International Journal of Engineering Research and Advanced Technology (IJERAT)

DOI: http://doi.org/10.31695/IJERAT.2018.3354

E-ISSN : 2454-6135

Volume.4, Issue 12
December -2018

A Proposed Study in Enhancing of Radiator in Internal Combustion Engine Cooling System Performance While Considering a Prolonged Life at a Frugal Cost

MSc. Muayyad A.H Al-Hayali[1], Dr. Mohammad M. Al-Azzawi[2] and MSc. Kousay N. Al-Ane[3]

[1, 3]University Professor and [2]Professor & Head

Air-Conditioning Engineering Department

Al-Rafidain University College

Baghdad, Iraq

ABSTRACT

The cooling system is one of essential parts in vehicle's engine, to endure a sustainable and stabilized engine temperature. As a consequence the main objective for this study is to propose a simple piping delineation taking into account fewer hoses and lower infiltration, The proposed delineation would become beneficial with coolant infiltration by the reduction in hose deficiency, take down shorthand of head loss at frugal cost and prolonged life of the piping system in vehicles engine.

Key Words: *Cooling System, I.C.Engine, Piping Delineation, Radiator.*

1. INTRODUCTION

I.C. engines in majority as a rule is often cooled by air or liquid substance coolant passing by means of air fins or radiator. The majority of the liquid substance cooled I.C. engines using coolant oil which has been combination of water as well as chemical like antifreeze and rust repression. The antifreeze mixture as a metier word contain coolant oil for engine cooling system. Which happen to minify hot spots that when avoiding it by applying air cool play difficult part of engine system. 47% higher than the clean water when using coolant oil as when we consider rate of heat transfer [1]. Developer's persistent effort is to develop fluid flow simulation potency associate with heat transfer calculations of cooling airflows to impose understandable analysis. Well modeled aerodynamics need undoubtedly an exact cooling flow simulation [2]. Favor of mathematical learning can be useful in heating obscurity for experimental correlation when considering a wick flow [3]. An act that is kind of ephemeral in smooth heat tube for cooling various electronics equipment of vapor core by calculating flow of the liquid and passing 2D hydrodynamic method to the wick area [4]. Alumina particle causing linear increment added to assess an leverage to thermal conductivity in hydrous fluids [5]. Particle size and fluid viscosity is substantial in respect of enrichment relation in thermal conductivity [6]. In super hydrophilic copper to fabricate post wicks in silicon substrates for depositing as well as controlling oxidation depend on heat transfer performance [7]. By using unleaded gasoline and additives blends (Ethanol blends and Isobutanol-Ethanol blends) effects on Spark Ignition engine (SI engine) performance as well as exhaust emission. Important benefit provided by cryogenic cooling was in reducing the cutting forces and enhancing surface roughness through control of the cutting temperature and adhesion between the interacting surfaces was reduced [8]. A Multiple Loop Heat Pipes as variable heat rejection system to refuse the large heat loads from a single - phase pumped loop, with ratios that are high in turndown [9]. The characterization of performance in Nano fluid coolant in engine radiator. The performance of the Nano was reported to be compared with ordinary coolant fluid used in radiator [10]. With a single cylinder performance analysis, diesel engine (Air Cooled) using fish oil biodiesel (B20) with diesel[11]. There was an increase in fuel consumption as well as brake thermal efficiency also exhausts emissions quite decreasing due to the Tamanu Methyl Ester and DiEthyl Ether with diesel blends [12]. This study proposed a simple less cost piping delineation, less number of connecting hoses and also infiltration was quite reduced.

2. Engine Cooling System Essential Parts:

A thermosiphon cooling system to be stated as shown in Figure1. Anticipate such type of cooling system in recent automobile vehicles. The water-cooled system presents a circulated water pump through passage in the head and block of the engine. The produced heat by the engine is to be soak up due to coolant water method of heat conduction. The hot coolant water flows into the radiator for cooling.

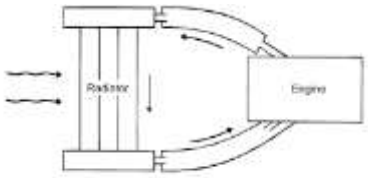

Figure 1. Thermo siphon cooling system.

recurrent cycle is to be considered. Thus, engine temperature is detached to avoid overheating while the engine maintains a stable working temperature.

2.1. Hoses

Figure 2. Hoses fitted in an I.C. engine

The hoses are the main connectors between both radiator and the engine to ensure an adaptable functionality. Tightly fitted hoses using hose clip. The hoses connected to the radiator should obtain to carry out hot water in the system.

2.2. Thermostat Valve

Figure 3. Typical Thermostat valve of cooling system in automobiles

Stable working temperature is necessary to keep engine running. The thermostat valve exists in order to maintain the engine function at working temperature its fitted between the engine water outlet and the radiator water inlet. When engine working temperature exceed the normal limits, the valve allows water to enter the radiator for cooling. When the engine operates below the normal limits of working temperature valve is close the water flow from the radiator and its circulating water to the engine through bye pass line.

2.3. Radiator

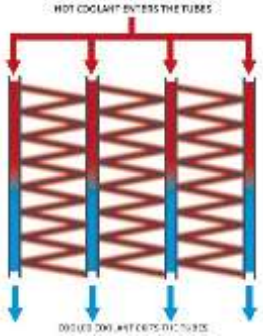

Figure 4. Radiator.

DOI : 10.31695/IJERAT.2018.3354

Most engines the radiator is in front. Two tanks at the top and bottom contains coolant water. Vertically arranged cooling fins in the form of tubes between these tanks. In abnormal temperatures, engine's thermostat allows the coolant water to flow into top tank of radiator. Then coolant water outflow to the bottom tank through the cooling fins previously discussed. Conduction and convection methods is presented in the coolant water that to be transferred in atmosphere by the fin materials and cooling fan air respectively. Thus, heat exchanger behaviour occur in radiator of the cooling system in I.C. engine.

2.4. Radiator Cap

Figure 5. Pressure Cap

This cap is tightly fitted using pressure spring at the top of the radiator. It prevents the flow of water outside the radiator. It keeps the working pressure and temperature at constant in the system of cooling. Air vent is also providing at the top of the cap.

2.5. Water Pump

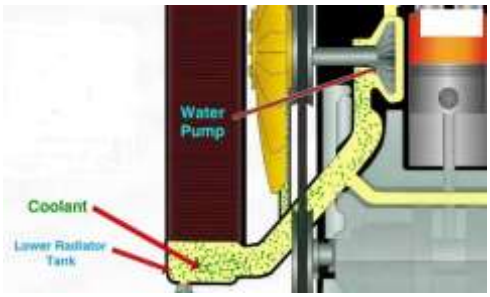

Figure 6. Water Pump

Usually fitted in front. It relates to the engine crank shaft pulley by means of belt for its rotation. Required pressure is attainable for coolant water circulation throughout the system of cooling. The lubrication provision is given to the bearing of the water pump. Also, it gives seating location of the fan blade.

2.5. Cooling Overflow Bottle

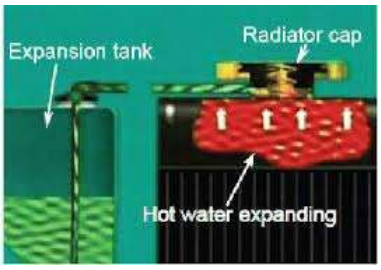

Figure 7. Cooling Overflow Bottle

The cooling overflow bottle is an extra coolant water that to be stored in expansion tank. Lowering the level of the coolant water due to evaporation in the system of cooling the cooling overflow bottle that is responsible for maintaining a constant level during the engine running. It is connected to the top tank of the radiator. Required coolant water supplied through one-way valve.

2.6. Indicator for Indicating Engine Temperature

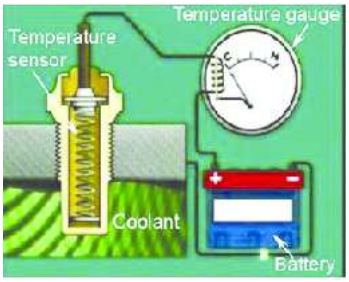

Figure 8. Temperature indicator

DOI : 10.31695/IJERAT.2018.3354

Sunken sensing plug in the coolant water presents in the engine block water jackets. The view of the Sensing Plug in the system of cooling is shown in Figure 9.

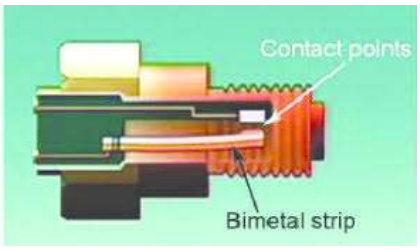

Figure 9. Sensing Plug

Sensing plug sense the temperature of coolant water through temperature gauge. Whenever engine gets experienced temperature in serious condition due to the sudden failure of water pump and leakage through hoses it gives danger sound for wariness to engine failure due to overheating.

3. ENGINE COOLANT AND ITS STRUCTURE

Water was earlier used in I.C. engine systems for the purpose of cooling. But coolant oil is added with water and used to Enhance the cooling effect and convenient for weather changing conditions like winter and summer taking into account of the coolant oil is added to water to avoid boiling and freezing of cooling water in the system during running. But, Modern I.C. engine cooling system water is mixed with Nonethylene Glycol fluid to improve system of cooling performance with somewhat a frugal cost. In addition, propylene glycol also added with coolant water for the application of automotive and heavy duty I.C. engine in view of obtaining effective cooling system performance. Mixing of coolant oil also prevent the corrosion, rust formation, oxidation of the engine parts. It also avoids bubble formation during the circulation to improve the performance.

4. CONCLUSION

Generally, contribution of heat exchanger to an outlet hose is considered when the efficiency of a radiator is good and constant. Currently, the temperature factor is dependent on the tubes used in the radiator. So modification of tubes in the radiator contributes to the engine cooling through efficient radiator action.

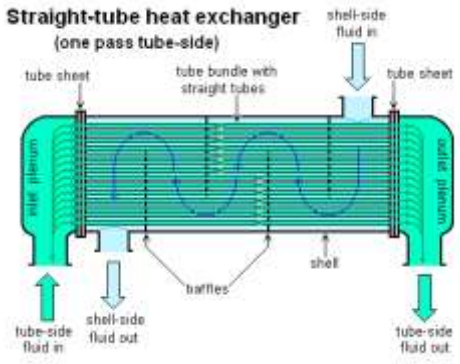

Figure 10. Straight-tube heat exchanger

REFERENCES

1. Oliet C, Oliva A, Castro J, Perez-Segarra CD. Parametric studies on automotive radiators. Applied Thermal Engineering. 2007; 27(11–12):2033–43.
2. Yadav JP, Singh BR. Study on Performance Evaluation of Automotive Radiator. S-JPSET. 2011; 2(2):47–56.
3. Trivedi PK, Vasava NB. Effect of variation in pitch of tube on heat transfer rate in automobile radiator by CFD analysis. International Journal of Engineering and Advanced Technology. 2012; 1(6):180–3.
4. Gadhave P. Enhancement of forced convection heat transfer over dimple surface-review. International Multidisciplinary e-Journal. 2012; 1(2):51–7.
5. Amrutkar PS, Patil SR. Automotive Radiator Performance – Review. International Journal of Engineering and Advanced Technology. 2013; 2(3):563–5.
6. Chavan DK, Tasgaonkar GS. Thermal optimization of fan assisted heat exchanger (radiator) by design improvements. International Journal of Modern Engineering Research. 2014; 1(1):225–28.
7. Ramakanth M, Balachandar C, Venkatesan M. Prediction of channel diameter to reduce flow mal distribution in radiators using ANN. Indian Journal of Science and Technology. 2015; 8(S9):341–46.

DOI : 10.31695/IJERAT.2018.3354

8. Kuppan T. Heat Exchanger Design Handbook. Marcel Dekker: New York, NY, USA, 2000.
9. Zhong Y, Jacobi AM. An experimental study of louver-fin flat-tube heat exchanger performance under frosting conditions. Proceedings of the 5th International Conference on Enhanced, Compact and Ultra-Compact Heat Exchangers: Science, Engineering and Technology. Engineering Conferences International. Hoboken: NJ, USA. 2005. p. 273–80.
10. Aliff Ashraf M. The design and development of the Radiator RIG, Malaysia Pahang (UMP). 2015. Available from: http://www.researchgate.net/publication/285188062
11. Van Velson Calin Tarau N, DeChristopher M, Anderson WG. Multiple loop heat pipe radiators for variable heat rejection in future spacecraft. 45th International Conference on Environmental Systems, ICES; Bellevue, Washington. 2015 Jul 12-16. p. 52.
12. Navaneethakrishnan P, Vasudevan D. Experimental study on performance and exhaust emission characteristics of a C.I. engine fuelled with tri compound oxygenated diesel fuel blends. Indian Journal of Science and Technology. 2015 Feb; 8(4).

DOI : 10.31695/IJERAT.2018.3354