Research Article Impact Factor: 4.226 ISSN: 2319-507X
Satish B. Ingle, IJPRET, 2016; Volume 4 (8): 282-293 IJPRET

INTERNATIONAL JOURNAL OF PURE AND APPLIED RESEARCH IN ENGINEERING AND TECHNOLOGY

A PATH FOR HORIZING YOUR INNOVATIVE WORK

SPECIAL ISSUE FOR
NATIONAL LEVEL CONFERENCE
"RENEWABLE ENERGY RESOURCES & IT'S APPLICATION"

AN EXPERIMENTAL ANALYSIS ON HEAT TRANSFER OF AUTOMOTIVE RADIATOR

PROF. SATISH. B. INGLE[1], SNEHAL S. BORKAR[2]

1. ASSIST.PROFESSOR IN MECHANICAL ENGG.DEPT. C.O.E.T, AKOLA.
2. PG STUDENT GHRCOE&M, AMRAVATI.

Accepted Date: 12/03/2016; Published Date: 02/04/2016

Abstract: Efficient cooling is an important requirement for automobiles. The operating temperatures in car radiators are kept in control through proper coolant air circulation. This investigations are studies performed on automotive radiators by means of a detailed overall heat transfer coefficient in an ethylene glycol and water mixture circulating through the circular tubes of an automobile radiator have been experimentally studied to evaluate their superiority over the base fluid. And the distance between fan and radiator is optimized by experimentation. The dominant thermal resistance for most compact heat exchangers occurs on the air side and thus a detailed understanding of air side heat transfer is needed to improve current design of fan and radiator and position of radiator. The impact of the selected coolant fluid on the heat transfer characteristics of radiator. As well as the importance of coolant flow lay-out on the radiator global performance. This work provides an overall behavior report of automobile radiators working at usual range of operating conditions, while significant knowledge-based design conclusions have also been reported. The results show the utility of the investigation as a selection of coolant and air flow through the core is affected by distance change in between fan and radiator which results on the heat transfer performance of radiator.

Keywords: Radiator, Heat Exchanger, Heat transfer, Temperature difference, Coolant, Distance between fan and radiator

Corresponding Author: PROF. SATISH. B. INGLE

Co Author: MS. SNEHAL S. BORKAR

Access Online On:

www.ijpret.com

How to Cite This Article:

Satish B. Ingle, IJPRET, 2016; Volume 4 (8): 282-293

PAPER-QR CODE

INTRODUCTION

OBJECTIVES:

The objective of this research work is

- To varies the mass flow rate of coolant and air for getting temperature difference between inlet and outlet
- Optimization distance between fan and radiator
- To investigate the performance of radiator with various blends of ethylene glycol and water

Experimental setup:

Investigation is conducted on the experimental setup shown in fig - 2

Fig 1– Experimental setup

EXPERIMENTAL PROCEDURE AND SCHEMATIC DIAGRAM

The above assembly is shown figure 3 as a schematic diagram. Firstly, coolant is pumped by pump from coolant tank, coolant flow control valve controls the flow and flow is measured by flow meter. The coolant is then passed to the radiator and inlet temperature of coolant is measured using thermocouples at position T_{ci} and also outlet temperature of coolant at position $T_{co.}$ Finally the coolant is returned back to the coolant tank. The air inlet and outlet Temperatures are taken at position T_{ai} and T_{ao}.

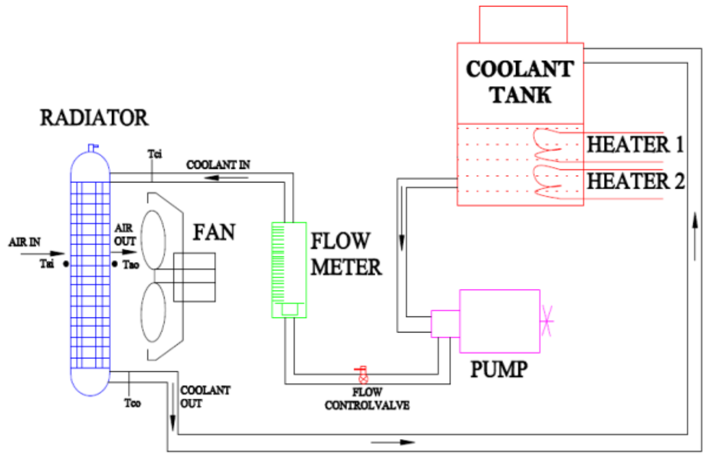


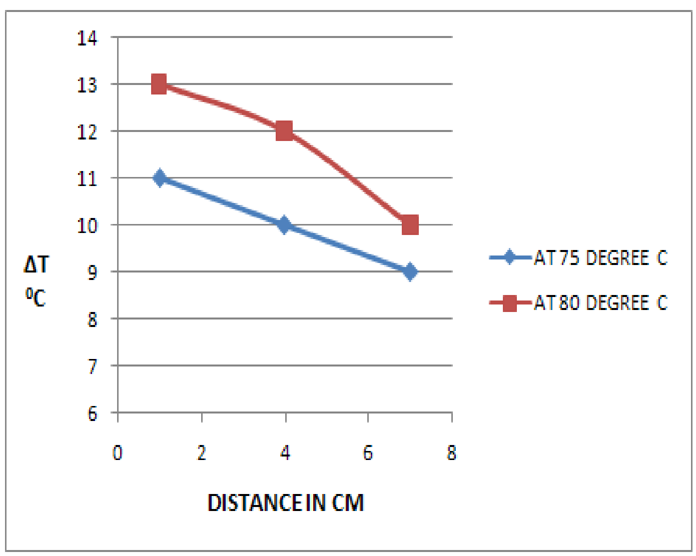
Fig 2– Schematic diagram of experimental setup

RESULTS AND DISCUSSION

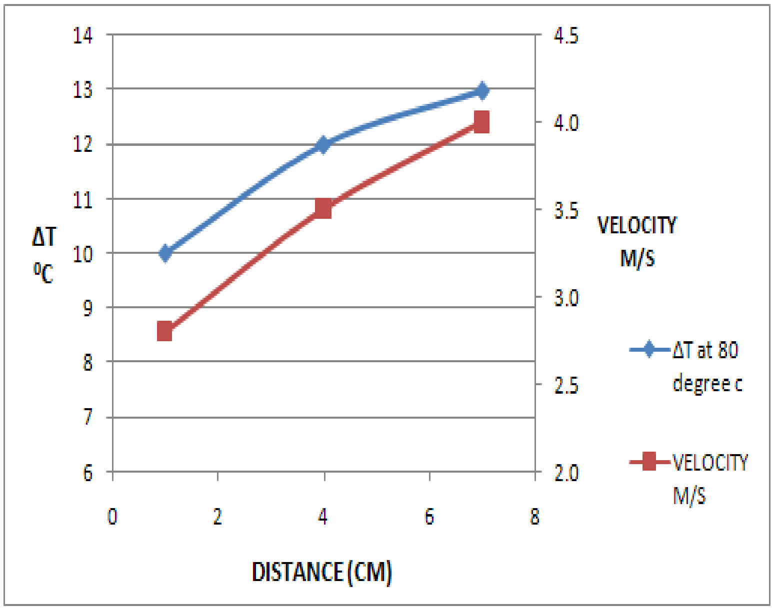
The experimentally and analytically result are discussed as below and graph are ploted

OPTIMIZATION OF DISTANCE BETWEEN FAN AND RADIATOR

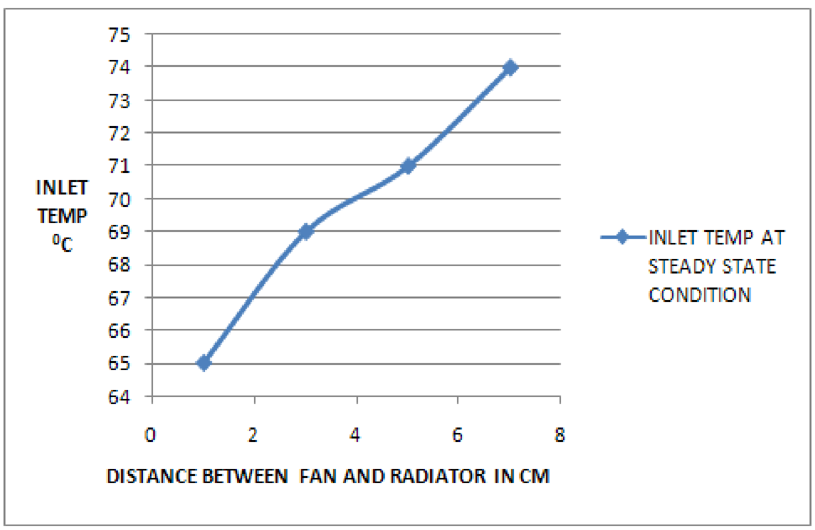
Coolant temperature difference (ΔT) with distance



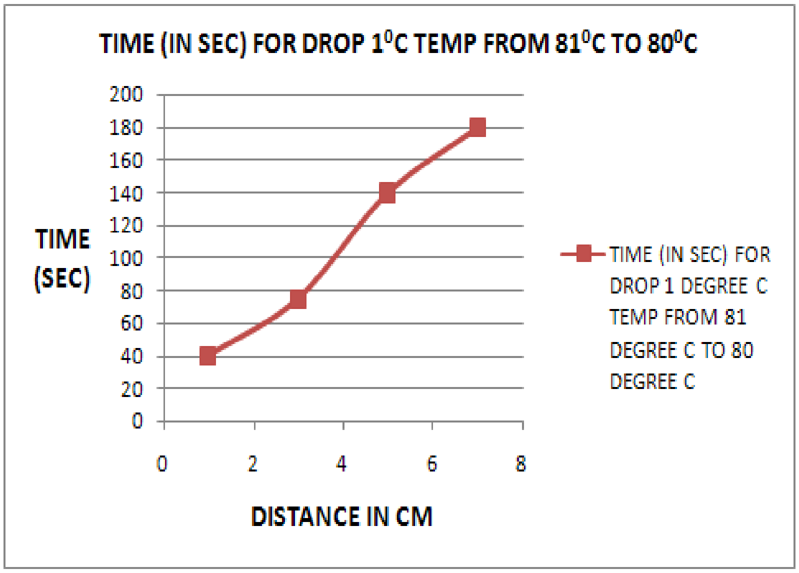
Coolant temperature difference (ΔT) with distance and velocity (m/s) of air



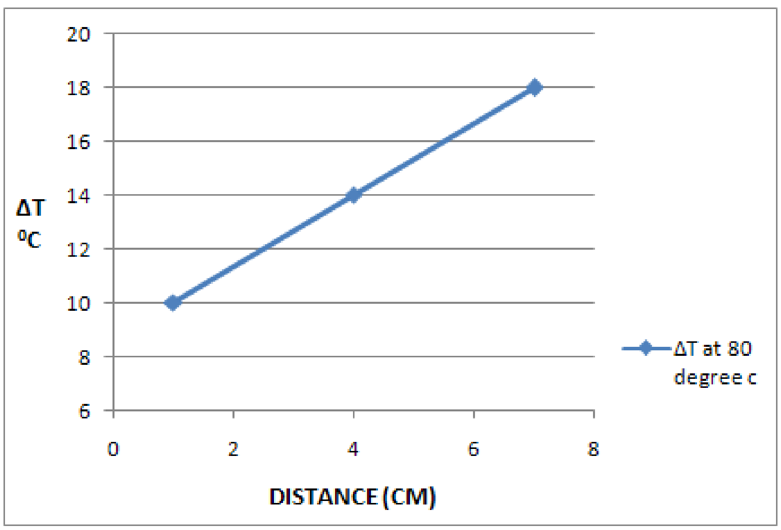
Steady state coolant Inlet Temperature with coolant valve full open and max air velocity at various distances



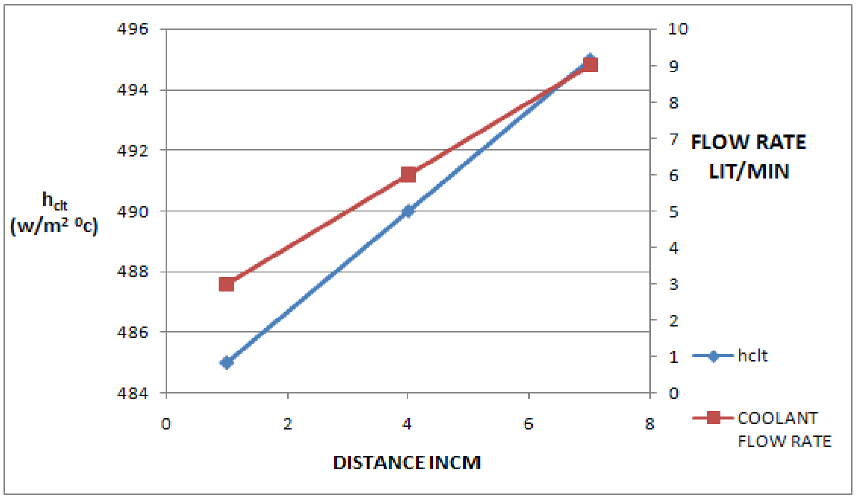
Time taken for drop of 1 ^{0}C temperature in unsteady state condition at valve full open of coolant and max velocity of air



Air side temperature difference for various distances at 80 ^{0}C constant temperature



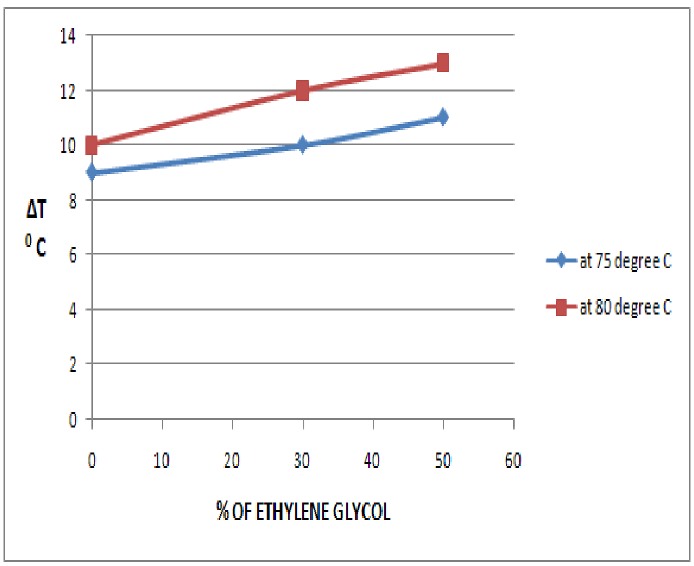
Coolant side heat transfer co-efficient (W/m^2 ^{0}C) at various distances



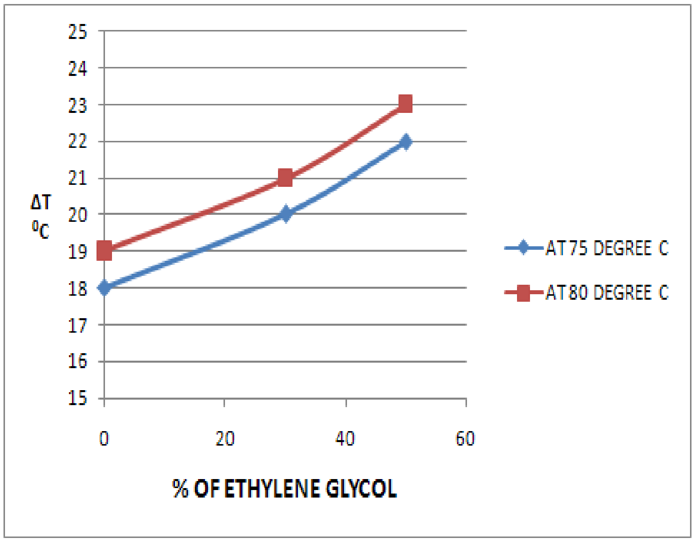
Air side heat transfer co-efficient ($W/m^2\ {}^0C$) and at various distances

INVESTIGATION FOR VARIOUS BLENDS OF WATER AND ETHYLENE GLYCOL AS A COOLANT

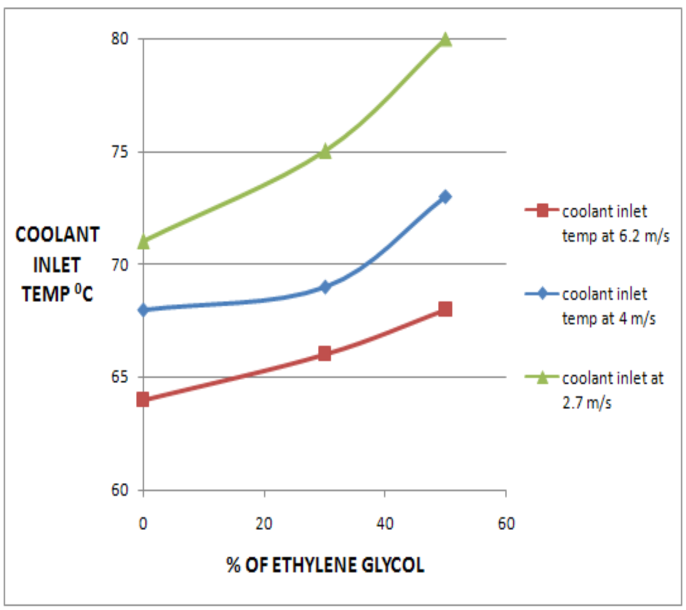
Coolant temperature difference (ΔT) for % of ethylene glycol is adding in water at 75 ^{0}C and 8^{0}C constant temperature.



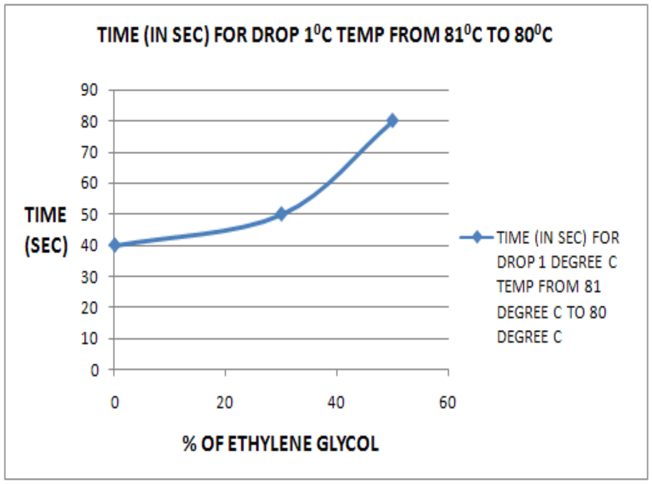
Air side temperature difference (ΔT) for % of ethylene glycol is adding in water at 75 ^{0}C and 80 ^{0}C constant temperature



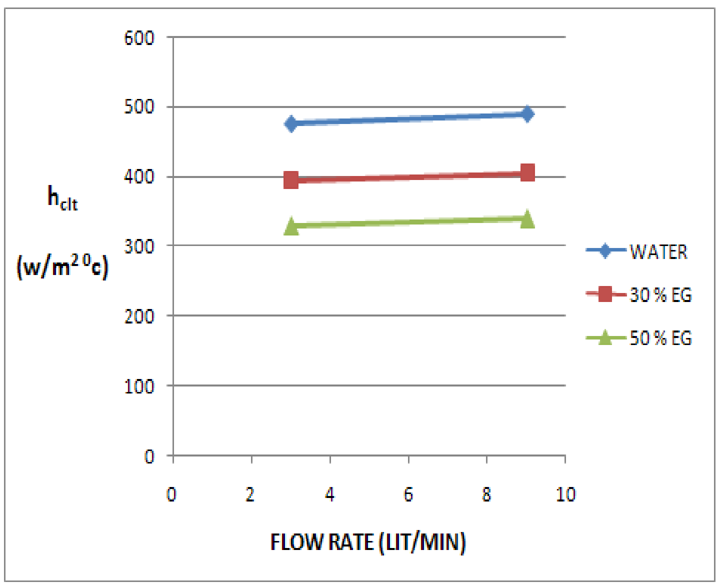
Steady state coolant Inlet Temperature with coolant valve full open and variable air velocity for % composition of ethylene glycol in water



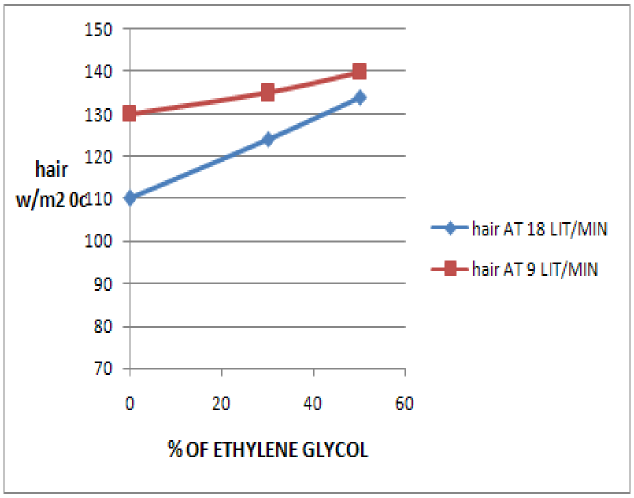
Time taken for drop 1 ^{0}C temperature on unsteady state condition with coolant valve full open and max air velocity



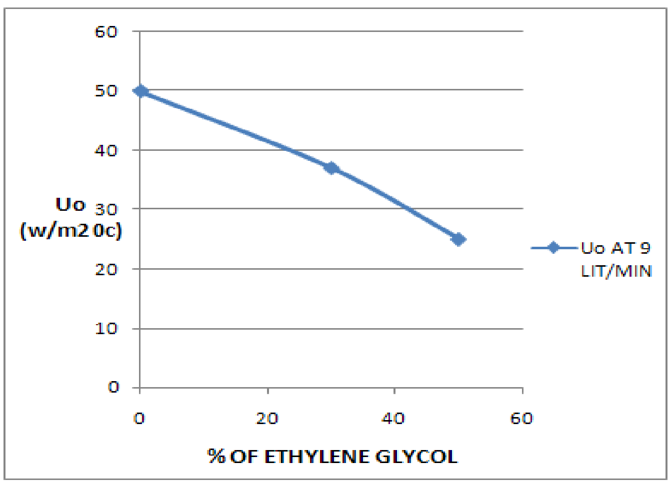
Coolant side heat transfer co-efficient (W/m^{2} ^{0}C) for % of ethylene glycol is adding in water at variable flow rate of coolant



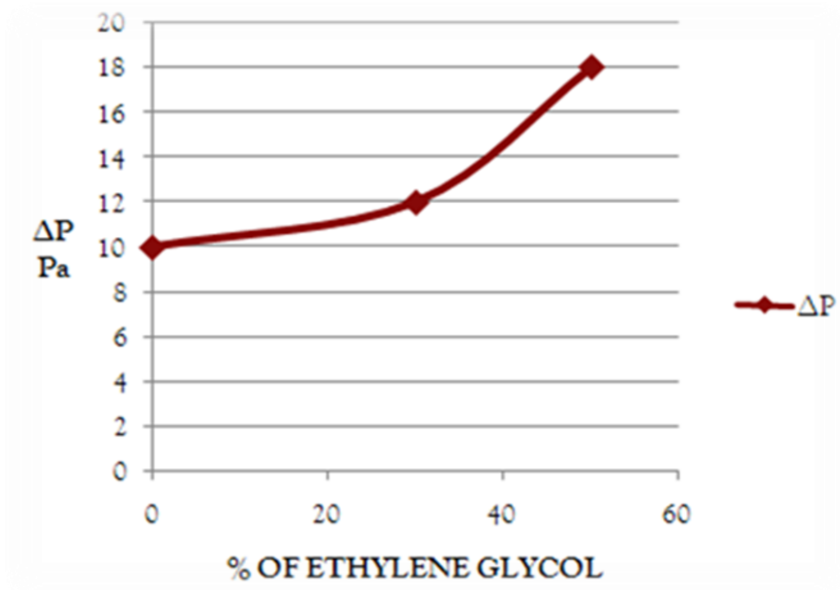
Air side heat transfer co-efficient (W/m^2 ^{0}C) for % of ethylene glycol is adding in water at variable coolant flow rate



Overall heat transfer co-efficient (W/m^2 ^{0}C) for % of ethylene glycol is adding in water



Pressure drop (Δp) for radiator on air side for % of ethylene glycol is adding in water



CONCLUSION

Conclusion for distance between fan and radiator

The effect of flow rate of coolant, velocity of air, and Distance between Fan and Radiator on Differences in Temperature of coolant and air, and heat transfer between coolant and air are investigated, experimentally and analytically. On the basis of previous results, the following discussion and conclusions are made

1) As the flow rate of coolant increases the temperature difference of coolant decreases

2) As the velocity of air increases the temperature difference of air decreases

3) As the distance between fan and radiator increases, overall heat transfer rate decreases

4) Greater overall heat transfer rate is obtained for distance of 1cm

Conclusion for investigation of various coolant

Investigation of effects of various blends of water and ethylene glycol on temperature difference and heat transfer evaluated experimentally. The calculated results have shown that the results achieved are as per expectations and the conclusions are summarized as follows

1) As the coolant percentage of ethylene glycol increases, the overall heat transfer coefficient decreases

2) Also, time for drop of 1^0c temperature from 81^0c to 80^0c increases

3) Better overall heat transfer coefficient is obtained for water

4) Better heat transfer rates can be achieved at flow rates of coolant above 60 lit/min

SCOPE FOR FUTURE WORK

- In the present work mass flow rate of coolant is less and due to which heat transfer is less so Better heat transfer can be obtained by increasing flow rate of coolant i.e. above 60 lit/min.
- The present work includes only the experimental analysis, doing a CFD analysis of heat transfer through coolant and air side can help in minimizing time of experimentation.
- In the present work, investigation are for only water and various blends of water and ethylene glycol, this can also be done for various other types of coolant.
- Only one type of Radiator used for present investigation. Different Radiator designs can also be taken up for investigation

REFERENCES

1. J. E. Hesselgreaves (2001) COMPACT HEAT EXCHANGER

2. C. Oliet, A. Oliva *, J. Castro, C.D. Pe´rez-Segarra, Parametric studies on automotive radiators, Centre Tecnolo` gic de Transfere`ncia de Calor (CTTC), Universitat Polite`cnica de Catalunya (UPC), ETSEIAT, Colom 11, 08222 Terrassa (Barcelona), Spain (2033 – 2043)

3. An analytical study on heat transfer performance of radiators with non-uniform airflow distribution - E Y Ng; P W Johnson ; S Watkins (1451-1466)

4. S.N. SRIDHARA, S.R. SHANKAPAL, AND UMESH BABU.(2005). CFD Analysis of fluid flow and heat transfer in single tube-fin arrangement of an automotive RADIATOR . International Conference on Mechanical Engineering 2005. December 2005.

5. Dawid Taler, Determination of heat transfer correlations for plate-fin-and-tube heat exchangers. (809 – 822).