

# Water Cooling with LPG as Refrigerant for Restaurants

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**Abstract** - In this project we have study water cooling with LPG as refrigerant for restaurant purpose. LPG is the combination of propane, butane, isobutene .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 and due to capillary we get refrigerant effect. From experimental investigation we have found that the COP of a LPG refrigerator is higher than domestic refrigerator.

## 1. Introduction -

In rural area there is still problem of electricity. we thought to produce the water cooler which run without electricity So we use of LPG gas as a refrigerant. In a LPG contain Propane 24.4%, Butane 56.4%, Isobutene 17.2%. 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 cost free Cooling Systems. LPG is stored in liquefied state in cylinder before its utilization as fuel. The LPG is cheaper and eco-friendly

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  $-2^{\circ}\text{C}$ , 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  $-2^{\circ}\text{C}$ . 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 studied and research.

The Refrigerator consists of capillary tube, copper tube, pressure gauge, sensors, high pressure pipes, burner, Gas pipe and it's arrange in series because there is no compressor it will work without electricity.

## 2. Literature Review -

S.J.Clage, Thermodynamic analysis of LPG as refrigerant for industrial refrigeration and transportation LPG 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 purpose and provide cost free refrigeration. So this work provides refrigeration for socially relevant needs as well as replaces global warming creator refrigerants because refrigerants like CFCs, HFCs which causes highly depletion of ozone layer (ODP) and Global Warming Potential (GWP)

Mani, K. and V. Selladurai, Experimental analysis of a new refrigerant mixture as drop-in replacement for CFC12 and HFC134a The hydrocarbon mixture refrigerant R600a/R290 (60/40wt%) give best performance than 600a (iso-butane) in domestic refrigeration system and the mixture gives best result for replacement refrigerant in existing machines, designed for CFCs and HCFCs. Capillary L=10 feet give good result than other higher length of capillary.

Fatouh, M. & El Kafafy, Experimental evaluation of a domestic refrigerator working with LPG Applied thermal engineering Hydrocarbon refrigerants offer desirable environmental requirements, i.e. zero ozone depletion potential and approximately zero global warming potential. The mixture of propane, butane and isobutene (LPG) offers many desirable characteristics, such as low operating pressure, discharge temperature and mass flow rates and high COP and specific volume, but requires a compressor design change.

R. W. James and J. F. Missenden, The use of propane in domestic refrigerators The experiments have shown that, even without design changes or system optimization, a refrigerator in which propane has been substituted for R12 is capable of similar performance with a lower charge. The explosion risks are small and the fire risks are similar, but significant in terms of smoke and lubricant burning. Propane presents an attractive alternative to current CFCs in small systems such as the domestic refrigerator, given correct technical application for operational and safety factors. Energy consumption could be improved with optimization. For the very large Third

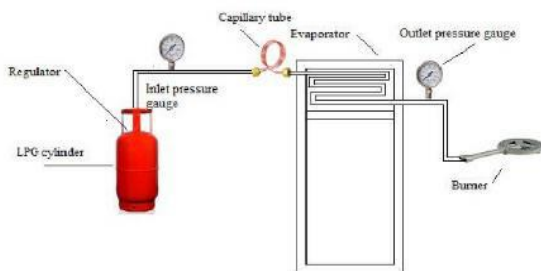
World requirements propane is well suited because of its wide and multiple sourcing and low cost.

**3. Objective - Implementation of capillary tube in LPG system**

- i. To study the effect of pitch of helical type capillary tube in helical tube on the R.E
- ii. The basic idea behind LPG refrigeration is to use the evaporation of a LPG to absorb heat.
- iii. To identify the form of residual waste in traditional refrigeration system.
- iv. To study the properties of spiral capillary tube

**4. Scope for work -**

To study and analyze the Vapour Compression Refrigeration system is our basic objective. We are substituting the compressor and condenser by a LPG cylinder. The pressure energy of LPG is very high as it can be compressed up to 12.5 bars and hence this pressure energy of LPG can be used for refrigeration by usage of this LPG system is also very low.



**Fig (1):- Working of LPG Refrigerator**

*Working Principle-* The basic idea behind LPG refrigeration is to use the evaporation of a LPG to absorb heat. The simple mechanism of the LPG refrigeration working is shown in figure

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.

High pressure LPG is converted in low pressure at capillary tube with enthalpy remains constant. After capillary tube, low pressure LPG is passed through evaporator. LPG is converted into low pressure and temperature vapour from and passing through 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 pipe by

burner. And we can use the low pressure of LPG in burning processes.

**5. Component's - Gas Cylinder, Copper Tube, Gas pipe, Pressure Gauge, Temperature Sensor, Capillary Tube.**

**5.1 Gas Cylinder -** It is used to store the high pressure LPG gas. LPG is stored in a cylinder at about 12.5 bar. LPG is used as a fuel for industrial, horticultural, cooking, agricultural, heating and drying processes.



**Fig(2):- Cylinder**

**5.2 Copper Tube -** Here we used copper tube as heat exchanger because:-

- i. It has excellent heat conductivity.
- ii. It has excellent electrical conductivity
- iii. It has good corrosion resistance.



**Fig (3):- Copper Tube**

**5.3 Pressure Gauge-**



**Fig (4) :- Pressure Gauge**

We use pressure gauge to measure the pressure of the gas we use two pressure gauge one at the outlet of cylinder to measure the pressure of cylinder and another after the capillary tube to measure the pressure after the capillary action.

#### 5.4 Capillary Tube:-



**Fig (5):-**Capillary Tube

we use capillary as thermal expansion valve in which the we get the refrigerant effect with the help of thermal expansion valve. In which we control the pressure LPG

#### 6. Advantages:-

- i. Time required for cooling is very less as compared to other water coolers.
- ii. Produce low noise and working is effective.
- iii. It does not required any electric supply or any other source
- iv. Easy to use and Eco-friendly cooling and working.
- v. Reliability is much better.
- vi. Eliminates the compressor and condenser
- vii. No moving parts
- viii. Instantly control the flame temperature

#### 7. Disadvantages:-

- i. After the refrigeration process, the exhaust of LPG is burn into burner. Because of the exhausted vapor LPG cannot converted into liquid phase again, because the process is very costly.
- ii. The main disadvantage of the system is that, the process is not continuous. As, we switch off the burner whole cycle stops and no further cooling takes place. The system is applicable whenever there is use of burner
- iii. LPG is explosive in nature

#### 8. Application

- i. The system can universally be used in industrial central cooling and domestic refrigeration and air conditioning as well.
- ii. Can be used in automobiles running on LPG or other Gaseous fuels for air conditioning.
- iii. The system can be used in restaurants for storage beverages.

#### Conclusion:-

After discussion on LPG refrigeration system, we conclude that:-

- i. Refrigeration effect is produce with the use of LPG.
- ii. Capillary tube is used to reduce the maximum pressure of gas cylinder to less than 1 bar. The capillary tube is more suitable as throttling device is LPG refrigeration system.
- iii. LPG is eco-friendly and economical refrigeration system and thus can be made easily available in rural areas.

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