

## LPG BASED REFRIGERATION SYSTEM

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**Abstract** -This paper researches the aftereffect of a testexamine completed to decide the exhibition of local icebox when a melted oil gas (LPG) which is locally accessible which includes 24.4% propane, 56.4% butane and 17.2% isobutenewhich is changed from organization to organization is utilized as a Refrigerant. The LPG is less expensive and has an ecological agreeable nature with no Ozone Exhaustion Potential (ODP) and no An unnatural weather change Potential (Gross domestic product). It is utilized in world for cooking purposes. The fridge utilized in the present investigation is intended to deal with LPG. The presentation parameters explored is the refrigeration impact in certain time. The cooler worked proficiently when LPG was utilized as a refrigerant rather than R134a. The evaporator temperature achieved 5°C with a surrounding temperature of 35°C. Likewise from the analysis which done in environmental condition, we can foresee the ideal benefit of cooling impact with the appropriate working state of managing valve and slender container of the framework.

**Key Words:** Vapour Absorption Refrigeration, LPG Refrigerant, Zero Refrigeration Cost, COP, Domestic Refrigerator, Eco-Friendly Refrigerants

### 1. INTRODUCTION

Because of the immense interest of power over the world, we consider recuperating the vitality which is as of now spent yet not being used further, to beat this emergency with less speculation. The climatic change and a worldwide temperature alteration request available and moderate cooling frameworks as fridges and forced air systems. As per the vitality review, the cooler is one of the heaviest power purchasers among family unit apparatuses.

The vitality utilization of iceboxes has improved consistently year over year. It chips away at the rule that the extension of LPG will be happens amid the transformation of fluid LPG into vaporous structure. Therefore, LPG gas weight drops and the volume of gas will be increment this will be result into dropped in temperature of gas and it goes about as refrigerant. As indicated by second law of thermodynamics, this procedure of cooling must be performed with the guide of some outside work. Henceforth, the power supply is normally required to drive a cooler. The substance which works in a fridge to separate warmth from a virus body and to convey it to a hot body i.e.to encompassing is

called refrigerant. All around 17500 metric huge amounts of customary refrigerants is devoured by residential refrigeration like CFC, HFC which causes high consumption if ozone layer (ODP) and Global Warming Potential (GWP). The utilization of LPG rather than CFC 22 has gained a superior ground since it has a situation cordial direction with no ODP. Great item productivity is come about by the utilization of LPG due to its attributes. Therefore we need to inspect these two sorts of refrigerants (LPG and CFC 22) in an adjusted residential cooler contrasting their presentation attributes parameters like weight, temperature and so forth.

#### 1.1 Objectives

- To obtain the characteristic benefits of LPG refrigerant.
- To determine the COP of refrigerator using LPG as refrigerant.
- To benefit the Cooling effect at free of cost by eliminating the compressor.
- To produce an eco-friendly refrigeration system, by green technology that eliminates the use of ozone depleting refrigerants.

#### 1.2 Properties of LPG

- Colourless.
- Odourless (It's normal to odorize LPG by adding an odorant prior to supply to the user, to the aid detection of any leaks).
- Heavier than air.
- Liquid LPG is half the weight of water.
- Non-toxic.
- LPG expands upon release and 1 liter of liquid will form approximately 250 liters of Vapour.

### 2. METHODOLOGY

#### 2.1 WORKING PRINCIPLE

The vapour absorption refrigeration system comprises of all the processes in the vapour compression refrigeration system like compression, condensation, expansion and evaporation. In the vapor absorption system the refrigerant used is ammonia, water or lithium bromide. The refrigerant gets condensed in the condenser and it gets evaporated in the evaporator. The refrigerant produces cooling effect in the evaporator and releases the

heat to the atmosphere via the condenser. the refrigerant enters the condenser at high pressure and temperature and gets condensed. The condenser is of water cooled type. When the refrigerant passes through the expansion valve, its pressure and temperature reduces suddenly. This refrigerant (ammonia in this case) then enters the evaporator. The refrigerant at very low pressure and temperature enters the evaporator and produces the cooling effect. In the vapor compression cycle this refrigerant is sucked by the compressor, but in the vapor absorption cycle, this refrigerant flows to the absorber that acts as the suction part of the refrigeration cycle.

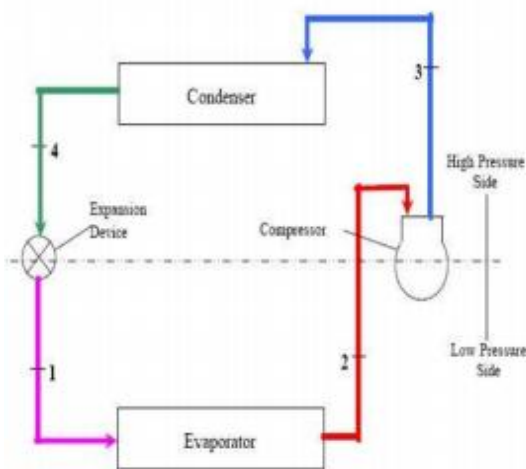


Fig-2.1: Schematic diagram of simple VACs

## 2.2 ACTUAL SYSTEM

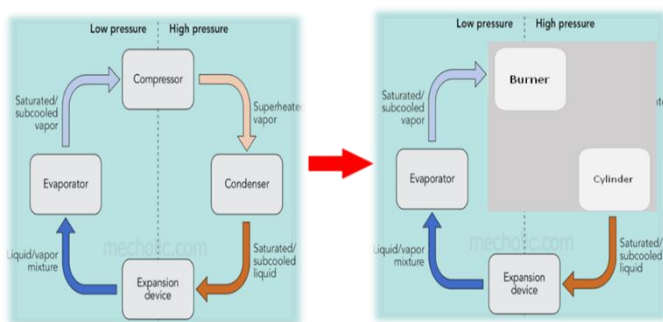


Fig-2.2: Modification of VAC

The straightforward instrument of the LPG refrigeration working is appeared in figure 2. The thought behind LPG refrigeration is to assimilate heat from encompassing by utilizing the vanishing of a LPG. The weight of LPG which is put away in barrel is at around 120 psi. We bringing down this weight of LPG up to weight 30 psi by utilizing fine thus that cooling is done on encompassing by engrossing warmth isentropically. Weight of LPG in barrel is high, when the controller of gas tank is opened then high weight LPG goes through gas pipe. After that this

high weight LPG is goes in the fine cylinder from high weight pipe. In the fine cylinder this high weight LPG is changed over in to low weight adiabatically for example enthalpy stays consistent. After fine cylinder, this low weight LPG is gone through evaporator. In the evaporator LPG is changed over into low weight and temperature vapor structure which ingests the warmth from the cooling chamber. Therefore the chilling chamber moves toward becoming chills.

## 2.3 BLOCK DIAGRAM

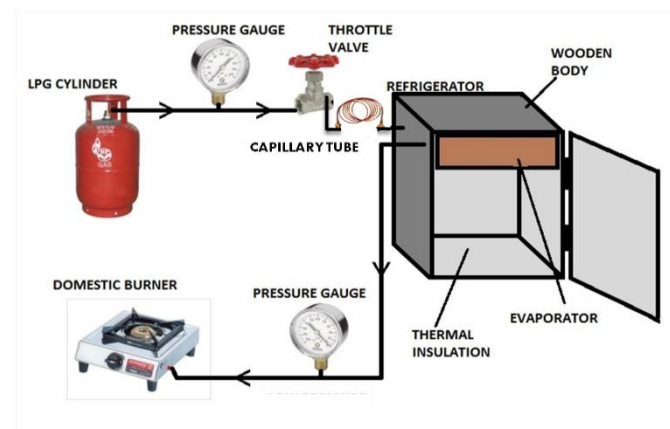


Fig -2.3 : Block Diagram

## 3. CONSTRUCTION

### 3.1 Components Used

- LPG Gas Cylinder



Fig:-3.1 LPG Cylinder

LPG is general creation of two gases chiefly Propane (C<sub>3</sub>H<sub>8</sub>) and Butane (C<sub>4</sub>H<sub>10</sub>), either put away independently or together as a blend in a chamber. These gases can be melted at an ordinary temperature by use of a weight increment. LPG is put away in a chamber at about 12.5 bars. LPG is utilized as a fuel for modern, plant, cooking, agrarian, warming and drying forms. LPG can be utilized as a fuel for cars.

- Capillary tube

The slender cylinder is the ordinarily utilized throttling gadget in the residential refrigeration. A fine cylinder is of

copper having a little bore distance across. It diminishes the weight of fluid refrigerant



Fig:-3.2 Capillary Tube

from condenser weight to evaporator weight when associated with a fluid line. The length of slim cylinder is more noteworthy when the evaporator weight is lower.

● **Pressure gauges**

There are numerous procedures for the estimation of weight and vacuums. Weight checks and vacuum checks are the instruments used to gauge weight.

The most generally utilized mechanical measure is Bourdon type weight check. It is a solid, straightened metal cylinder twisted into a roundabout shape, a dial graduated in weight unit for example bar. Weight measure records the check



Fig:-3.3 Pressure Gauge

a roundabout shape, a dial graduated in weight unit for example bar. Weight measure records the check weight which is the contrast between liquid weight and outside air weight. These checks are accessible in the various scopes of weight.

● **Evaporator sheet**

The evaporator is likewise a significant segment of the refrigeration framework. The cooling impact is created by going the refrigerant through evaporator loop.



Fig:-3.4 Evaporator Sheet

The genuine cooling impact happens inside the evaporator in the refrigeration frameworks. The warmth is expelled from the substance by exchanging the warmth

from the substance to be cooled to the refrigerant with the assistance of evaporator. In this manner the evaporator goes about as warmth exchanger surface

● **High pressure pipes**



Fig:-3.5 High Pressure Pipes

When there is a need of transferring gas at high pressure, the range of high pressure pipes are used. It consists of a steel pipe with steel spheres fixed at both the terminals. These spheres are pressed against the seating of connecting hole with the help of two swivelling nipple and thus the gas leakage is prevented.

**3.2. Fabrication of LPG Refrigeration System**



**3.3 Specifications**

- Refrigeration Box : Thermo coal Insulated
- L=270mm W=250mm
- H=380mm T=40mm
- Evaporator Sheet : L=1000mm H=330mm
- LPG Cylinder : 14.2kg
- Capillary Tube : D=0.031mm L=3000mm
- Pressure Gauge : 500psi & 250psi
- Filter : D=44.5mm H=60mm
- Regulator : D=4mm upto 250psi
- Pressure Pipes : 1500mm\*2no
- Thermocouple : Digital

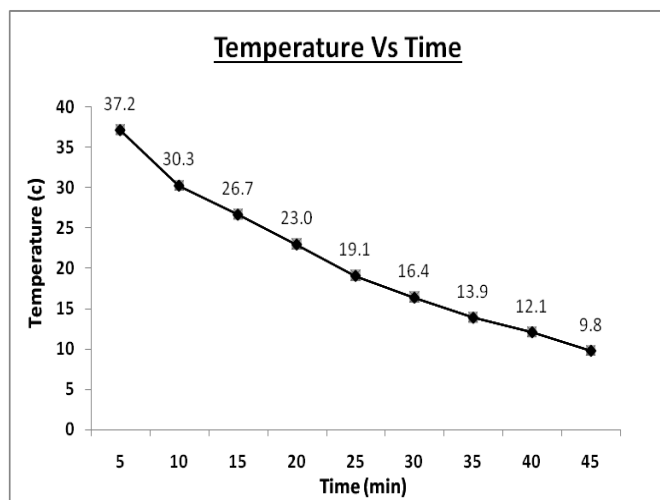
L=Length W=Width H=Height  
T=Thickness D=Diameter Kg=Kilogram

#### 4. EXPERIMENTAL OBSERVATION AND RESULTS

As we conducted an experiment with the system of initial pressure of 110 psi from LPG cylinder and output pressure of 40 psi to obtain refrigeration effect. The observations have been tabulated as shown in below Table 1 and also graphical representation of experiment i.e. **Temperature vs. Time** is shown below graph.

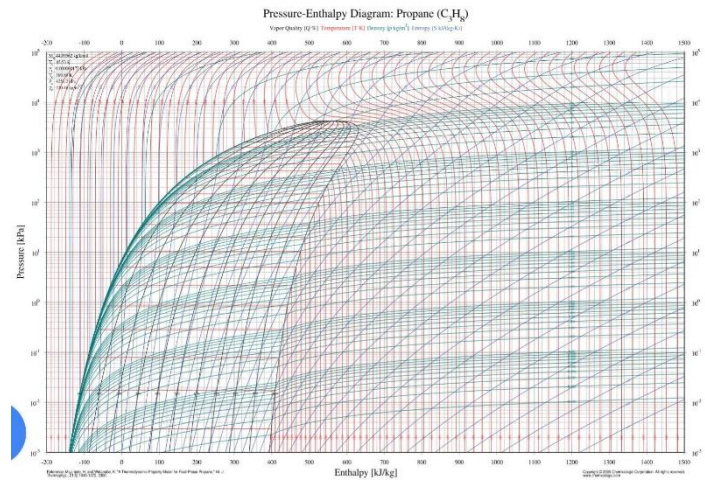
**Table 4.1:** Initial & Delivery Pressures with resp't to time

Time	Initial Pressure	Delivery Pressure	Temperature
Min	psi	psi	Celsius
5	110	41	37.2
10	110	40	30.3
15	110	41	26.7
20	110	40	23.0
25	110	40	19.1
30	110	36	16.4
35	110	40	13.9
40	110	38	12.1
45	110	40	9.8



**Chart 4.1:** Temperature Vs Time

#### 5. GRAPHS AND TABLE



**Chart 5.1:** Pressure Enthalpy chart of Propane

**Table 5.1:** Pressure vs. Temperature of Propane

LPG (Propane) Cylinder Pressure Chart			
Temperature		Vapour Pressure	
C	F	kPa	PSIG
54	130	1794	257
43	110	1358	197
38	100	1186	172
32	90	1027	149
27	80	883	128
16	60	637	92
-1	30	356	51
-18	0	152	24
-29	-20	74	11
-43	-45	0	0

#### 6. ADVANTAGES OF LPG

- Use of LPG as a refrigerant additionally improves the average efficiency of via 10.0 to 20.0%.
- The ozone depletion capacity (ODP) of LPG is zero and international warming capacity (GWP) is 8 that is extensively negligible as compared to different refrigerant.
- A component from environment friendly, use of LPG also gives us lot of free blessings.
- LPG does not shape acids and there with the aid of gets rid of the hassle with blocked capillaries.
- There is 60% discount in weight of the system because of better density of LPG.
- This refrigerator works while strength is off.
- The components are efficaciously silent in operation.
- Running cost is zero
- Eliminates the compressor and condenser.

## 7. APPLICATIONS OF LPG REFRIGERATION

- It may play an crucial function in eating places in which constantly cooling and heating is required.
- It is able to be utilized in chemical industries for refrigeration purpose.
- It could be beneficial in far flung elements in which strength is not to be had.
- It can be used in refineries wherein intake of LPG is excessive.

## 8. CONCLUSIONS

- From the apparatus setup, the coefficient of performance of the refrigerator using LPG as refrigerant is 1.1 which is comparable to a domestic refrigerator.
- Though the COP is less than the Domestic refrigerator however the cooling effect or Refrigeration effect is observable and effective.
- To reach 10°C within 45min, this is good enough to preserve the consumable products.
- Hence the LPG based refrigerator can be used as an alternative for cooling instead of domestic refrigerator.

### Economical

- Reduction in cost by utilizing direct LPG Gas from the cylinder.
- Consumption of Electricity is reduced to nil.

### Inexpensive and Affordable

- Refrigeration is made less bulky as compressor and condenser are eliminated.
- The running cost of refrigerator is reduced.

### Refrigeration Capacity

- Designing the system to meet the different cooling loads under different pressures.

## 9. FUTURE SCOPE

- The system can further be improved and implementing in air conditioning of vehicles where LPG is used a fuel.
- The project can be implemented in restaurant and community program hall, mobile canteen, mid-day meal of school so to preserve food products like vegetables, milk etc.

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