ISSN 2395-1621

A Review on-Waste Heat Recovery System for AC of Vehicles Using Vapour Absorption System

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ABSTRACT

Depleting fossil fuels is a future challenge. Internal combustion engines are major consumer of fossil fuels. Large amount of energy from internal combustion engine is wasted into the environment. This low-grade energy can actually be recovered for useful purpose. In our project we focus on recovery of this heat for running air conditioning system using Aqua ammonia vapor absorption refrigeration system.

The major use of internal combustion engines is in automobiles. Conventionally, automobile AC works on VCR cycle which consumes mechanical energy and reduces economy. This VCR system is replaced by VAR system by utilizing exhaust waste heat. In this work, feasibility of the waste heat recovery system is studied and the system components are designed using basic thermodynamic laws and heat transfer correlations. A working model is fabricated and tested.

Keywords: Internal combustion engines, Aqua ammonia, Vapor compression cycle, Vapor Absorption cycle.

ARTICLE INFO

Article History

Received: 4th May 2019

Received in revised form : 4th May 2019

Accepted: 06th May 2019

Published online : 13th May 2019

I. INTRODUCTION

Air conditioning of a vehicle can be done by two methods. First is Vapour Compression Refrigeration System (VCRS) and another is vapour absorption refrigeration system (VARS). Presently, in the vehicles VCRS is used in most of the cases. Instead of VCRS if VARS is used in vehicles the refrigeration system could be operable in a vehicle without adding running cost for air conditioning. There is a great impact on the running cost of a vehicle due to increasing cost of fuel. The A/C system adds nearly 35 % extra cost in fuel expenses.

Exhaust gas energy is being invested in many forms. The first form is the most familiar and that is using it for supplying domestic hot water for residences which is the most worldwide spread form of exhaust gas energy use. We are trying to use this exhaust energy to run the AC system of an automobile preferably car.

Alternately, it becomes a matter of investigation that waste heat recovery of an engine for application in car A/C can reduce the fuel economy of vehicles. Literature review gives that there is an indication that reducing the A/C load decreases A/C fuel consumption. An automobile engine utilizes only about 25% of available energy and rests are lost to cooling and exhaust system. If one is adding conventional air conditioning system to automobile, it further utilizes about 5% of the total energy.

II. PROBLEM STATEMENT

1.Our current four wheelers AC work on electrical energy by using refrigerant as FREON (a chlorofluorocarbons) which consequently uses more petrol. So, to overcome these disadvantages, we are designing a system in which heat of exhaust gases is used as heat input and Aqua Ammonia is used as refrigerant. Thus, this reduces our current fuel consumption.

2.Our approach will be using the following cycle- Design—Implement—Check at every milestone of our project thus helping us to design the best system with more efficiency without compromising the safety.

A. OBJECTIVES

1 To recover waste heat from exhaust of different IC engine
2 To save fuel which is burn for working of A.C.
3 To increase the mileage of vehicle.
4 To fabricate the design with the knowledge and the selected material which is cost effective

III. CONSTRUCTION

The waste heat recovery system consists of following components

- Absorber
- Generator
- Condenser
- Evaporator
- Thermocouples
- Engine

Working of the setup

Working of setup consist following:
1) Condenser-Just like the traditional condenser of VCC, the refrigerant enters in the condenser at high pressure and temperature and get condense.

2) Expansion Valve-When refrigerant passes through the expansion valve its pressure and temperature reduces suddenly. This refrigerant enters the evaporator

3)Evaporator-The refrigerant is enters in the evaporator at low pressure and temperature and produces cooling effect, then this refrigerant flow towards absorber that acts as a suction part of refrigeration cycle.

4) Absorber-When refrigerant from the evaporator enters in a absorber, it is absorbed by the absorbent due to which its pressure reduces. The initial flow of refrigerant from the evaporator to absorber occurs because of vapour pressure of the refrigerant. The vapour pressure of refrigerant absorbent solution depends on the nature of absorbent its temperature and concentration. then refrigerant entering in the absorber is absorbed by the absorbent its volume decreases thus the compression of refrigerant occurs. The heat of absorption is also released in the absorber in external coolant.

5) Pump-When the absorbent absorbs, refrigerant strong solution of refrigerant absorbent is formed. This solution is pumped by the pump at high pressure to the generator this pump increases pressure of solution to above 10 bar.

6)Generator-The refrigerant absorbent solution in the generator is heated by external source of heat this is can be exhaust gas steam, hot water. Due to heating the temperature of solution increases. The refrigerant in the solution gets vaporised and it leaves the solution at high pressure. the high pressure and temperature refrigerant enter the condenser, where it is cooled by coolant and it then enters the expansion valve and finally into the evaporator where it produces cooling effect. This refrigerant again absorbed by weak solution in absorber.

When the vaporised refrigerant leaves the generator, weak solution is left in it. This solution enters in pressure reducing valve then backs to the absorber where it is ready to absorb fresh refrigerant. In this way the refrigerant keeps on repeating cycle.

Fig: Setup of VAS

IV. SPECIFICATIONS

Serial Number	Component	Values
1	Evaporator	Length=1.1m ID=8mm OD=10mm
2	Condenser	ID=4mm OD=6mm
3	Capillary	ID=1mm OD=2mm
4	Temp. Indicator	Range=10-100^{o}c
5	Low pr. Gauge	140 Psi
6	High pr. Gauge	270 psi
7	Cooling Box	Capacity=5 lit
8	T joint	-
9	Dryer	-
10	Flai Nut	-

V. CONCLUSION

1) The system is an absorption cycle based cooling process wherein it is primarily charged utilizing the waste heat to drive the Ammonia salt Absorption Cycle.
2) Our system with refrigerant storage has the advantage of accumulating refrigerant during the hours of high exhaust gas isolation.
3) Every aspect of absorption cooling technology is governed by the properties of working fluids. Hence the advent of new working fluids would enable completely different.
4) Among the major working pairs available, NH3-CaCl2 is used considering its advantages over other working fluids.

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