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Design and Fabrication of Cooling System by Using LPG in Automobile

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Abstract— **This Document gives information about using a LPG in Automobile for cooling Purpose. It seen that LPG in Naturally in High Pressure. Although this high pressure in not required for engine so this high pressure can be used for cooling purpose. LPG is a by product in petroleum refineries and comprises of 24.4% propane, 56.4% butane and 17.2% isobutene which have very low boiling point (lower than 0 oC). The use of LPG for refrigeration purpose can be environment friendly since it has no ozone depletion potential (ODP).**

LPG is available in cylinders at high pressure. When this high pressure LPG is passed through the capillary tube of small- internal diameter, the pressure of LPG is dropped due to expansion and phase change of LPG occurs in an isenthalpic process. Due to phase change from liquid to gas latent heat is gained by the liquid refrigerant and the temperature drops. In this way LPG can produce refrigerating effect for a confined space.

I INTRODUCTION

Cooling system is refers to removing of Sensible heat from any substance and to the lower extent. It always seen that humans feel comfortable in range between 20^{O}C to 28^{O}C. we have tried to achieve this temperature without expenditure of external electrical energy.

The Refrigerating systems commonly used in present era are running on halogenated Refrigerant. Although these systems have excellent thermodynamic and thermo-physical properties, it has adverse impact on environment. Refrigerator is one of the appliances which are running 365 days in year. It means the Refrigerator consumes more electricity than other domestic appliances. LPG Refrigerator eliminates the use of electricity for Refrigeration. In LPG refrigeration system, Conventional VCR (Vapour Compression Refrigeration System) uses LPG as refrigerant and produced the refrigerating effect produced by use of LPG as refrigerant. But in our proposed very simple type of refrigeration system in which the high pressure LPG is passing through a capillary tube and expands.

After expansion the phase of LPG is changed and converted to gas from liquid and then it passes through the evaporator where it absorbs the heat and produces the refrigerating effect. After evaporator low pressure gas passes through the I.C. Engine where it burns with Fuel and gives high efficiency.

II LPG AS A REFRIGERANT

LPG is an alternative fuel that is popular in the industrial, household, and especially automotive sectors. LPG has almost all of the key properties required for use in SI engines. Because of bans on the use of HFC and HCFC based refrigerants LPG makes a reasonable alternative refrigerant. LPG is a low-GWP refrigerant that is widely used today, despite its flammable nature. However, by adding certain amounts of molecules, such as CO2, the flammability risk has shown to be reduced LPG as a refrigerant has been widely discussed for use in closed-loop vapour compression refrigeration cycle, with results similar or better than R-134a for certain compositions and pressures

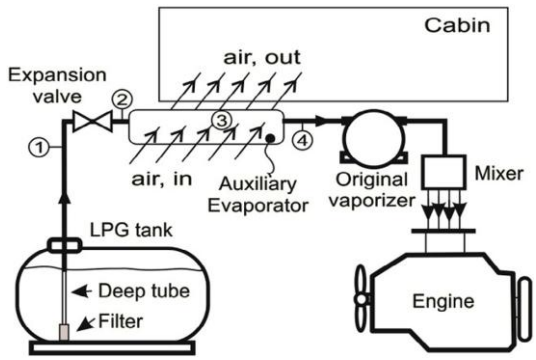


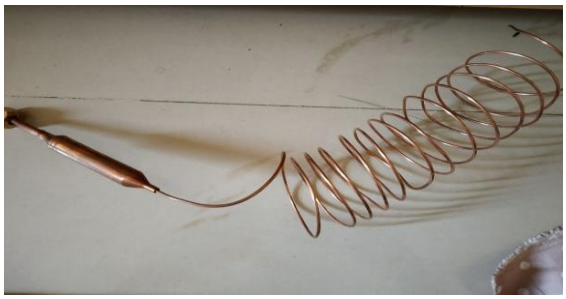
Figure 1. LPG and air flow path of a ½ cycle refrigeration System on an LPG vehicle

Among the existing gas fuels, CNG and LPG are the most widely used for fleets and private cars, especially on SI engines. Both CNG and LPG produce a potential cooling effect when evaporated within the vaporizer devices. However, in this study we selected LPG because it has a lower cylinder pressure than CNG, which is 0.8–1.0 MPa for LPG and 20- 27 MPa for CNG.With lower pressure, LPG is easier to handle than CNG. Most studies on LPG-fueled vehicles focus on the exhaust

emission characteristics and comparisons to other fuels power characteristics, and supply systems'/C system to have to work very hard immediately after a car is turned on. Excessive fuel consumption due to the A/C system varies depending on the type of vehicle, driving conditions/behaviour, weather conditions, desired comfort level inside the cabin, sophistication of the A/C system being used, and methods of measurements.

When LPG is used to fuel internal combustion engines, it is often referred to as auto gas or auto propane. In some countries, it has been used since the 1940s as a petrol alternative for spark ignition engines. Two recent studies have examined LPG-Diesel fuel mixes and found that smoke emissions and fuel consumption are reduced but HC emissions are increased. The studies were split on CO emissions, with one finding significant increases, and the other finding slight increases at low engine load but a considerable decrease at high engine load. Its advantage is that it is non-toxic, non-corrosive and free of tetra-ethyl lead or any additives, and has a high octane rating (108 RON). It burns more cleanly than petrol or diesel and is especially free of the particulates from the latter.

III DESIGN OF EVAPORATOR COIL



Assume.

Notation: -

T_3 = Temp. At inlet of evaporator = -11.7^0 c

T_4 = Temp. At outlet of evaporator = 3.4^0 C

T_{hat} = temp. Of atmosphere = 30^0 C

Now, $\Theta i = Tatm - T_3$

= 30-(-11.7) = $\mathbf{41.7^0\ C}$

Θo = Tatm - 3.4

= 30 - 3.4 = $\mathbf{26.6^0\ c}$

Then,

$\Delta T = ((I - \Theta o)/ (\ln (\Theta i / \Theta o)))$

=41.7-26.6/ (ln (41.7/26.6))

= 33.58^0 C

Therefore,

$$Q = U * A * \Delta T$$

Taking U=16 w/$m^2\,^0$ C will be the best selection (from Heat &Mass transfer handbook)

Now we are try to create such a box which have temperature above atmospheric .That means overall heat transfer increases for 10%

U= 16 * 1.1

= **18 w/$m^2\,^0$ C**

Therefore

$$Q = U * A * \Delta T$$

The System Is Designed For 75 Watt Refrigeration Effect. So For That Calculation of Area of Evaporator Coil Is As Follows

75 =18*A*33.58

:. Acontact =**0.124 m^2**

Now,

Acontact = Π * Dtube * Ltube

0.124 =Π * 9.5* 10^{-3} * L tube

:. Ltube =**4.15 m**

:.Ltube=Perimeter * number of tubes

We know,

Coil size = 160 x 100

Perimeter = (160 + 100) x 2 =520 mm

4150 = 520 * Number of turn

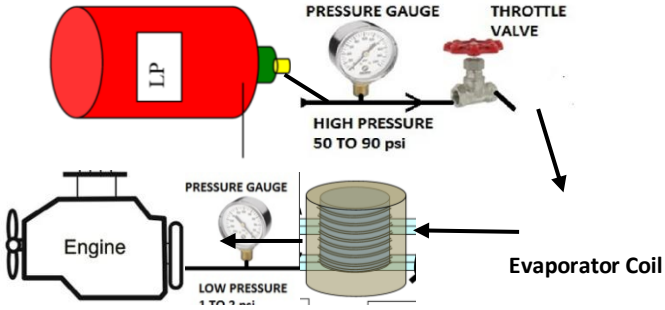
Number of turns =7.98

Number of turns=8

IV WORKING OF SYSTEM

In India, LPG is the main domestic fuel in urban areas. The indigenous availability of LPG is expected to fall much short of the household demand alone. LPG gas cooler works on principle of transferring cooling effect of compressed gas to water storage tank. The flowing gas absorbs heat of Driving Compartment and pass to Engine .Lpg gas cooler is basically cooling device which is used at domestic as well as industrial & hotel application.

In this project with the help of capillary tube we create maximum phase changing in evaporator coil which tends to drop in temperature in evaporator section.



V SELECTION OF MATERIAL

Copper, the most noble of the metals in common use, has excellent resistance to corrosion in the atmosphere and in fresh water. In sea-water, the Copper nickel alloys have superior resistance to corrosion coupled with excellent anti-fouling properties.

Copper cladding of wooden hulled warships, introduced by the Royal Navy in the 18th century to prevent damage by wood-boring insects and worms such as the treed,

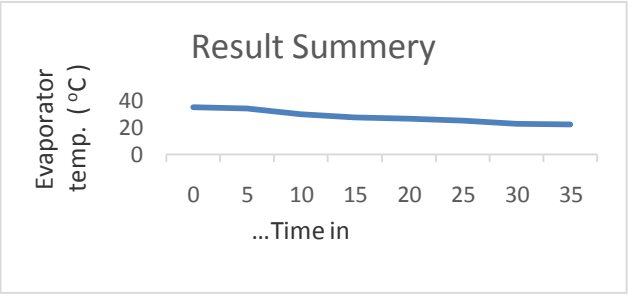
was discovered to prevent biofouling by weed and mollusks. This meant that ships could stay at sea for long periods without cleaning. Nelson's successful blockade tactics and subsequent victory at Trafalgar was partly due to the superior speed of his clean-hulled ship.

The addition of nickel to copper improves its strength and durability and also the resistance to corrosion, erosion and cavitation in all natural waters including sea-water and brackish, treated or polluted waters. The alloys also show excellent resistance to stress-corrosion cracking and corrosion fatigue. The added advantage of resistance to bio-fouling, gives a material ideal for application in marine and chemical environments for ship and boat hulls, desalination plant, heat exchange equipment, sea-water and hydraulic pipelines, oil rigs and platforms, fish farming cages, sea-water intake screens, etc.

The purpose of this publication is to discuss typical applications for copper-nickel alloys and the reasons for their selection. The two main alloys contain either 10 or 30% nickel, with iron and manganese additions as shown in Table 12, which lists typical international and national standards to which the materials may be ordered in wrought and cast forms

Table 1 Results

Time in (min)	Capillary inlet Pressure (psi)	Evaporator outlet pressure (psi)	Evaporator temp. (^{o}C)
0	65	10	35
5	65	10	33.8
10	65	10	29.9
15	65	10	27.4
20	65	10	26.5
25	65	10	24.8
30	65	10	22.5
35	65	10	22



X axes: Time Period in minute.
Y axes: Evaporator temperature in ^{o}C.

VI CONCLUSION

In this modern technological world, peoples always gives first preference to the cost and causes of each operation. So we have designed a new refrigeration System known as “CAR AC WORKING ON LPG” along with the WORKING OF CAR ENGINE .By comparing existing cars which includes running parts used for refrigeration in car .So finally we conclude that our refrigeration system requires less cost and also increases the value of the product by reducing mechanical losses so that it becomes beneficial form environment point of view by releasing less harmful emission

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