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Review Paper on LPG Refrigeration System

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ABSTRACT- This paper researches the world today is concerned about saving the environment, everywhere measures have been taken up to reduce pollution. Investigates the result of an experimental study carried out to determine the LPG is locally available which comprises of 24.4% propane, 56.4% butane, and 17.2% isobutane which is varied from company. The LPG is cheaper and possesses an environment friendly nature with no Ozone Depletion Potential (ODP) and no Global Warming Potential (GDP). We have design and analysed a refrigerator using LPG as refrigerant. As the high-pressure LPG stored in cylinder. Pressurized LPG is passed through the small internal diameter of capillary tube. The result is decreasing the pressure of LPG due to expansion and phase of LPG occurs in an isenthalpic process. The latent heat of evaporation gained by the liquid refrigerant in evaporator and temperature decrease of surrounding. That is the way the LPG can produce refrigerating effect. Performance parameters investigated is the refrigeration effect in certain time. The refrigerator worked efficiently when LPG was used as a refrigerant instead of any other refrigerant. 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 and the evaporator temperature goes down to the 0.5 ˚C. In the final result we have found that the COP of an LPG Refrigerator is higher than a domestic refrigerator

Keywords: LPG Cylinder,Evaporator, Capillary tube, Burner, Pressure Gauge, Wooden body, etc.

I. INTRODUCTION

Refrigerator became the daily part of our life. Its usage is increasing day by day. On the other side, its harmful effect to environment also increasing gradually. We need to reduce this harmful effect, but we cannot avoid using refrigerator. But we can use some other techniques to produce refrigeration effect, which does not cause any global also increasing day by day, but its production rate remains the same. Usage of electricity should be reduced. It is estimated that electricity consumption of refrigerator is high among other household appliances. LPG refrigeration system does not require electricity. Only input is high pressure Liquefied Petroleum Gas. Our aim is to produce Refrigeration effect by passing LPG through copper tubes of small diameter. 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. Henceforth, we suggest NO COST Cooling Systems.

LPG consists mainly of propane (R-290) and butane (R-600), and LPG is available as a side product in local refineries. In Cuba for already several decades LPG is used as a drop-in refrigerant. LPG mixtures have composition of a commercial LPG mixture suitable as „drop-in" replacement for R-12 was calculated crudely as 64% propane and 36% butane by mass. Liquefied petroleum gas (LPG) of 60% propane and 40% commercial butane has been tested as a drop-in suitable for R 134a in a single evaporator domestic refrigerator with a total volume of 10 ft3.

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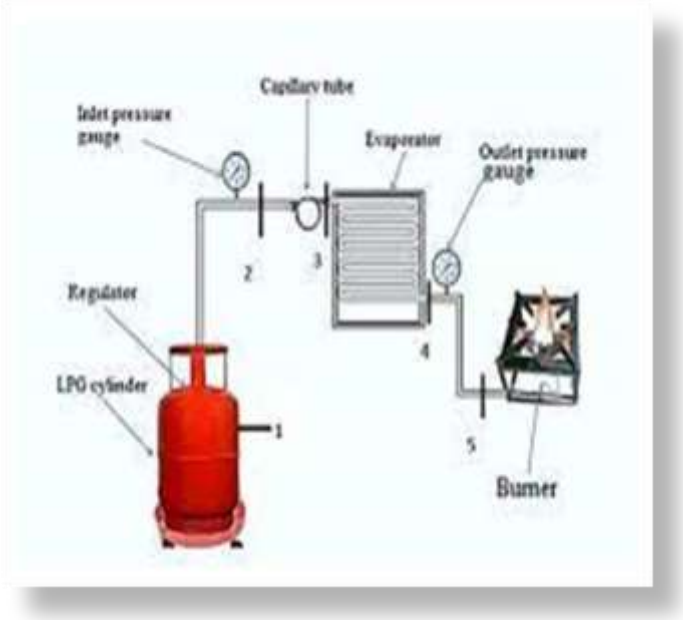
II. LITERATURE REVIEW

•A Baskaran & P Koshy Mathews: A Performance Comparison of Vapor Compression Refrigeration System Using Eco Friendly. Refrigerants of Low Global Warming Potential VCR system with the new R290/R600a refrigerant mixture 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

- Baskaran & P Koshy Mathews': A Performance Comparison of Vapor Compression Refrigeration System Using Eco Friendly Refrigerants of Low Global Warming Potential. R600a have a slightly higher performance coefficient (COP) than R134a for the condensation temperature of 50 C^0 and evaporating temperatures ranging between -30 C^0 and10^0 C.Hence, the coefficient performance (COP) of this mixture was up to 5.7% higher.
- Also, actual COP of mixed refrigerant refrigerator was higher than that of R134a by about 7.6%. From the experiment it was observed that, every mode of mixed refrigerant yields higher COP than HFC-134a. The mixed refrigerant in domestic refrigerator, observed the freezer temperature lower than that of the R134a.When the evaporator temperature
- LPG (Liquefied Petroleum Gas) is the combination of propane, isobutene and highest amount of butane with 56.4%. The use of LPG for refrigeration purpose can be environment friendly since it has no ozone depletion potential (ODP). In these electricity refrigerator systems, we have to use LPG as refrigerant because of it having low boiling point property and it also have high pressure. "Analysis and performance of domestic refrigerator using LPG as refrigerant" is based on the principle of adiabatic expansion of a refrigerant (In this case LPG) from 80 psi to 10 psi so that thermodynamically it absorbs heat from surrounding and cooling may be done

III. WORKING DIAGRAM



IV. WORKING

The basic idea behind LPG refrigeration is to use the evaporation of an 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. Hence as long as the burner is burnt, the cooling effect can be obtained.

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V. PROBLEM DEFINITION

Chlorofluorocarbons, commonly referred to as CFCs, are non- combustible liquids that were, at one time, frequently used as refrigerants and aerosol propellants, as well as for cleaning products. Since scientists linked CFCs to the depletion of the ozone layer, they have been largely phased out, but old refrigerators and other devices that use CFCs might still be in service. Through inhalation, digestion or other physical contact, as well as from exposure to harmful levels of ultraviolet rays, CFCs can have a negative impact on human health.

V. OBJECTIVE

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

VI. CALCULATTONS

Experimental Reading

SL No.	Inlet Pre	Outlet pre	Time	Capillary Temp	Evaporator Temp	Water Temp
1	5.525	1.22	10	30	33	29
2	5.235	1.21	20	25	27	27
3	5.405	1.20	30	21	24	25
4	5.413	1.111	40	19	21	21
5	5.556	1.101	50	16	18	19
6	5.511	1.101	60	15	16	17

In the experimental reading inlet pressure gives the pressure at inlet, outlet pressure gives the pressure at outlet. Thisexperiment is taken in a time interval of 10 min.Capillary temperature gives the temperature inside capillarytube. Evaporator temperature gives the temperature inside evaporator. Water temperature gives the temperature of water kept inside the refrigerator
Size of refrigerator: - 335×265×135 mm^3
Initial temperature of water: - 30^0 C
Initial temperature of evaporator: - 33^0 C
Specific heat of LPG vapor is 1.495kJ/Kg K

Refrigerating Effect
From propane table,
The properties of LPG at 5.525 bars are
Enthalpy h1 = 430.3 kJ/Kg.
The properties of LPG at 1.22 bars are
Enthalpy hf = 107.3 kJ/Kg.
Hfg = 375kJ/kg
XLPG = Dryness fraction of LPG from graph =0.5
h2 = hf+ X. hfg (1)
= 107.3 + 0.5 x 375
= 294.8 KJ/Kg
hg = hf+ hfg(2)
= 107.3 + 375
= 482.3 KJ/Kg.
h3 = hg + Cp. ΔT (3)
= 482.3 + 1.67 x 48
= 562.46 KJ/Kg
So, the refrigerating effect is,
RE = h3 – h2 (4)
= 562.46 – 294.8
= 267.66 KJ/Kg

Work Input-

For work input we have an LPG cylinder of 14.5 Kg. so, the work input is amount of energy required for filling of 1Cylinder.Some of the LPG bottling plants use a comprehensive monitoring technique for. Keeping track of energy /fuel Consumption on per ton basis. PCRA Energy Audit,
1. Consumption = 40×4200=168000kWh
2. For lighting energy consumption= 227340kWh
3. LPG compressor consumption= 153360 kWh
Total consumption for LPG pumps
One pump having 40 kW motor and 96 m head or 150cubic meter /hour discharge
Annual operating = 4200 hrs
Annual energy 6 hrs /day in 350 days
= 168000+227340+153360

= 548700kWh
Per day consumption
= 548700/350
=1567.71 kWh
500 cylinders are refilled every day, so per cylinder electricity consumption.
=1567.71/500
=3.1354kWh
For filling of 1 LPG cylinder of 14.5 kg the power input is
= 3.1354kWh
So, 1 kg of LPG is
= 3.1354/14.5
=0.2162 kWh
We run the set up for 1 hr
= 0.2162×1000/ (9.45/10000) ×3600
= 63.55W

Coefficient of Performance (COP)

COP = (h3-h2)/w (5)
= (267.66)/63.55
= 4.2

After finding out the COP of the LPG refrigerator we found out the heat liberated by LPG after burning in the
burner with the burner efficiency of 92 %

VII.CONCLUSION

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 most suitable for hotel, industries, refinery, chemical industries where consumption of LPG is very high. We are continuing this project with some fabrication work and we have collected various equipment's which is required for this project like high pressure pipes, regulator valve, and capillary tube. We
are going to analyse the experimental details of LPG
refrigerator, in the major project

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