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LPG REFRIGERATION SYSTEM

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ABSTRACT

This paper find out the result of an experimental study performed to determine the performance of domestic refrigerator when a liquefied petroleum gas (LPG) which is locally available which comprises of 24.2% propane, 57.6% butane and 17.2% isobutene which is change from company to company is used as a Refrigerant. The LPG is cheaper and possesses an environmental friendly nature with zero Ozone Depletion Potential (ODP) and no Global Warming Potential (GDP). It is used in world for cooking activity. The refrigerator is designed to work on LPG. The performance parameters investigated is the refrigeration effect in specific time. The refrigerator worked efficiently when LPG was used as a refrigerant in the place of R134a. The evaporator temperature reached 4°C with an ambient temperature of 36°C. Also from the experiment which done in atmospheric condition, we can determine the optimum value of cooling effect with the suitable operating condition of regulating valve and capillary tube of the system.

INTRODUCTION

The term ‘refrigeration’ is 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 atmospheric temperature of its surroundings. In other words, the refrigeration means a continued removal of heat from a body, whose temperature is already less than the temperature of its surroundings .For example, if some space (say in cold storage) is to be kept at -3 °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 kept after the temperature is one decreased to -3 °C. Thus in a refrigerator, heat is virtually being passed from a lower temperature to a higher temperature. The refrigeration system is known to the human, since the middle nineteenth century. The scientist, of the time, developed a few stray machines to get some pleasure. But it attracted scientists for proper studied and research. They were able to manufacture a reasonably reliable machine by the end of nineteenth century for the refrigeration purpose. But with the use of efficient rotary compressors and gas turbines, the science of refrigeration reached its present height. Hebrews, Greeks, and Romans places large amounts of ice into storage pits dug into the ground surface and coated with wood and straw. The ancient Egyptians filled earthen jars with hot water and put these jars on their roofs, thus exposing the jars to the night’s cold air. In India, evaporative cooling was employed. When a liquid vaporizes quickly, it expands rapidly. The increasing modules of vapor abruptly increase their kinetic energy and this increase is drawn from the intermediate surrounding stage of the vapor. Therefore these surroundings are 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 reduce. Cooling wine by above method was recorded in 1550.

EQUIPMENTS

LPG Gas Cylinder

LPG means Liquefied Petroleum Gas. LPG consist of Propane (C₃H₈) and Butane (C₄H₁₀) , either stored separately or together as a mix. This is because these gases can be liquefied at a normal temperature by application of a moderate pressure, or at normal pressure by application of LPG using refrigeration.

Capillary Tube

The capillary tube is the commonly used as throttling device in the domestic refrigeration. The capillary tube is a tube of very small internal diameter of copper. It is of very long length and it is coiled to many turns so that it would occupy compact space. The internal diameter of the capillary tube used for the refrigeration applications changes from 0.5 to 2.28 mm(0.020 to 0.09 inch). When the refrigerant enters in the capillary tube, its pressure decreases suddenly due to very small internal diameter. The drop in pressure of the refrigerant through the capillary depends on the internal diameter of capillary and the length of capillary. Smaller is the diameter and more is the length of capillary more is the decrease in pressure of the refrigerant as it passes through it.

Evaporator

The evaporator is very important parts of the refrigeration system. through the evaporator cooling effect is produced in the refrigeration system. in the evaporators actual cooling effect takes place in the refrigeration system. many people consider the evaporator is the main part of the refrigeration system, & consider other parts as less useful. The evaporator exchanges heat from the substance to be cooled to the refrigerant, thus extracting the heat from the from the substance. The evaporator is used for large variety of diverse application in refrigeration and hence the available in large variety of shapes, sizes and designs. They are also classified in different manner depending on the method of feeding the refrigerant, construction of the evaporator, direction of air circulated around the evaporator, application and also the refrigerant control. In the domestic refrigerators the evaporator is commonly known as freezers since the ice is made in this compartment. In the evaporators the refrigerant enters at very low pressure and low temperature after passing through the capillary tube. This refrigerant absorbs the heat from the substance to be cooled so the refrigerant gets heated while the substance gets cooled. Even after cooling the substance the temperature of the refrigerant coming out from the evaporator is cool than the substance. In the large refrigeration plants the evaporator is used for cooling water. In such cases shell and tube type of heat exchanger is used as the evaporator.

Pressure Gauge

Many instruments have been developed for the measurement of pressure and vacuums. The instruments used to measurement of pressure are called as pressure gauges or vacuum gauges. A manometer is also refer to a pressure measuring instrument, usually limited to measure the pressure near to atmospheric. The term manometer is often used to refer specifically to liquid column hydrostatic instruments. Catering to the requirements of to power and allied Industry, we offer quality array of stainless steel, weatherproof pressure gauges. These gauges are available in 63mm, 100mm, and 150mm sizes and can be customized as per requirement.

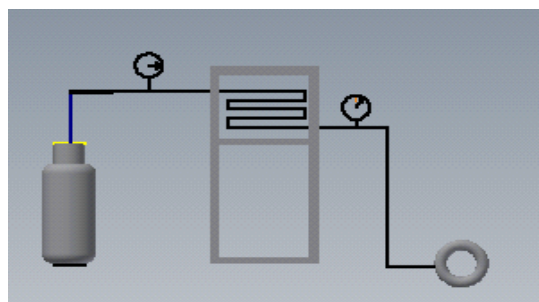
High Pressure Pipes

The high pressure pipes are required where requirement to transfer gas at high pressure. They are made of a steel pipe with steel ball fitted to both ends.

OBSERVATION TABLE

Time (in min)	Capillary inlet pressure (in bar)	Evaporator outlet pressure (in bar)	Evaporator temp (in° C)
0	12	5	36
10	12	5	30
20	12	5	21
30	12	5	15
40	12	5	10
50	12	5	6
60	12	5	4

DIAGRAM





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Fig 1: LPG refrigeration system.

CONCLUSION

After performing this project “LPG REFRIGERATION SYSTEM”, it is concluded that refrigerating effect is produced with the use of LPG as a refrigerant . From observation table, It is concluded that, when the regulating valve is fully open then the evaporator temperature downs from 36°C to 4°C in 60 minutes. It is also concluded that, in the capillary tube pressure of gas 12 bar from the cylinder is reduced to 5 bar. capillary tube is the more suitable throttling device in LPG refrigeration system. This system is cheaper at initial setup as well as operating cost. It does not need any external energy sources for running the system and no moving part in this system. So maintenance cost is very less. This system is most suitable for hotels, industries, refinery, chemical industries where use of LPG is very high.

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