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Differentiate Theoretical and Computational Performance of Oval Shape Fin with Different Geometry

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Abstract - *Fins are important part of engine mostly used for transfer cooled and effective air for cooling of IC engine. The main purpose of using these cooling fins is to cool the engine cylinder by air. Normally rectangular fins are used in these work we are changing rectangular shape fin to oval shape. Fins are subjected to high temperature variations and thermal stresses. By doing thermal analysis on the engine cylinder fins, it is helpful to know the heat dissipation inside the cylinder. Aim of these project is to increase the heat dissipation rate by increasing the surface area. The fin materials used in this analysis are: Aluminum alloy 204 the modification was done in size as well as geometry*

***Key Words*:-Engine Cylinder Fins, Thermal Analysis, ANSYS, SOLID EDGE, Heat Flux**

1. INTRODUCTION

Fins are extended surfaces designed to increase the heat transfer rate of the body by increasing the convective surface area. Mainly transfer cooled and effective air to engine & maintain uniform temperature. Fins are use by increase heat transfer rate; improve fin efficiency & cooling capacity and avoid failure. An air cooled motorbike engine dissipates waste heat from the cylinder through the cooling fins to the cooling air flow created by the relative motion of moving motorbikes. A fin are used to cool engine by increasing convection. In cylinder only 25-30% of power that are produce are useful about 70% of power is loss ,it should be necessary to remove waste heat from cylinder block. If it is not remove it causes damage to cylinder and piston. Shape of cylinder block, piston is change. To prevent the parts from damage fins are used. To prevent from damage Engine have cooling mechanism in engine to remove this heat from the engine. In some bikes water-cooling system and almost all two wheelers uses Air cooled engines, because Air-cooled engines have more advantages like lighter weight and lesser space requirement.

1.1 Problem Statement

It is seen that the quantity of heat given to the cylinder walls is considerable and if this heat is not removed from the cylinders it would result in the prigniation of the charge. In addition, the lubricant would also burn away, thereby causing the seizing of the piston. Change the shape of block and piston Excess heating will also damage the cylinder material

1.2 Objectives

- In this present work thermal analysis of Honda splendor bike fins and it valid with theoretical result
- Thermal analysis and mathematically evaluation of modified existing fins dimensions
- To determine the type of geometry and its dimensions for optimum heat transfer rate.

1.3 Methodology

- 2 D drawing of Exiting fins
- 3 D Modeling of Exiting fins on SOLID EDGE ST9
- Theoretical Calculation of fins
- Thermal Analysis of fins on analytical software(ANSYS)

1.4LiteratureReview

In this chapter, reviews various studies carried out in the field fins and their analysis,

RashinNath.KK, (2017) et al. The heat transfer rate increases for zigzag and wavy fin compared to that of conventional flat fin. By changing the fin geometry from the convention flat fin the heat transfer rate can be improved greatly, which leading to less thermal stress development. Zigzag and wavy fin thus can be preferred over conventional fins

B N Niroop Kumar Gowd (2014) concluded that the shape of the fin can be modified to improve the heat transfer rate and can be analyzed. The thickness of the original model is 3mm, reduced to 2.5mm.

By reducing the thickness of the fins, three other materials are considered which have more thermal conductivities than Aluminum Alloy 204. By observing the thermal analysis results, thermal flux is more for Beryllium than other materials.

Prof. Arvind S. Sorathiya et al, (2014) concluded that large number of fins with less thickness can be preferred in high speed vehicles than thick fins with less number as it helps inducing greater turbulence and hence higher heat transfer possible. Wider spacing shorter fins are prefer than the longer fins. Heat transfer rate and heat transfer coefficient can be increased with the wind velocity. Based on review study cylinder heat transfer rate also increase by changing the various types of geometry of fins mounted on it.

AmitYadav et.al, (2017) inspect that the default fins thickness 3mm and it of rectangular shape. Fin shape has been changed to circular and curved and the thickness has been varied from 3mm to 2.5mm. Conclude that the circular fin of thickness 2.5mm example aluminum 2014 can give a better heat transfer rate rather than the present (default fin).

2. PROJECTDETAIL

2.1 2D Drawing:-

From these 2 d drawing all dimensions are collected.
No of fins:- 30
Length of fin (l)=65mm=0.065m
Width of fin (w)=30mm=0.030m
Thickness (t)=0.003m

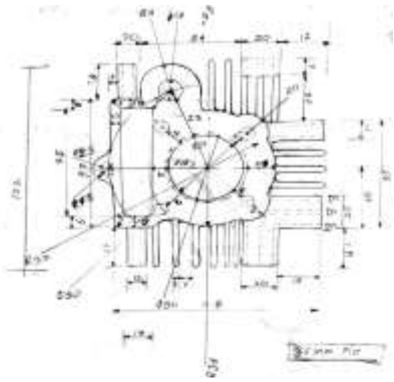
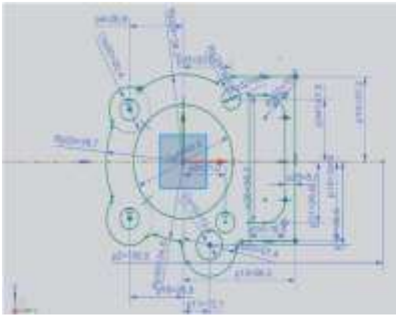


FIG.TOP VIEW



2.2 3D modeling :-

For modeling of the fin body, we have used SOLID EDGE ST9 which is parametric 3D modeling software.

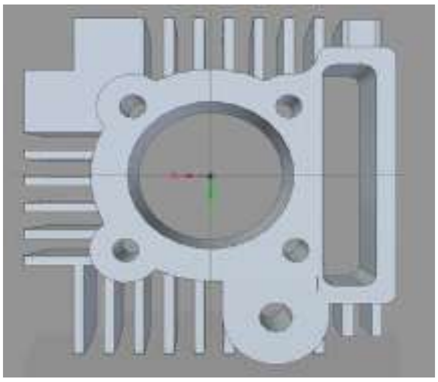


FIG 2 3D rectangular shape fin body top view

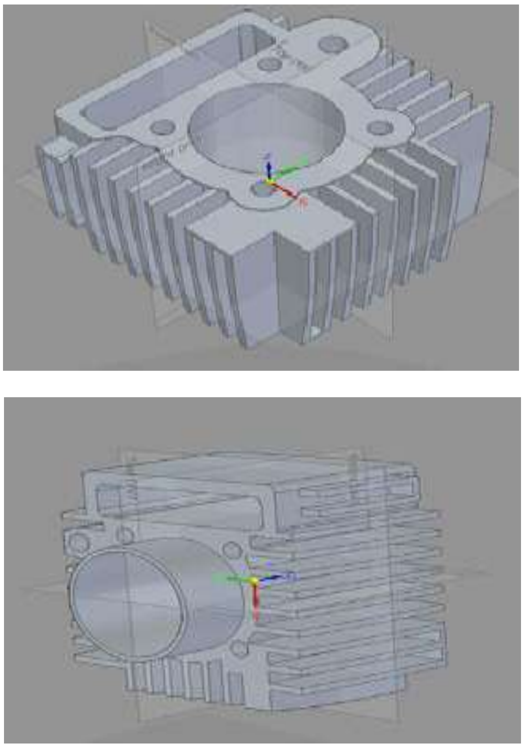


FIG 3.3D modeling OF Bottom view and side view OF FINS

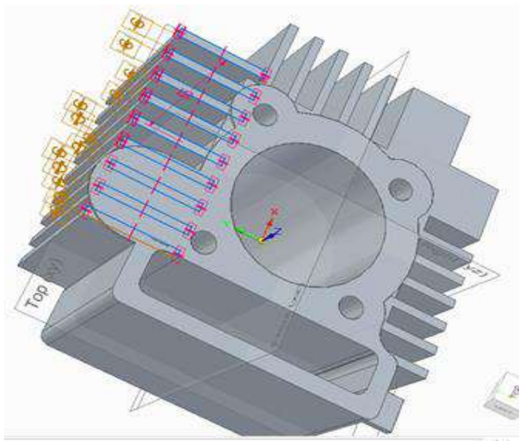


Fig 4.fin body with pitch distance of fins

2.3 Theoretical Calculation:-

Length of fin (L)=65mm=0.065m
Width of fin (w)=30mm=0.030m
Thickness (t)=0.003m
K=conductivity of fin material =180W/mk
T=temperature of cylinder head=550K
Ta=atmospheric temperature=303K

Heat transfer rate before putting the fin

Qwithout fin=hA(T0-T∞)
Qwithout fin =26.02 W

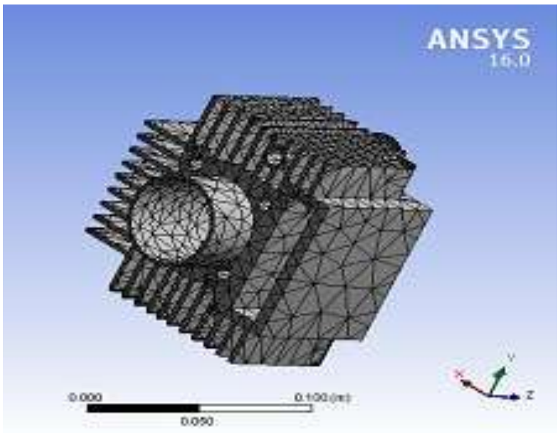
Heat transfer rate after putting the fin

Qonefin =20.906 W/fin
Total heat transfer for30 fin
Qtotal= Qone fin *30
Qtotal =30 *20.906
Qtotal =627.18 W
Total heat fluxfor 30 fin
q=k×(T-T∞)×30
q =269.724 W/m²

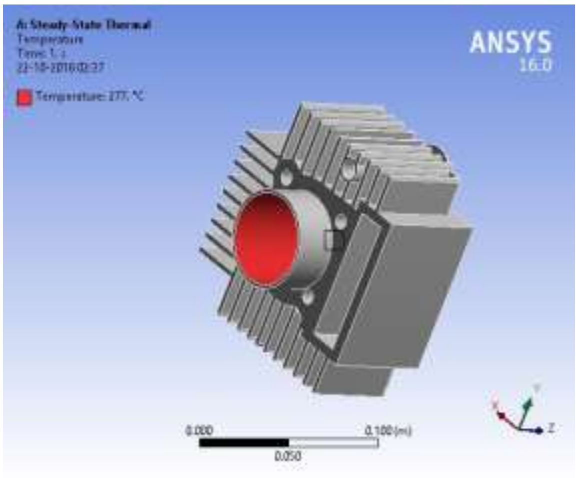
2.4 Thermal Analysis Of Fin Body

1. Convert file to igex format:-For analysis we have used ANSYS16.0, which is FEA software. In which first of all convert part which is created in solid edge st 9, with .par format to .igex.
2. Meshing : for these analysis we use hyper mesh method.it is software base on the fundamental of finite element analysis.in FEA you need to break a large component into very small pieces this method is called meshing. Hyper mesh is use for meshing purpose.

A) Meshing :-

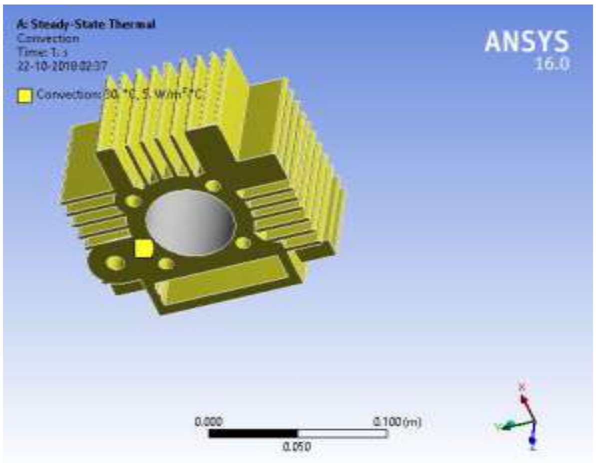


B)Boundry condition temperature to cylinder bore



Input Temperature given to the cylinder bore is to be 277ºC.

C) Boundry condition temperature to fins and outer body:-



Temperature given to the fins are 30ºC.it is surounding temeprature

D) Boundary Condition:-

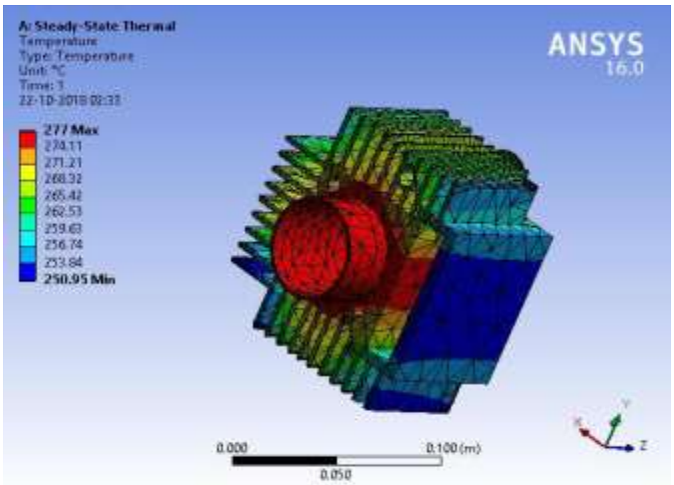
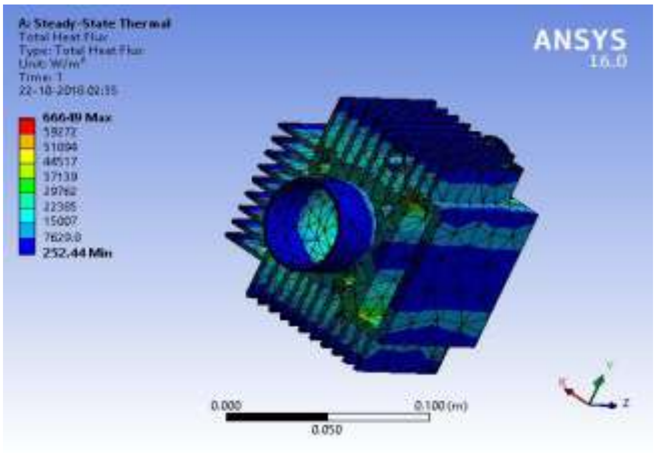


Fig.shows the maximum and minimum temperature.maximum temperature is present at inner side i.e. bore of cylinder.it is about 277ºC.and minimum temperature present is 250.95ºC.

E) total heat flux result :-



Total heat flux by ANSYS is 252. 44W/m^2

Observation Table & Result

Theoretical result of heat flux	**269.12 W/m^2**
Computational result of heat flux	**252.44 W/m^2**

3. Summary

Fins are important part of cylinder to increase the heat transfer rate i.e. removewaste heat.In this project we have designed a cylinder fin body used in a 100cc Hero Honda Motorcycle and modeled in parametric 3D modeling software SOLID EDGE ST9.and its analysis in ANSYS 16.0 .theoretical calculation of fins using formula. From these we found that fin is short fin. Present used material for fin body is Aluminum alloy 204. The shape of the fin is rectangular.

By observing theoretical result and computational thermal analysis results, heat flux of fins that we calculated by theoretical (269.724 W/m^2) is nearly equal to heat flux calculated by ANSYS 16.0(252.44W/m^2)

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