# Effect of Fins Height on Two Wheeler Engine Cylinder

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***Abstract***- *This paper describes our effort to find out the effect of fin height on two-wheeler engine cylinder for temperature distribution. For this purpose, we have used fins with rectangular geometry with variable height of fins 7mm, 5mm and 3mm respectively. Then Steady State Thermal Analysis done on the implemented geometries with variable heights of fins using ANSYS AIM 18.1 Student version software, Results obtained from different geometries are investigated based on Temperature distribution, Directional heat flux and Total Heat flux and thermal analysis is done on the generated results. Finally, to find out conclusions comparative study carried out between results mention above.*

***Keywords***- Finite Element Analysis (FEA), Aluminum Alloy, Temperature Distribution, Steady State Analysis.

## I. INTRODUCTION

Heat generated between Engines after fuel is burned out. Extra heat generated by friction between the moving parts. approximately 30% to 35% of the energy only released is utilized for actual work. The remaining (65% to 70%) removed from the engine to prevent the parts from melting.

For this objective Engine contain of cooling mechanism in engine to take out this heat from the engine limited heavy vehicles uses water-cooling method and nearly all two bikes uses Air cooled engines, because of Air-cooled engines has rewards like lighter weight and smaller space requisite hence they are only option. Heat produced during combustion in Internal Combustion engine must be maintained at upper level to rise thermal efficiency, but to prevent engine parts from thermal damage some heat must be remove from the engine. In air-cooled engine exterior stretched surfaces are called as fins and provided at the periphery of engine cylinder to increase heat transfer rate.

Fins are widely used for cooling of IC engines. Engine cylinder fins are the outside stretched surfaces purposely provided on condition that it removes heat from place. The amount of conduction, convection and radiation of an object determines the amount of heat it transfers. Increasing the temperature gradient between the object and the environment, increasing the convection heat transfer coefficient and increasing the surface area of the object increases the heat transfer. The different types of fin geometries that can be used for an IC engine are Rectangular fins, Triangular fins, Trapezoidal fins and Pin fins as shown in figure 1.

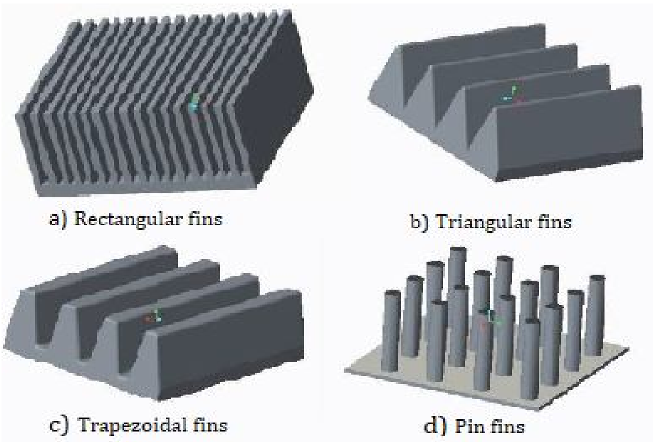


Fig-1: Different types of fin geometries

## II. METHODOLOGY

To investigate the effect of fin height on the temperature distribution through cylinder following procedure is done as shown in figure 1 in ANSYS aim 18.1 (student version)

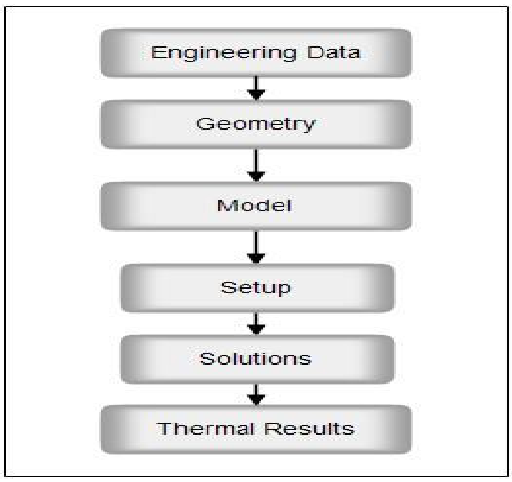


Figure 1: Steady State Thermal Analysis

2.1 **Engineering Data:** There are several material in the Engineering Data Sources that we can use directly, By clicking the Engineering Data Sources, then Thermal Material, then clicking the plus near Aluminium or required material.

2.2 **Geometry:** in Geometry Select the Geometry cell in an analysis system schematic. Browse to the CAD file from the following access points: Right-click on the Geometry cell in the Project Schematic and choose Import Geometry. Double-click on the Model cell in the Project Schematic. The Mechanical application opens and displays the geometry.

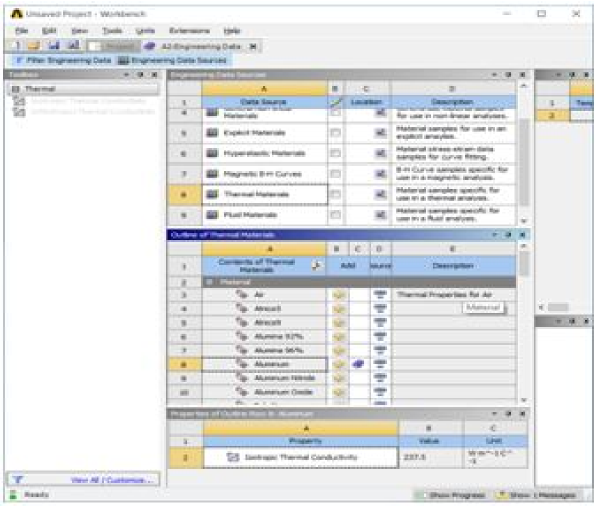

Figure 2: Engineeering Data list in Ansys AIM 18.1

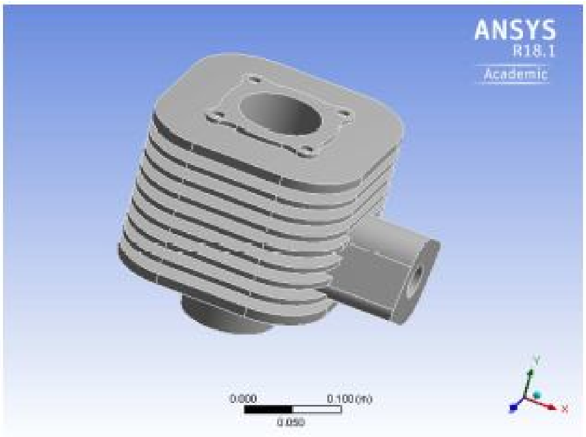


Figure 3**:** Geometry added using geometry option.

2.3 **Apply Mesh model/Preview Mesh:** There are no specific considerations for steady-state thermal analysis itself. However if the temperatures from this analysis are to be used in a subsequent structural analysis the mesh must be identical. Therefore, in this case you may want to make sure the mesh is fine enough for structural analysis. It is recommended to use the multizone method, which may help generate a more reasonable result.

2.4 **Setup:** For a steady-state thermal analysis, we can specify an initial temperature value. This uniform temperature is used during the first iteration of a solution as follows, to evaluate temperature-dependent material properties. As the starting temperature value for constant temperature loads. Following loads are supported in a steady-state thermal analysis, Temperature. Convection Radiation, Heat Flow, Perfectly Insulated, Heat Flux, Internal Heat Generation, Imported Temperature, Imported Convection Coefficient, Fluid Solid Interface etc.

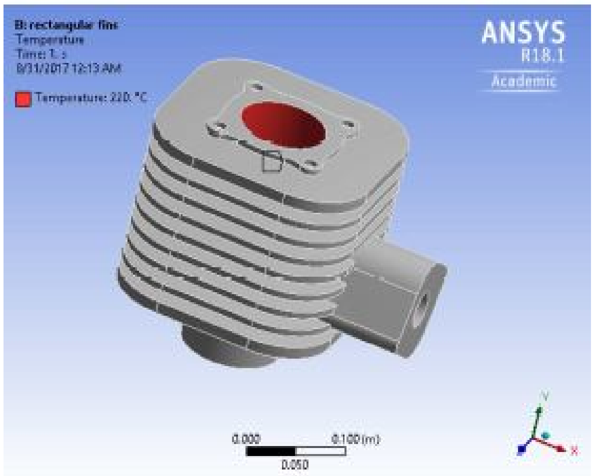


Figure 4**:** Geometry added using geometry option.

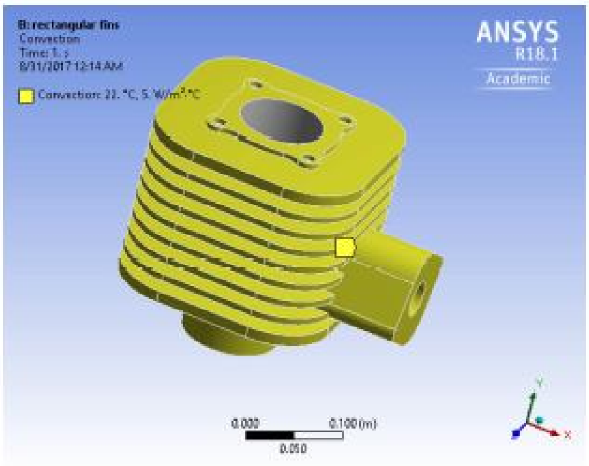


Figure 5**:** Geometry added using geometry option.

**2.5 Solution:** The Solution Information object provides some tools to monitor solution progress. Solution Output continuously updates any listing output from the solver and provides valuable information on the behavior of the structure during the analysis. Any convergence data output in this printout can be graphically displayed. By right click the Solution button, we can ask the solver to generate several kinds of result. In this case, we select Temperature, total heat flux and directional heat flux etc.

**2.6 Thermal Results:** Applicable results are all thermal result types. Once a solution is available, you can contour the results or animate the results to review the response of the structure. Because of a nonlinear analysis, you may have a solution at several time points. You can use probes to display the variation of a result item over the load history. Also of interest is the ability to plot one result quantity (for example, maximum temperature on a face) against another results item (for example, applied heat generation rate). You can use the Charts feature to develop such charts.

## III. RESULTS AND RESULTS ANALYSIS

The results obtained for temperature distribution from the Finite Element Analysis using ANSIS are shown in figure 6 to figure 10 and Experimentation of different size models are collected and made it in tabulated form as follows in table 1 and table 2. Various graphs are plotted for experimental results as shown on figure 11 and ANSYS results in figure 12 and discussion is carried out on graphs.

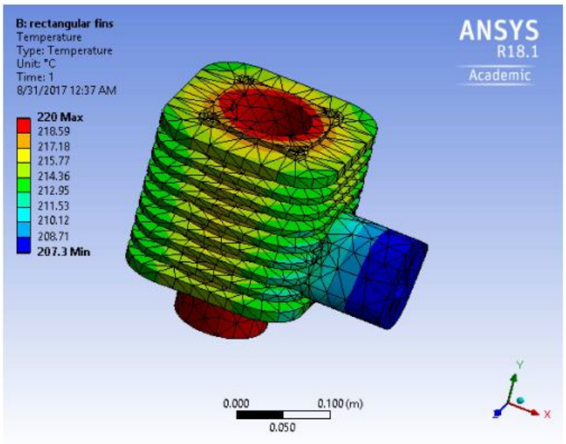


**Fig-6:** Temperature Distribution for Rectangular Fins of Aluminium Alloy 6061 with 3 mm Fin Height.

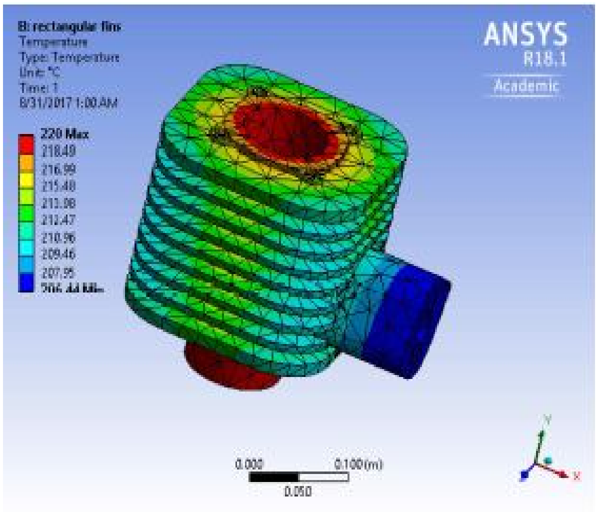


**Fig-7:** Temperature Distribution for Rectangular Fins of Aluminium Alloy 6061 with 5 mm Fin Height.

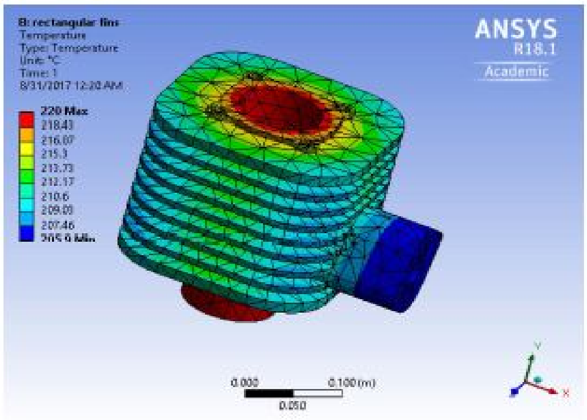


**Fig-8:** Temperature Distribution for Rectangular Fins of Aluminium Alloy 6061 with 7 mm Fin Height.

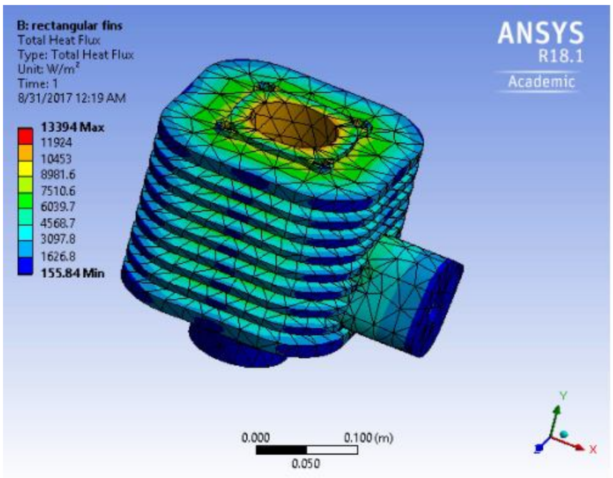


**Fig-9:** Total Heat Flux for Rectangular Fins of Aluminium Alloy 6061 with 7 mm Fin Height.

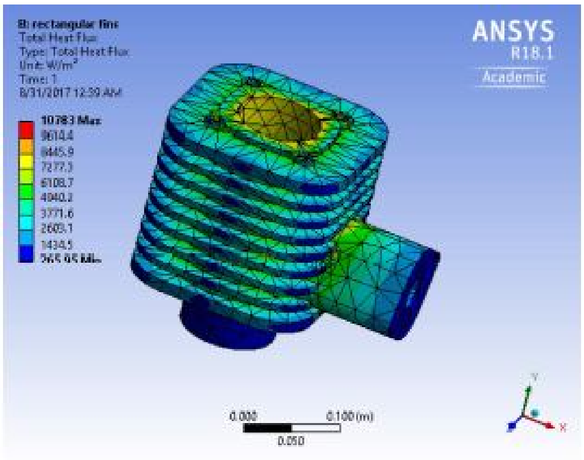


**Fig-10:** Total Heat Flux for Rectangular Fins of Aluminium Alloy 6061 with 5 mm Fin Height.

Table 1: ANSYS Result table for Maximum and Minimum Temperature Distribution of fines with rectangular geometry and variable height size.

| SR. NO. | Fins Height | Cylinder Temp (Maximum) | Temp. on Fins Tip (Minimum) |
|---|---|---|---|
| 1 | 7mm | 220°c | 205.9 |
| 2 | 5mm | 220°c | 206.44 |
| 3 | 3mm | 220°c | 207.3 |

Table 2: ANSYS Result table for Maximum and Minimum Total Heat Flux of fines with rectangular geometry and variable height size.

| SR. NO. | Fins Height | Cylinder Total heat flux (Maximum) | Total heat flux on Fins Tip (Minimum) |
|---|---|---|---|
| 1 | 7mm | 13394 | 155.84 |
| 2 | 5mm | 11561 | 260.96 |
| 3 | 3mm | 10783 | 265.95 |

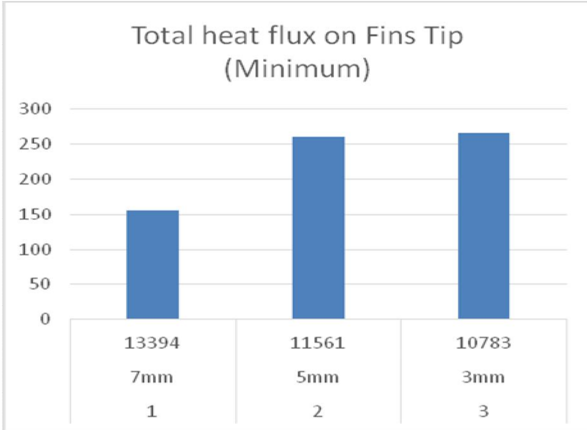


**Fig-11:** Graphical representation of temperature Distribution results with ANSYS for Rectangular Fins of Aluminum Alloy 6061 with variable size fin height.

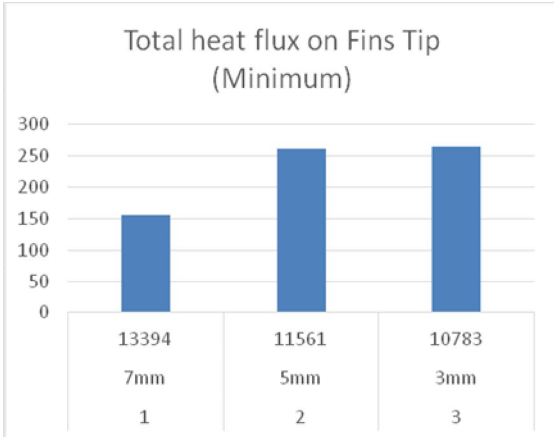


**Fig-12:** Graphical representation of Total Heat Flux results with ANSYS for Rectangular Fins of Aluminum Alloy 6061 with variable size fin height.

Graph in Figure 11 shows the variation of temperature with Height for cylinder with rectangular and triangular fins of varying fin thickness and materials. From this graph, it is clear that the temperature distribution is maximum for cylinder with rectangular fins having 3.5 mm fin thickness and for the material aluminum alloy 6061 Such as Graph in figure 12 shows the variation of Total Heat Flux with Height for cylinder with rectangular fins of material aluminum alloy 6061. From this graph, it is clear that the temperature distribution is minimum for cylinder with rectangular fins having 3.0 mm fin height.

## IV. CONCLUSIONS

Finite element analysis and experimental investigation on the thermal behavior of cylinder with different fins of varying fin height, geometry and material is carried out. Based on the finite element analysis and experimental investigation of different fins, following conclusions are drawn. Results obtained from the finite element analysis are in close approximation with results of experimental method. FEA and Experimental results analysis shows that the temperature distribution is maximum for the cylinder with rectangular fin of 7 mm fin Height for aluminium alloy 6061 and minimum for triangular fin of 3 mm Height for aluminium alloy 6061.

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