

A Review paper on: Design and Fabrication of LPG as Refrigerant

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Abstract— This project investigates the result of an experimental study carried out to determine the performance of domestic refrigerator when a liquefied petroleum gas (LPG) which is locally available which comprises of 24.4% propane, 56.4% butane and 17.2% isobutene which is varied from company to company is used as a Refrigerant. The LPG is cheaper and possesses an environment 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. The performance parameters investigated is the refrigeration effect in certain time. The refrigerator worked efficiently when LPG was used as a refrigerant instead of R134a. The evaporator temperature reached 15°C with an ambient temperature of 35°C. Also, from the experiment which done in atmospheric condition, we can predict the optimum value of cooling effect with the suitable operating condition of regulating valve and capillary tube of the system.

Keywords— LPG, Efficiency, LPG Evaporator, Capillary

I. INTRODUCTION

The term 'refrigeration' in a broad sense is used for the process of removing heat (i.e. Cooling) from a substance. It also includes the process of reducing and maintaining the temperature of a body below the general temperature of its surroundings. In other words, the refrigeration means a continued extraction of heat from a body, whose temperature is already below the temperature of its surroundings. For example, if some space (say in cold storage) is to be kept at -2 °C, we must continuously extract heat which flows into it due to leakage through the walls and also the heat, which is brought into it with the articles stored after the temperature is one reduced to -2 °C. Thus, in a refrigerator, heat is virtually being pumped from a lower temperature to a higher temperature. The refrigeration system is known to the man, since the middle nineteenth century. The scientist, of the time, developed a few stray machines to achieve some pleasure. But it paved the way by inviting the attention of scientist for proper studies and research.[2,3]

They were able to build a reasonably reliable machine by the end of nineteenth century for the refrigeration jobs. But with the advent of efficient rotary compressors and gas turbines, the science of refrigeration reached its present height. Hebrews, Greeks, and Romans places large amounts of snow into storage pits dug into the ground and insulated with wood and straw. The ancient Egyptians filled earthen jars with boiled water and put them their roofs, thus exposing the jars to the night's cool air. In India, evaporating cooling was employed.

When a liquid vaporizes rapidly, it expands quickly. The rising modules of vapor abruptly increase their kinetic energy and this increase is drawn from the intermediate surroundings of the vapor. These surroundings are therefore cooled. The intermediate stage in the history of cooling foods was to add chemicals like sodium nitrate or potassium nitrate to water causing the temperature to fall. Cooling wine via above method was recorded in 1550.[4,5]

II. LITERATURE REVIEW:

In the cyclic process of refrigeration, the heat is removed from the low temperature reservoir and is thrown to high temperature. As per the second law of thermodynamics the natural flow of heat is from high temperature to low temperature reservoir. In the cyclic refrigeration process since the flow of heat is reserved, the external work has to be done on the system. The cyclic process of refrigeration is also reverse of the thermodynamic power cycle or Carnot cycle in which the heat flows from high temperature reservoir to low temperature reservoir. Hence the cycle of refrigeration is also called as Reversed Carnot Cycle. Although government agencies are not able to continuously supply a major portion of electricity in both the urban as well as in rural areas. Still the people in these regions require refrigeration for a variety of socially relevant purposes such as cold storage or storing medical supplies and domestic kitchens this project has the novelty of using LPG instead of electricity for refrigeration. This solution is convenient for refrigeration in regions having scares in electricity.

It works on the principle that during the conversion of LPG into gaseous form, expansion of LPG takes place. Due to this expansion there is a pressure drop and increase in volume of LPG that results in the drop of temperature and a refrigerating effect is produced. This refrigerating effect can be used for cooling purposes. So, this work provides refrigeration for socially relevant needs as well as replaces global warming creator refrigerants. Conventional VCR (Vapor Compression Refrigeration System) uses LPG as refrigerant and produced the refrigerating effect. But in our proposed very simple type of refrigeration system in which high pressure LPG is passing through a capillary tube and expands. After expansion the phase of LPG is changed and converted from liquid to gas and then it passes through the evaporator where it absorbs the heat and produces the refrigerating effect. After evaporator it passes through the gas burner where it burns.[1,3,5]

This work investigates the result of an experimental study carried out to determine the Coefficient of performance of domestic refrigerator when a propane-butane mixture is liquefied petroleum gas (LPG) which is available and comprises 56.4% butane, 24.4% propane, and 17.2% isobutene. This paper also presented an experimental investigation of COP by the effect of changing capillary tube length, capillary tube inner diameter and capillary coil diameter on the mass flow rate of refrigerant in an adiabatic helical capillary tube. Large amount of electricity supply is not available easily in large part of under-development country like India. It will also prove to be an effective for remote area such as research sites, mines, & deserts where electricity is generally not available. The LPG is cheaper and possesses an environmental free in nature with no ozone depletion potential (ODP). Also, LPG is available as a side product in local refineries. The results of the present work indicate the successful use of this propane-butane mixture as an alternative refrigerant to CFCs and HFCs in domestic refrigerator. It would include Experimental setup of working model and detailed observation of the LPG refrigerator and represents its application in refinery, hotel, chemical industries where requirement of LPG is more.[5,6]

Component used are Connectors, Pressure Gauge. Many techniques have been developed for the measurement of pressure and vacuums. Instruments used to measure pressure are called pressure gauges or vacuum gauges. Regulator: This type of regulator is used to send high pressure gas from the cylinders. These are mainly used in functions to Burners. Copper Tubes Air-Conditioning and Refrigeration Systems, **Copper** is the preferred material for use with most refrigerants. Because of its good heat transfer capacity as well as corrosion resistance and cheaper in cost. As for all materials, the allowable internal pressure for any copper tube in service is based on the formula used in the American Society of Mechanical Engineers Code for Pressure Piping (ASME B31): [10]

Have use of propane in domestic refrigerators and conclude that the 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 cfc's used currently.

Has conducted performance tests on the performance of liquefied petroleum gas (LPG) as a possible substitute for R12 in domestic refrigerators. The refrigerator which is initially design to work with R12 is used to conduct the experiment for LPG (30% propane, 55% N-butane and 15% isobutane). Various mass charges of 50, 80 and 100g of LPG were used during the experimentation. LPG compares very well to R12. The COP was higher for all mass charges at evaporator temperatures lower than -15°C . Overall, it was found that at 80g charge, LPG had the best results when used in this refrigerator. The condenser was kept at a constant temperature of 47°C . Cooling capacities were obtained and they were in the order of about three to fourfold higher for LPG than those for R12.

III. CONCLUSION:

- LPG refrigeration system is more efficient and more economical than a regular VCC refrigeration system.
- It reduces pollution and hence is more environment friendly.
- Small systems can be operated without electricity.
- Compressor and condenser have been eliminated.

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