FINAL PROJECT

HEAT TRANSFERS ANALYSIS OF CAR RADIATOR FOR COOLING SYSTEM OF TOYOTA RUSH 1.5 M/T

RESEARCH PAPER

Submitted as a Partial Fulfillment of the Requirements for Getting the Bachelor Degree of Engineering in Automotive Department

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2011

APPROVAL

The final project entitles “Heat Transfers Analysis Of Car Radiator For Cooling System Of Toyota Rush 1.5 M/T” has been Approved by supervisors for getting the Bachelor Degree of Engineering in Automotive Department of Muhammadiyah University of Surakarta.

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ACCEPTANCE

The final project entitles “Heat Transfers Analysis Of Car Radiator For Cooling System Of Toyota Rush 1.5 M/T” has been defended in front of examiners team and approved as a partial fulfillment of the requirements for getting the Bachelor Degree of Engineering in Automotive Department of Muhammadiyah University of Surakarta.

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TESTIMONY

I assert verily that the research entitles:

HEAT TRANSFERS ANALYSIS OF CAR RADIATOR FOR COOLING SYSTEM OF TOYOTA RUSH 1.5 M/T

That made to fulfill some of requirements to get bachelor degree of Engineering in Automotive Department of Muhammadiyah University of Surakarta, as far as I know is not a plagiarism of a research that has been published, except the information source that used to solve the problem.

Surakarta, November 2011

Researcher,

David Sinurat

MOTTO

We are what we repeatedly do.

Excellence, therefore, is not an act but a habit.

(Aristotle)

Knowing is not enough; we must apply.

Willing is not enough; we must do.

(Johann Wolfgang von Goethe)

Every artist was first an amateur.

(Ralph Waldo Emerson)

You cannot dream yourself into a character;

you must hammer and forge yourself one.

(Henry David Thoreau)

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The writer realizes that this research paper is far from being perfect, so the writer sincerely welcomes any constructive comment, criticism, and suggestion from anyone.

Wassalamualaikum Wr. Wb.

Surakarta, November 2011

The writer

David Sinurat

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2. Diameter hydraulic (D_h): $D_h = \frac{4 \times A_c}{P}$
3. Outside pipe heat transfers convection coefficient (h_o): $\hat{h}_o = \frac{k \times N_{uD}}{D_h}$
4. Fin parameters (m): $m = \left[\frac{h_o \times P_m}{k \times A_m}\right]^{\frac{1}{2}}$
5. Efficiency of a fin (η_f): $\eta_f = \frac{\tan(m \times l)}{m \times l}$
6. Total efficiency of fins (η_o): $\eta_o = 1 - \left[\frac{N \times A_f}{A_t} \times (1 - \eta_f)\right]$
7. Thermal resistance of fins (R_f): $R_f = \frac{1}{\eta_o \times h_o \times A_t}$
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12. Heat transfer rate through fins ($\dot{Q}_o$): $\dot{Q}_o = \frac{1}{R_t} \times LMTD \times F_C$
13. Efficiency of radiator: $\eta = \frac{Q_{actual}}{Q_{segment\ analysis}}$

ABSTRACT

DAVID SINURAT. D700070010. HEAT TRANSFERS ANALYSIS OF CAR RADIATOR FOR COOLING SYSTEM OF TOYOTA RUSH 1.5 M/T. MUHAMMADIYAH UNIVERSITY OF SURAKARTA. 2011.

Although gasoline engines have improved a lot, they are still not very efficient at turning chemical energy into mechanical power. Most of the energy in the gasoline (perhaps 75%) is converted into heat, and only 25% of total energy produced in gasoline engine which converted into effective work. Therefore, it is the job of the cooling system to take care of that heat. The objectives are to investigate heat transfer rate through radiator and create simple segment analysis which then compared to full radiator analysis.

Cooling systems are designed to allow the engine to reach a normal operating temperature as soon as possible and then maintain that operating temperature over the course of driving in a wide range of ambient temperature ranges and finally, to prevent any overheating that might occur. Coolants in the closed loop system are designed to absorb engine heat and transfer it to the radiator so that through convection and thermodynamics heat transfer may occur. A radiator is a type of heat exchanger. It is designed to transfer heat from the hot coolant that flows through it to the air blown through it by the fan. In order to obtain the result, it is important to know inlet and outlet temperature of radiator and air which passing through radiator.

Total heat transferred by car radiator is vary depend on speed of vehicle which will affect air flow speed through radiator. When thermostat opens total heat transferred by radiator is 13274.61 Btu/hr. Segment analysis for radiator when thermostat opens is 15842.1 Btu/hr. Therefore, heat transfer efficiency of car radiator of Toyota Rush 1.5 M/T is 83.6%.

Key words: car cooling system, heat transfer, and radiator