potential (GDP). It is used in world for cooking purposes. The refrigerator used in the present study is designed to work on LPG. Pollution is minimized by the usage of LPG and also the cost is minimized by LPG Refrigeration system. Hence this innovative concept of the LPG refrigeration system is proposed and the fabrication is carried out.

Keywords- Compressor, LPG, Ozone Depletion Potential, Global Warming Potential, Fabrication work.

I. INTRODUCTION

In India, more than 80% of the domestic refrigerator utilizes HFC 134a as refrigerant, due to its excellent thermodynamic and thermo physical properties. But, HFC 134a has a high global warming potential (GWP) of 1300. Hydrocarbon refrigerants, particularly LPG serves as the best contender to replace HFC's from domestic refrigerator as well as car air conditioners. As we know According to second law of thermodynamics, Heat is virtually being pumped from a lower temperature to a higher temperature by adding some of external work. Therefore, this two types of refrigerants (LPG and CFC 22) to be examined using a modified domestic refrigerator in term of their performance characteristics parameters such as pressure and temperature at specified location at the refrigerator and the safety requirements while conducting the experiment. By performing the tests on new system, it is indicate that the successful of using LPG as an alternative refrigerant to replace CFC 22 in domestic refrigerators is possible by getting LPG.

II. LITERATURE REVIEW

The energy crisis persists all across the globe. We think of recovering the energy which is already spent but not being utilized further, to overcome this crisis with no huge investment. The climatic change and global warming demand accessible and affordable cooling systems in the form of refrigerators and air conditioners. Annually billions of dollars are spent in serving this purpose. Hence forth, we suggest NO COST Cooling Systems.

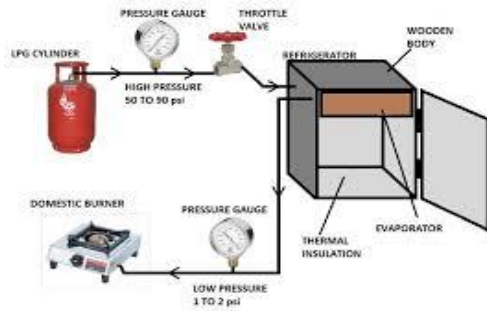
A.Baskaran&P.KoshyMathews:A Performance Comparison of Vapour Compression Refrigeration System Using Eco Friendly.Refrigerants of Low Global Warming Potential VCR system with the new R290/R600a refrigerant mixture as a substitute refrigerant for CFC12 and HFC 134a. The refrigerant R290/R600a had a refrigerating capacity 28.6% to 87.2% higher than that of R134a.

B.O.Bolaji, have Experimental study of R152a/R32 to replace R134a in a domestic refrigerator and find out that COP obtained by R152a is 4.7% higher than that of R134a. COP of R32 is 8.5% lower than that of R134a and propane is an attractive and environmentally friendly alternative to CFCs used currently.

R.W.James & J.F.Missenden, have use of propane in domestic refrigerators and conclude that he implications of using propane in domestic refrigerators are examined in relation to energy consumption, compressor lubrication, costs, availability, environmental factors and safety propane is an attractive and environmentally friendly alternative to CFCs used currently.

III. COMPONENTS AND DESCRIPTION

Frame, LPG gas cylinder, Capillary tube, Evaporator or refrigerator, Pressure gauge, Gate valve.



Frame:

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

LPG Gas cylinder:

Liquefied petroleum gas or liquid petroleum gas (LPG or LP gas), also referred to as simply propane or butane, are flammable mixtures of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles.

It is increasingly used as an aerosol propellant and a refrigerant, replacing chlorofluorocarbons in an effort to reduce damage to the ozone layer. When specifically used as a vehicle fuel it is often referred to as auto gas. Varieties of LPG bought and sold include mixes that are primarily propane

Capillarytube:

Capillary action (sometimes capillarity, capillary motion, or wicking) is the ability of a liquid to flow in narrow spaces without the assistance of, and in opposition to, external forces like gravity. The effect can be seen in the drawing up of liquids between the hairs of a paint-brush, in a thin tube, in porous materials such as paper, in some non-porous materials such as liquefied carbon fiber, or in a cell. It occurs because of intermolecular forces between the liquid and surrounding solid surfaces.

Evaporator:

An evaporator is a device used to turn the liquid form of a chemical into its gaseous form. The liquid is evaporated, or vaporized, into a gas.

An evaporator is used in an air-conditioning system to allow a compressed cooling chemical, such as R-22 (Freon) or R-410A, to evaporate from liquid to gas while absorbing heat in the process.

Pressure gauges:

Many techniques have been developed for the measurement of pressure and vacuums. Instruments used to measure pressure are called pressure gauges or vacuum gauges.

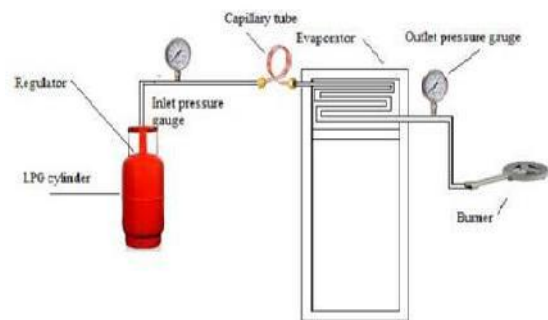
Gate valve:

A flow control valve regulates the flow or pressure of a fluid. Control valves normally respond to signals generated by independent devices such as flow meters or temperature gauges. Control valves are normally fitted with actuators.

IV. WORKING PRINCIPLE

The basic idea behind LPG refrigeration is to use the evaporation of a LPG to absorb heat. LPG is stored in the LPG cylinder under high pressure when the gas tank of regulators is opened then high pressure LPG passes in gas pipe. This LPG is going by high pressure gas pipe in capillary tube. It works on the principle that during the extraction of heat the LPG expanded there is a pressure drop and increase in volume of LPG that results in the drop of temperature and a cooling effect.

Thus the refrigeration effect can be obtained while burning a stove using the LPG gas. The LPG gas from the gas tank passes over the capillary tube as said above and enters a refrigeration cycle and reaches the burner.



The basic idea behind LPG refrigerator is to use the LPG to absorb heat. The simple mechanism of the LPG refrigeration working is shown in the figure. LPG is stored in the LPG cylinder under high pressure. When the gas tank of regulators is opened then high pressure LPG passes through

the high pressure pipe. This LPG is going by high pressure gas pipe to capillary tube. High pressure LPG is converted in low pressure at capillary tube with enthalpy remains constant. After capillary tube, low pressure LPG is passed through the evaporator. LPG is converted into low pressure and temperature vapor from and passes the evaporator which absorbs heat from the chamber. Thus the chamber becomes cool down. Thus we can achieve cooling effect in refrigerator. After passing through the evaporator low pressure LPG is passed through the pipe to burner. And we can use the low pressure of LPG in burning processes is 60% reduction in weight of the system due to higher density of LPG. This fridge works when electricity is off. The parts are effectively silent in operation. Running cost is zero. Eliminates the compressor and condenser.

V. ADVANTAGES AND DISADVANTAGES

Advantages: It eliminates the blocking problem.

It is efficient to save fuel. Low Weight. The fridge works when the electricity is off. It is efficient to save fuel. No Pollution. Running cost is zero. Eliminates the compressor and condenser. Noiseless in operation.

No need of separate power for running the refrigeration system. The cost of the system is low.

Disadvantages: LPG is explosive in nature. Cannot maintain constant pressure in LPG cylinder. After the refrigeration processes, the exhaust of LPG is burn into burner. Because of the exhausted vapour LPG cannot converted again liquid phase, because of this the process is very costly. The prevention of leakage of the LPG is the major problem in LPG refrigeration system. Because of the LPG is highly inflammable.

VI. APPLICATIONS

Application of LPG Refrigeration System:

It can play an important role in restaurants where continuously cooling and heating is required. It can be used in chemical industries for refrigeration purpose. It can be useful in remote parts where electricity is not available. It can be used in refineries where consumption of LPG is high.

VII. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution

to bridge the gates between the institution and the industries .After performing this project “LPG REFRIGERATION”, it is concluded that refrigerating effect is produced with the use of LPG. From observation table, It is concluded that, when the regulating valve is fully open then the evaporator temperature downs from 32°C to 31°C in 30 minutes. It is also concluded that, in the capillary tube pressure of gas 5 bar from the cylinder is reduced to 1 bar. The capillary tube is more suitable throttling device in LPG refrigeration system.

This system is cheaper at initial as well as running cost. It does not require an external energy sources to run the system and no moving part in the system. So maintenance cost is also very low. This system is most suitable for hotel, industries, refinery, chemical industries where consumption of LPG is very high. We are proud that we have completed the work with the limited time successfully. “THE FABRICATION OF THE LPG REFRIGERATION SYSTEM WITHOUT COMPRESSOR” is working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities.

The aim of the LPG refrigerator was to use LPG as a refrigerant and utilizing the energy of the high pressure LPG cylinder for producing the refrigerating effect. We also conclude that, we are trying to burn the exhaust LPG, the pressure of exhaust gas is less than 10 PSI, so that the flame produce by the burner is spreading outside. This system is most suitable for hotel, industries, refinery, chemical industries where consumption of LPG is very high.

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