iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** IV **Month of publication:** April 2020

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue IV Apr 2020- Available at www.ijraset.com

Automobile A/C System using Waste Heat from the I.C Engine

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Abstract: The increase in rapid economy and development there is problem of shortage of energy everywhere, in the I.C Engine the Waste heat is major reason of heat loss and pollution. The ratio of total heat supplied to the system and heat used in system is very low in the I.C Engine, the most of heat is wasted into the surrounding and in the environment, Because of that we need to utilize the heat from the waste heat of the I.C.Engine. In Recent Scenario road transport vehicles refrigeration and cooling system is using Vapour Compression Refrigeration Cycle which is directly connected to engine by physical contact, and because of that direct contact the VCRS cycle use power from the fuel supplied to system and we lose extra amount of fuel for running that VCRS cycle. But if we replace that VCRS cycle from VARS cycle than we can Neglect that power loss. The VCRS cycle is physicochemical process replace the mechanical process of VCRS cycle. So In this paper we dealt with that concept of heat required for running VARS cycle is can be obtained by Waste heat From IC Engine.
Keywords: IC Engine, VARS, VCRS, Heat Conservation, Heat Energy, Automobile Ac System, Refrigeration Cycle

I. INTRODUCTION

Much of an internal combustion engines heat from combustion is discarded out of the exhaust or carried away via the engine cooling water. All this wasted energy could be useful. The common automobile, truck or bus air conditioner uses shaft work of the engine to turn a mechanical compressor. Operating the mechanical compressor increases the load on the engine and therefore increases fuel consumption, emissions and engine operating temperature. With an absorption refrigeration system, we can utilize the exhaust heat and the heat absorbed by the engine's cooling water. This heat, which could be considered as free energy, would be enough to drive adsorption refrigeration.

It is well known that an IC engine has an efficiency of about 35-40%, which means that only one-third of the energy in the fuel is converted into useful work and about 60-65% is wasted to environment. In which about 28-30% is lost by cooling water and lubrication losses, around 30-32% is lost in the form of exhaust gases and remainder by radiation, etc. In a Vapour Absorption Refrigeration System, a physicochemical process replaces the mechanical process of the Vapour Compression Refrigeration System by using energy in the form of heat rather than mechanical work. The heat required for running of a Vapour Absorption Refrigeration System can be obtained from the exhaust of any vehicle working with an IC engine, which would otherwise be exhausted into the atmosphere. Hence using a Vapour Absorption Refrigeration System will not only prevent the loss of power from the vehicles engine but will also produce refrigeration using the low grade energy (i.e. exhaust) from the engine. The use of a Vapour Absorption Refrigeration System will also reduce pollution by reducing the amount of fuel burned while working the conventional vapour compression refrigerating unit.

II. METHODS OF IMPLEMENTATION IN AN AUTOMOBILE

In The Vehicle Refrigeration System Heat Supplied To The VARS System Has Two Ways:

A. By Using Another Combustion Chamber For heat production, i.e. in vehicle we can provide another combustion chamber with gas system for the access amount of heat required for the running of VARS cycle, By that we can produce extra heat and we can use that for the Run VARS cycle, But that makes system non useful because here we are trying to save energy from waste heat and if we provide another combustion chamber than it has no meaning of this project also.

B. In I.C.Engine the fuel (like petrol and diesel) burn in the combustion chamber and because of that combustion the chemical energy converted into heat energy and that pushes the piston downwards and that rotate the crank which is conversation of heat energy to mechanical energy, and in this process only 25% to 35 % energy is converted into useful energy and most of the energy wasted into below points..

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The remaining heat energy is wasted into the atmosphere in the form of:

1) heat carried away by the cooling water,
2) heat taken away by the exhaust gases,
3) heat carried away by the lubricating oil,
4) And, heat lost by radiation.

The cooling water and exhaust gases carry away the maximum amount of heat from the engine, i.e. around 60% (approx). This heat is called the low grade energy of the engine.

III. COMPONENTS OF NEW REFRIGERATION SYSTEM

A. Condenser

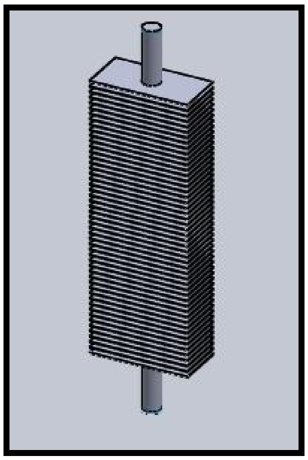


Figure: Condenser

Just like in the traditional condenser of the vapour compression cycle, the refrigerant enters the condenser at high pressure and temperature and gets condensed.

B. Capillary Tube


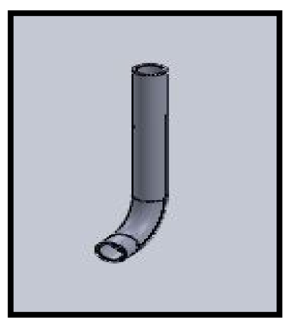

Figure: capillary tube

A capillary tube is a long, narrow tube of constant diameter. Diameter Range of capillary tube is 0.5 mm to 3 mm and the length ranges of capillary tube is from 1.0 m to 6 m. The pressure reduction in a capillary tube occurs due to the following two factors:

1) The most common reason for pressure drop is surface friction and that friction leads to the pressure drop in capillary tube.
2) When pressure of liquid refrigerant is reduces than liquid refrigerant is evaporated into the mixture of liquid and vapour. The density of vapour is less than that of the liquid. Hence, the average density of refrigerant decreases as it flows in the tube. The mass flow rate in the whole capillary is constant, and the velocity of refrigerant increases since the increase in velocity or acceleration of the refrigerant also requires pressure drop. And because of that pressure reduction takes place into the capillary tube.

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C. Evaporator

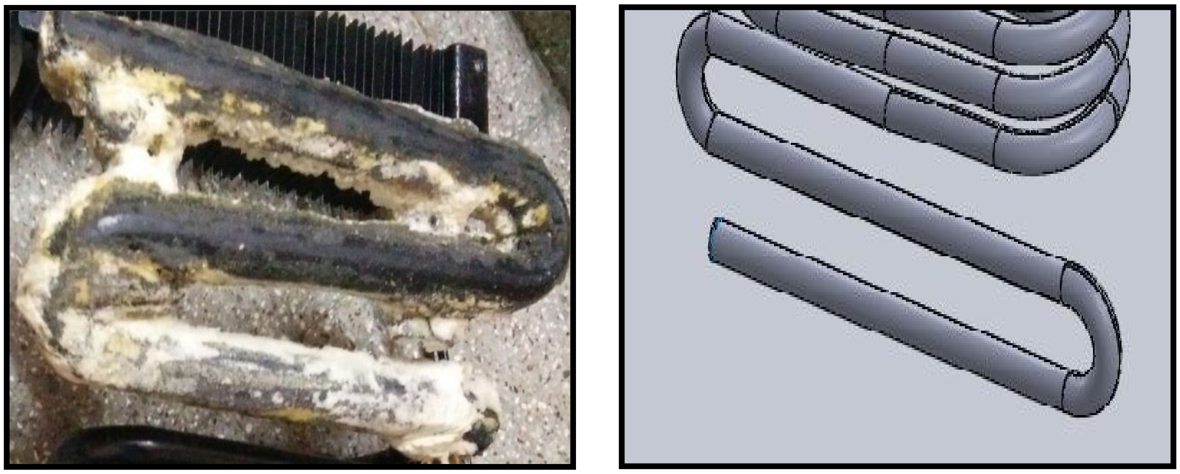

Figure: Evaporator

The refrigerant at very low pressure and temperature enters the evaporator and produces the cooling effect. In the vapour compression cycle this refrigerant is sucked by the compressor, but in the vapour absorption cycle, this refrigerant flows to the absorber that acts as the suction part of the refrigeration.

D. Absorber

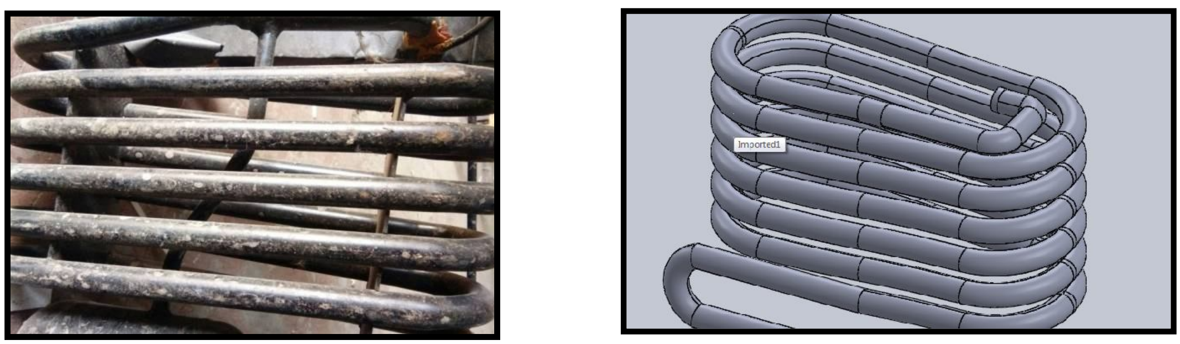

Figure: Absorber

The safeguard is a kind of vessel comprising of water that goes about as the Absorbent and the past ingested refrigerant. Hence the safeguard comprises of the powerless arrangement of the refrigerant (smelling salts) and permeable (water). At the point when smelling salts from the evaporator enters the safeguard, it is consumed by the permeable because of which the weight inside the safeguard decreases further prompting more stream of the refrigerant from the evaporator to the safeguard. At high temperature water ingests lesser alkali, henceforth it is cooled by the outside coolant to build it smelling salts retention limit. The introductory stream of the refrigerant from the evaporator to the safeguard happens on the grounds that the vapour weight of the refrigerant-permeable in the safeguard is lower than the vapour weight of the refrigerant in the evaporator. The vapour weight of the refrigerant-permeable inside the spongy decides the weight on low-weight side of the framework furthermore the vaporizing temperature of the refrigerant inside the evaporator. The vapour weight of the refrigerant-permeable arrangement relies on upon the way of the retentive, its temperature and focus. At the point when the refrigerant entering in the safeguard is consumed by the spongy its volume diminishes, in this way the pressure of the refrigerant happens. In this way safeguard goes about as the suction a portion of the compressor. The warmth of retention is likewise discharged in the safeguard, which is uprooted by the outside coolant.

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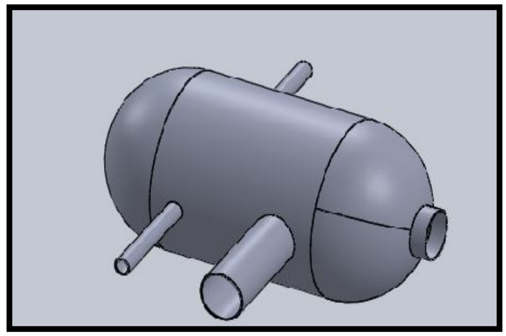

Figure: Absorber Tank

E. Pump

When the absorbent absorbs the refrigerant strong solution of refrigerant-absorbent (ammonia-water) is formed. This solution is pumped by the pump at high-pressure to the generator.

F. Generator

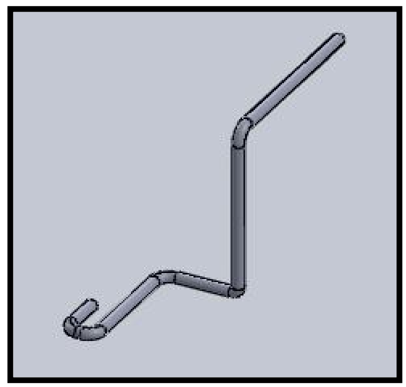

Figure: Generator

The refrigerant-smelling salts arrangement in the generator is warmed by the outer wellspring of warmth. This is can be steam, boiling point water or whatever other suitable source. Because of warming the temperature of the arrangement increments. The refrigerant in the arrangement gets vaporized and it leaves the arrangement at high weight. The high weight and the high temperature refrigerant then enters the condenser, where it is cooled by the coolant, and it then enters the extension valve and afterward at last into the evaporator where it creates the cooling impact. This refrigerant is on the other hand consumed by the feeble arrangement in the safeguard. At the point when the vaporized refrigerant leaves the generator powerless arrangement is left in it. This arrangement enters the weight decreasing valve and after that back to the safeguard, where it is prepared to assimilate crisp refrigerant. Along these lines, the refrigerant continues rehashing the cycle. The weight of the refrigerant is expanded in the generator, thus it is thought to be identical to the pressure a portion of the compressor.

IV. OBJECTIVES OF THE WORK

The objective of our project is as follows:

A. The significance of the work is that it will provide space cooling for the truck driver and thereby enhances his performance and efficiencywithout affecting performance of the engine essentially the fuel economy.
B. The major objective of our project is to study about the behavior of various systems objected to west heat. Proper design of the system in smaller area.
C. Select efficient refrigerant to improve efficiency.
D. Proper calculation of require heat and available heat at I.C engine exhaust.

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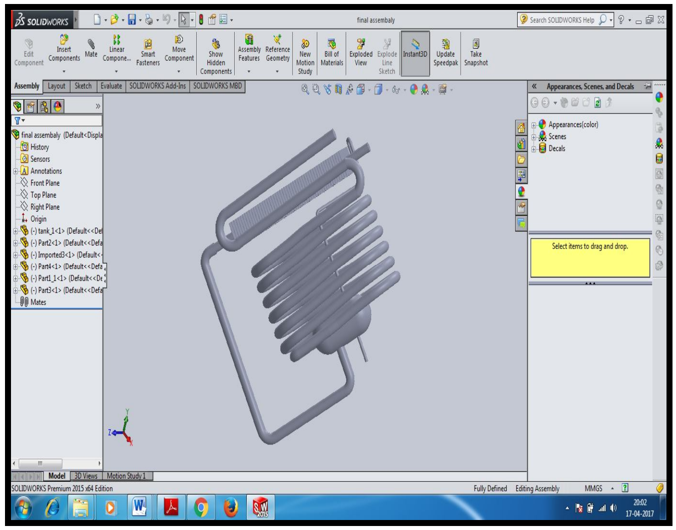
V. EXPERIMENTAL SETUP



VI. ACTUAL SETUP

VII. CONCLUSIONS

After studying of different refrigeration system we conclude that the vapour Absorption Refrigeration System is more preferable than vapour Compression Refrigeration System and the Heat Require For working of Vapour absorption Refrigeration system is easily available from the engine exhaust than the heat require for the running the system.

After Study of different Refrigerant Properties Ammonia is Best Preferable Refrigerant for this model. The Design of this model is very complicated to implement in the Automobile Vehicle.

Performance of auto air conditioner using exhaust waste energy from I.C engine has been carried out in this investigation. It is evident that COP strongly depends on working conditions such as generator, absorber, condenser and evaporating temperature.

In india, transportation vehicles air conditioning system is never given importance because of its cost. And the energy which expelled into atmosphere is totally wasted. So we can save energy by use of this project and we have this project for utilize the waste heat into creating refrigeration effect. And for that VARS cycle is more preferable without affecting the vehicles efficiency.

In this model we used ammonia refrigerant for VARS cycle and ammonia is eco friendly gas ant that does not affect the OZONE layer so this could be effective solution. In this way we conclude that total heat supplied to the system as fuel is approximately converted 35% into useful mechanical work for the IC Engine and that remaining waste heat is wasted into environment by Many forms as exhaust gases and engine cooling systems, and that result the overall entropy rise and environment pollution, So it is important to use that waste heat into useful work. And by this project we tried to solve this problem and tried to make model for solution.

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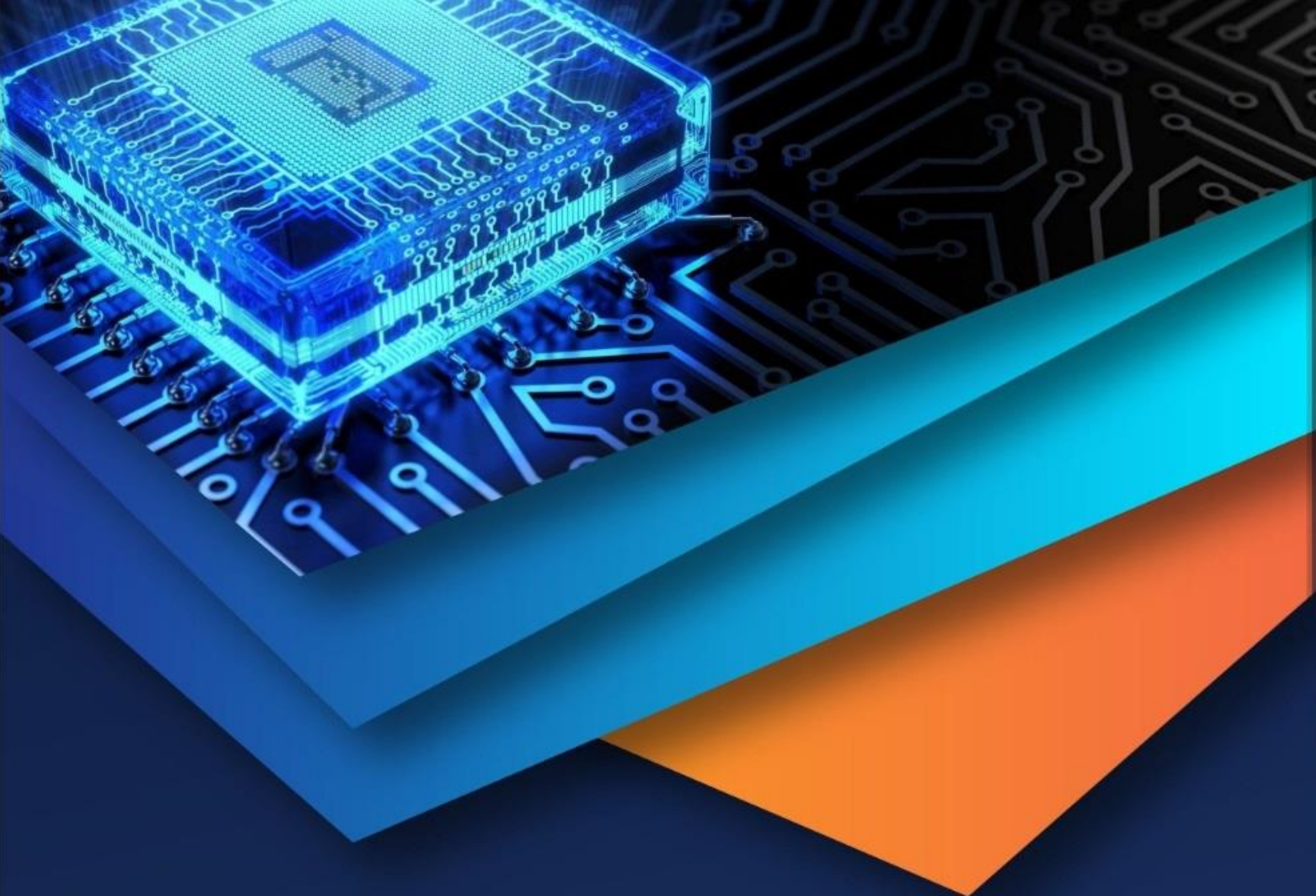

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