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FEASIBILITY STUDY ON RADIATOR MANUFACTURING PROCESS TO IMPROVE STRUCTURE STABILITY THROUGH NDT TECHNIQUES

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Abstract

When it comes to cooling internal combustion engines, radiators play a key role. This is true not just for cars but also for piston-engine aeroplanes, railroad locomotives, and other power generation facilities. However, the fan's round motion creates low-velocity zones or high-temperature regions in the corners of the blown/sucked air. NDT applications for radiators will be discussed in this article, as well as how to pick between various NDT methods and how to benefit from strategic partnerships to provide dependable services. A non-destructive test is used to examine the practicality of vehicle radiators in this article. Non-destructive testing processes such as mechanical qualities, chemical composition, size, and deterioration are illustrated in the feasibility evaluation. Vickers hardness, as determined by a hardness tester, is used to evaluate tensile strengths. Radiators, air conditioners, and radiators are all recommended for best efficiency. Radiators have remained mostly untouched till recently.

Keywords: Radiator, NDT, and Feasibility are all things to consider.

Introduction:

The proposed study focuses on developing a new radiator design that may be used to either heat or cool a fluid. Also, it focuses on the development of a fan-assisted air-cooled heat exchanger for application in automobiles, internal combustion engines, refrigeration systems, and power plants. More than one kind.

There are a variety of heat exchangers that use air as a heat transfer medium since it is readily available and does not pose any disposal concerns. Air flow is either spontaneously produced or assisted in well-known heat exchangers by the use of one or more fans. Using a fan decreases equipment size and expense, making it more compact. Because of this, fan-assisted radiators are more common.

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Examination of heat-exchanger materials used to assess their metallurgical structure, mechanical qualities, and corrosion resistance is carried out. During their service life, these materials must be able to withstand the situations they will encounter. Various fabrication methods, such as bending, welding, or shaping, should be able to be applied to these materials without affecting their qualities adversely, as long as they are adequately tested and inspected beforehand. To put it another way, destructive and non-destructive testing are the two most common methods of testing. When Nondestructive Testing fails, it may be necessary to do Destructive Testing.

No matter whether a heat exchanger is being built or repaired, the inspection side is going to rely on one or more of the above NDT methods to help locate flaws on the surface or subsurface of the material, such as discontinuities, changes in thickness, nicks or even welding joints of slag entrapment, porosity or cracking that are not penetrated or undercut. Below are examples of heat exchanger components that have been damaged or are expected to be affected by corrosion.

Literature review:

Auto radiators were also studied parametrically by [1]. A radiator is used in a performance study evaluation. The cooling mass flow rate, inlet coolant temperature, and other parameters may be changed. Auto Radiator of Tubular Type Pioneers in Heat Transfer nano-particles volume concentration in a subchannel shape boosts heat transmission, according to their findings. The greater the Reynolds number, the higher the heat transfer rates are seen for each concentration. Radiative transfer in participating medium, non-linear coupled mode heat transfer, and inverse design and management of thermal systems with non-linear heat transfer have all been the focus of his study. Passive heat load accumulator was used for engine cooling system heat load averaging capacity. Phase change material that stores heat is known as a heat load accumulator.

This is done by sacrificing PCM phase shift from solid to liquid or vice versa at peak and discharges stored heat under lower heat load conditions. This results in a smaller heat exchanger with the same amount of heat removal. Reduces cooling system stress as well. [5] spoke about a cooling system with hydraulic control. It is possible to decrease parasitic losses by using actuators to enhance temperature tracking. The controller in an actuator-based engine cooling system regulates the operation of the coolant pump and the radiator fan.

s. It delivers the necessary power to the system components. So as to control power consumption of cooling-capable system components, it does so Hydraulic thermal management systems employ a non linear back-stepping robust controller to adjust engine coolant temperature. Using nano fluid-based coolant in engine cooling systems and the impact on cooling capacity were discussed in [6], [7]. The thermal conductivity of 565nanofluid is found to be greater than that of a base coolant, such as 50/50 water and ethylene glycol. Thermal conduction is

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facilitated. [8] Conventional radiators are rectangular in shape, making it impossible for a circular fan to cover the whole surface area. It reduces heat transmission by creating a lower velocity zone at the corners. Rather than using square or rectangular radiators, the author proposes using a compact, energy-efficient circular radiator that requires less energy to operate and makes better use of available air flow.

Methodology:

DESCRIPTION OF THE COMPONENT

Radiator:

330x335x23 mm is the dimensions.

Aluminum is the chosen material for this product.

• Type of flow that moves downward

Al tubes and Al plates are included in this category.

• 37 plates with a diameter of 10 mm in the tube.

• 3 litres of capacity

Hydraulic Power Unit

Pumps for submersion

• Voltage: 165-220 V/50 Hz

• 19 watts of power

One hundred and twenty-one thousand cubic feet per hour

Power Cable

• 1 phase, 2 conductors

• I(max) -30A at 240V/50Hz AC power

Elements for Heating

2000W, 1500W

Reservoir

• Material-Plastic

At least 2.5 to 3 litres

Frame

In addition to the material –MFD

Pipes

• Material-Polyurethane

The following procedures must be followed in order to assess a vehicle radiator's performance:

Add water until it reaches the designated maximum level in the reservoir.

The heating element should be turned on once you've turned on the main power supply.

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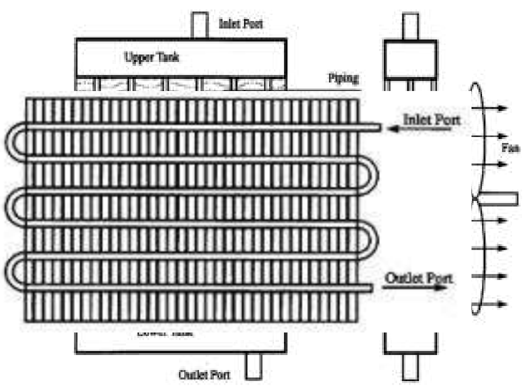
In order to achieve a temperature range of 60-900C, the water should be allowed to be heated.

Turn on the electricity and the fan.

Control panel energy metres may be used to keep track of how much power each fan and



pump uses.

6. Record the rate at which the water metre is discharging water (in litres per minute).

Using a thermometer, record the inlet temperature Ti.

Using a thermometer, record the outlet temperature T0.

By adjusting the pump discharge, record the inlet and exit temperatures.

The graph between discharges (Q) vs time (T) should be shown. Ti and T0 should be plotted on a graph.

The radiator's design

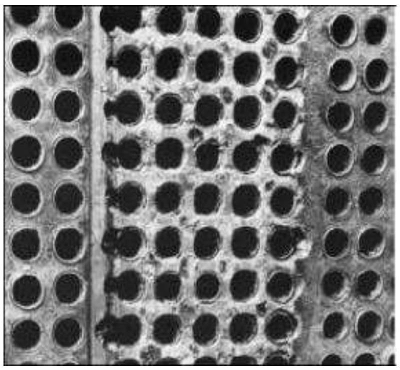
Current applications almost exclusively make use of this preexisting architecture. The entrance port allows hot water to flow into the higher tank, where it is dispersed via a tubing system as seen in the image. These tubings are excellent.

All the way down the tubes' length, a slew of fins link and round them. In order to circulate or draw

air through the radiator and its fins, a fan is attached on a shaft.

Radiator internal surface

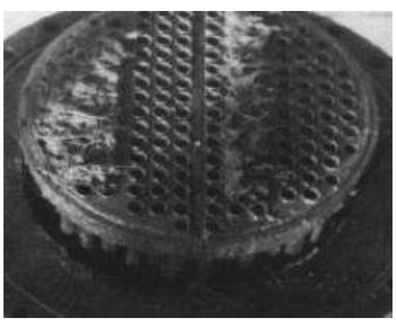
Results and observations:

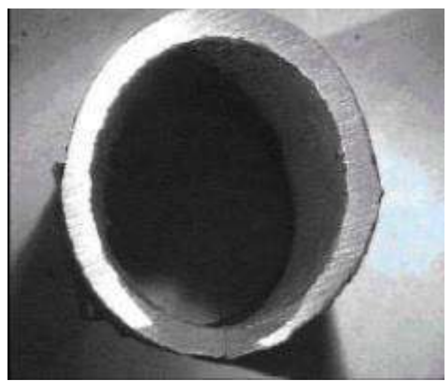


Radiator fabrication

Sever corrosion in Air cooled HE Frame and partition plate

Tubes along radiators





Excessive clearance between baffle and tubes from accelerated corrosion

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Graphitic corrosion

Table shows temperatures ranges of radiator during fabrication process

S. no	Inlet temp T_1 (^0C)	outlet temp T_0 (^0C)	Time (seconds)
1.	65	66	60
2.	70	64	120
3.	75	60	180
4.	80	61	240
5.	85	64	300
6.	90	66	360

Average temperature of the radiator

S. no	**TEMPERATURE (T)0C**	∇t
1.	11	16.92
2.	1	18.75
3.	15	20
4.	19	23.75
5.	21	24.7
6.	24	26.67

Conclusions:

When the rpm of the radiator is increased, we see an increase in the velocity of the radiator in the areas with low velocity and high temperature (poor heat transfer).

• The layout is simple and efficient.

Due to a less amount of material,

• As a result of the 24 percent material savings, the cost savings on mass manufacturing will be around 20 percent.

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