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Parametric Study on Radiator Test Rig

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Abstract - This test system is designed to test performance of Radiators under various air and hot water flow rate conditions. Automotive engine produce extra heat during engine operation. Automotive engine cooling system regulates engine surface temperature for optimum efficiency. Recent advancement in engine for power forced engine cooling system to develop new strategies to improve its performance efficiency and to reduce fuel consumption along with controlling engine emission to mitigate environmental pollution norms. Automobile radiator test rig is designed to evaluate the performance of automobile radiator.

1.INTRODUCTION

Radiators are heat exchangers used to transfer thermal energy from one medium to another for the purpose of cooling and heating. The majority of radiators are constructed to function in automobiles, buildings, and electronics.

The thermal performance of an automotive radiator plays an important role in the performance of an automobiles cooling system and all other associated systems. For a number of years, this component has suffered from little attention with very little changing in its manufacturing cost, operation and geometry. The radiator is always a source of heat to its environment, although this may be for either the purpose of heating this environment, or for cooling the fluid or coolant supplied to it, as for engine cooling. Despite the name, most radiators transfer the bulk of their heat via convection instead of thermal radiation. Spacecraft radiators necessarily must use radiation only to reject heat.

2. LITERATURE REVIEW

Priti Pramod Bodkhe and JP Yadav, Mechanical Department MITCOE Punein their studies, also presented parametric study on automotive radiator. In the performance study evaluation, radiator is installed into a setup. The various parameters including mass flow rate of cooling, inlet coolant and temperature are varied. Dittus, W.,& Boelter , Pioneers in Heat Transfer in Automobile Radiator of Tubular type the conclusion of their studies shows the heat transfer increases with nanoparticles volume concentration in the sub channel geometry . The highest heat transfer rates are detected, for each concentration corresponding to the higher Reynolds number. John R Howell, The History of Engineering Radiation in Heat Transfer his research has centered on developing solution techniques for radioactive transfer in participating media , solution of highly non-linear combined mode heat transfer problems and most recently inverse design and control of thermal system with combined –mode (non –linear) heat transfer. Ying Gaun, Hongjiang Cui, MinghaiLi, Carried work on engine cooling system with heat load averaging capacity using passive heat load accumulator. Heat load accumulator is phase change material which stores heat generated during peak and dissipates stored heat during reduced heat load condition this is achieved by sacrificing phase change of PCM from solid to liquid or vice versa. This leads to compact heat exchanger for same heat rejection. Also it reduces load on cooling system.

3. EXPERIMENTAL SETUP OF TEST RIG

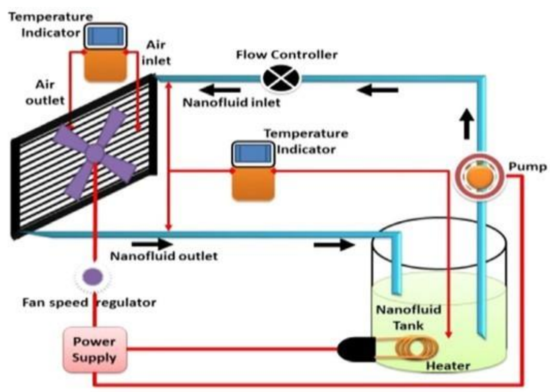

Fig. 1 Schematic representation of experimental setup

2.1. DESCRIPTION OF COMPONENTS:

a) Automobile Radiator

Radiators are used for cooling internal combustion engines, mainly in automobiles but also in piston-engine aircraft, railway locomotives, motorcycles, stationary generating plants and other places where such engines are used.

To cool down the engine, a coolant is passed through the engine block, where it absorbs heat from the engine. The hot coolant is then fed into the inlet tank of the radiator (located either on the top of the radiator, or along one side), from which it is distributed across the radiator core through tubes to another tank on the opposite end of the radiator.

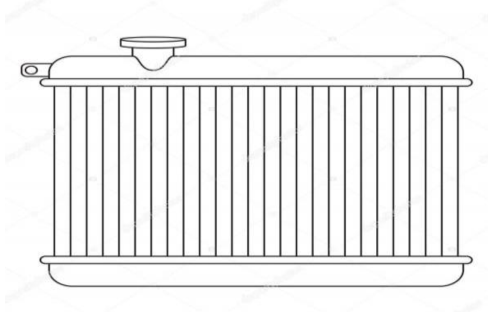

Fig. 2 Radiator

b) Cooling Fan

The cooling system is made up of the passages inside the engine block and heads, a water pump to circulate the coolant, a thermostat to control the temperature of the coolant, a radiator to cool the coolant, a radiator cap to control the pressure in the system, and some plumbing consisting of interconnecting hoses.

Fig. 3 Cooling fan

c) Water Pump

Car's water pump is the key to making the entire system work. It is an impeller pump and is usually buried under the timing belt cover on the side of the engine. Blades on the pump force coolant to flow through the engine and back to the radiator to be cooled by a forced air cooling fan.

Fig. 4 Water Pump

3. EXPERIMENTATION

We need to evaluate the performance of an automobile radiator using a radiator test rig and temperature sensors

1. Fill the reservoir with water up to indicated maximum level.
2. Switch on the main power supply and then switch on the heating element
3. Allow the water to get heated up to 60-900C.
4. Switch on the fan and the power.
5. Note down the electricity consumed by fan and pump by energy meter provided in control panel
6. Note down the discharge of water from the water meter(L/min).
7. Note down the inlet temperature Twith the help of thermometer.
8. Note down the outlet temperature Twith the help of thermometer.
9. Note down the inlet and outlet temperatures by varying the pump discharge

4. EVALUATION

Qh (kW)	Qc (kW)	Q (kW)	A (m2)	(ΔT) lmtd (°C)	U (kW/m2.K)
1.036	1.071	1.054	0.343	11.669	0.263
1.008	1.033	1.0204	0.343	6.117	0.486
0.252	0.504	0.378	0.343	3.6197	0.304
0.641	1.204	0.9224	0.343	10.8407	0.248
0.627	1.638	1.1324	0.343	16.623	0.198
0.585	1.736	1.1604	0.343	19.471	0.174

The radiator test rig is developed in the thermal laboratory. The radiator heat transfer rate is analyzed for various mass flow rates of hot and cold fluid. Their heat transfer rate is summarized in the above table and their behavior is expressed with the help of overall heat transfer coefficient.

5. ADVANTAGES

1. Easy to find the inlet and outlet temperatures of the fluids used in the radiators.
2. This radiator testing rig is very compact for using and easily transported from one place to another.
3. It is cost efficient.
4. If any damage occurs the parts of the testing rig can be easily replaced.

5. Compared to other radiator testing rigs it is less in weight.

3. CONCLUSIONS

Thus we are coming up with result that the Radiator testing rig of compact size and cost efficient is used to test the radiator performance by monitoring input and output temperatures in small scale. We are going to eliminate the difficulties in measuring the performance of the radiators.

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