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Thermal Analysis of Muffler Guard for HERO XTREME 200R Bike Using FEA and CFD Technique

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Abstract – *Muffler guard is used to protect the human body touching over it and to maintain the heat transfer of muffler for various conditions. For this project in order to obtain the thermal performance of muffler guard is carried out by FEA and CFD technique in ANSYS (14.5) software. In this project there are three main concepts of heat transfer such as conduction, convection and radiation is find out heat transfer for muffler guard. In this project mainly focus on the thermal behavior of muffler guard to predict performance parameter such as temperature along the time and speed. To compare thermal performance for basic design of muffler guard with modified design of muffler guard. We tried to validate CFD results by plotting graphs along temperature vs. muffler end and temperature vs. respective points.*

Key Words: Temperature, Muffler Guard, ANSYS

1. INTRODUCTION

Large amount of heat given off by internal combustion engine heat shields are used on most of the automotives to protect components and body parts from the heat damage as well as protection from high temperature to the surrounding being. Heat shield is made up of steel, alumimium and composite materials. There three main concepts of heat transfer such as conduction, convection and radiation is used to find heat transfer happening in the muffler guard. For analysis mainly focus on thermal behavior of muffler guard.

Thermal analysis will be carried out with boundary condition fora realistic working condition. Steady state thermal analysis to determine temperature for boundary condition steady state thermal analysis may be either linear with constant material properties or non-linear with constant material properties depends on the temperature. The thermal properties of most material do vary with temperature. The finite element analysis (FEA) is a computational technique used to obtain solution of boundary value problems in engineering. The static structure analysis of muffler guard is done by finite element analysis by using ANSYS (14.5) software.

2. OBJECTIVES

1] Analysis of temperature distribution for muffler guard at boundary conditions.

2] Thermal analysis of basic design of muffler guard.

3] Thermal analysis of modified design of muffler guard.

4] To compare the results for basic design and modified design of muffler guard with graphs.

5] To validate results using analysis software ANSYS (14.5)

3. MUFFLER GUARD MODEL ANALYSIS

3.1Thermal analysis

Thermal analysis is performed on the muffler guard to find out heat distribution during no cooling is offered when temperature of bottom mounting places is around 100 ^{0}C, small end of the muffler guard is at 80 ^{0}C and big end of the muffler guard with temperature of 120 ^{0}C at the maximum conditions of temperature are taken from CFD analysis.

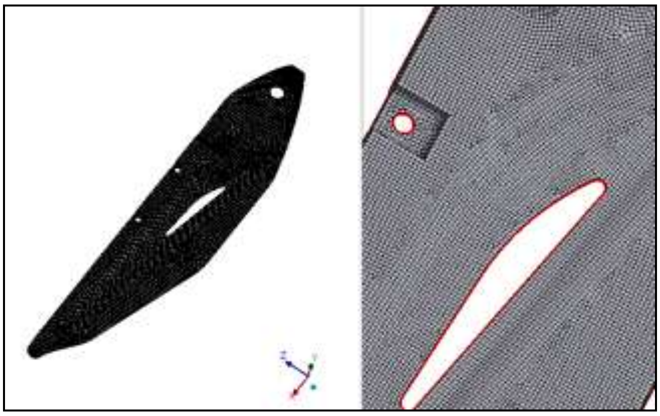


Fig-1- Meshed Model for Thermal Structural Analysis

Total of 26395 nodes and 25946 elements are used to mesh the model as shown in above fig-1. Shell 181 elements are used for the analysis.

3.2 CFD ANALYSIS

A) Thermal Analysis of Basic Design for Muffler Guard

Iteration 1

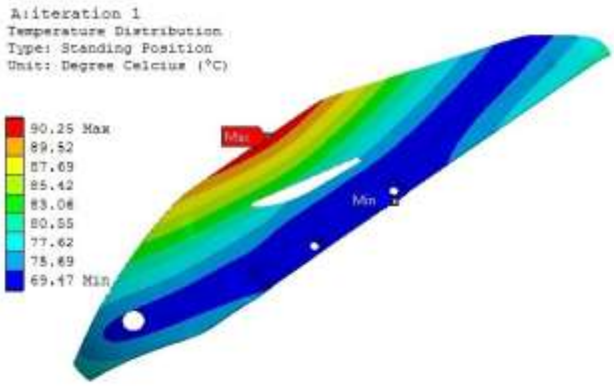
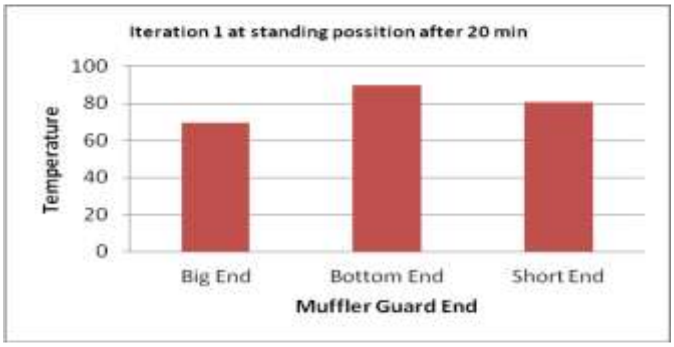


Fig-2- Temperature distribution for standing position

Muffler Guard End	CFD (°C)
Big End	69.47
Bottom End	90
Short End	80.55

Table-1- CFD Values of Temperature for Iteration 1



Graph-1- Temperature vs. Muffler Guard End for Iteration 1

Iteration 2

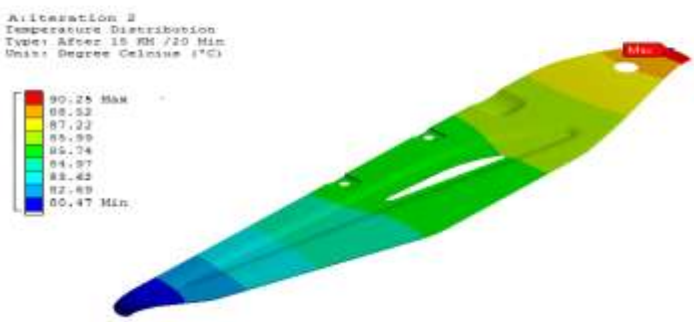
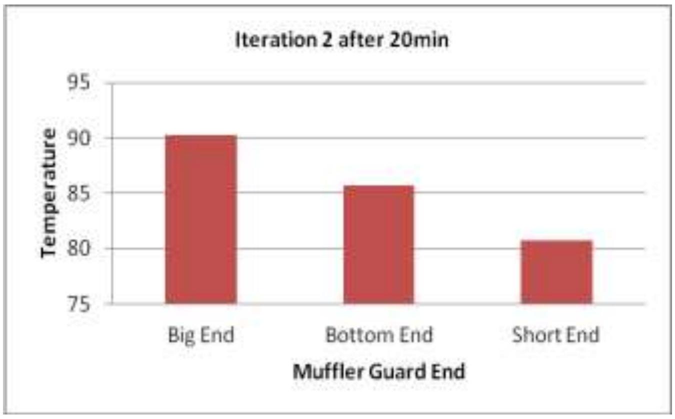


Fig-3- Temperature distribution after 20 Minutes

Muffler Guard End	CFD (°C)
Big End	90.25
Bottom End	85.74
Short End	80.74

Table-2- CFD Values of Temperature for Iteration 2



Graph-2- Temperature vs. Muffler Guard End for Iteration 2

Iteration 3

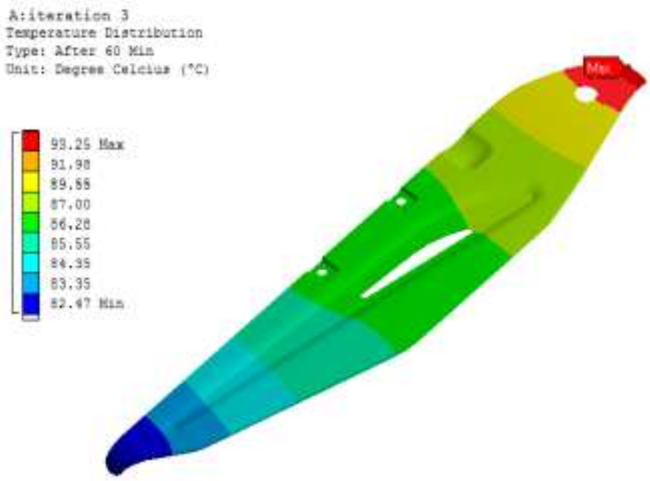


Fig-4- Temperature distribution after 60 Minutes

Muffler Guard End	CFD (°C)
Big End	93.25
Bottom End	86.28
Short End	82.47

Table-3- CFD Values of Temperature for Iteration 3

Graph-3-Temperature vs. Muffler Guard End for Iteration 3

B) Thermal Analysis of Modified Design for Muffler Guard

Iteration 1

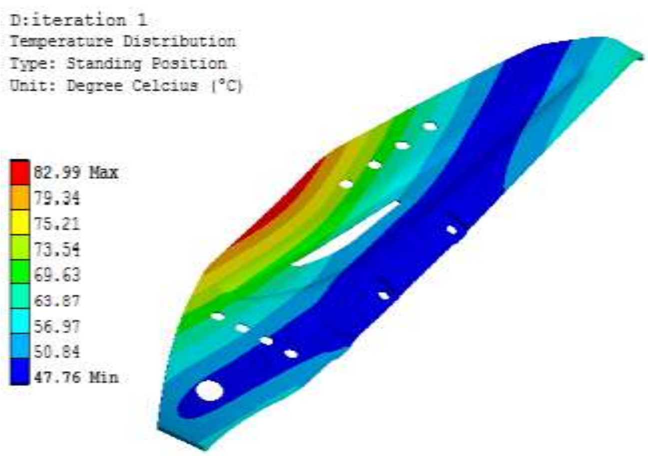
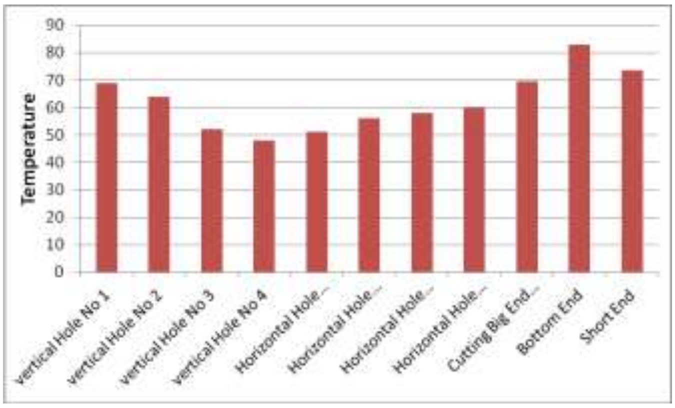


Fig-5- Temperature distribution for standing position

Muffler Guard Respective Points	CFD (°C)
vertical Hole No 1	69
vertical Hole No 2	63.87
vertical Hole No 3	52
vertical Hole No 4	48
Horizontal Hole No 1	51
Horizontal Hole No 2	56
Horizontal Hole No 3	58
Horizontal Hole No 4	60
Cutting Big End Line	69.63
Bottom End	82.99
Short End	73.54

Table-4- CFD Values of Temperature for Iteration 1



Graph-4- Temperature vs. Respective Points for Iteration 1

Iteration 2

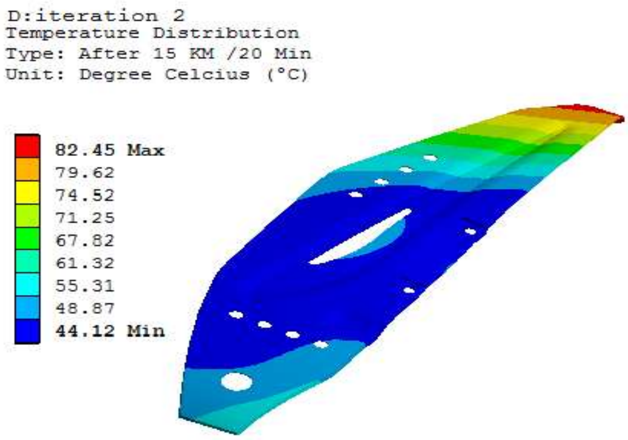
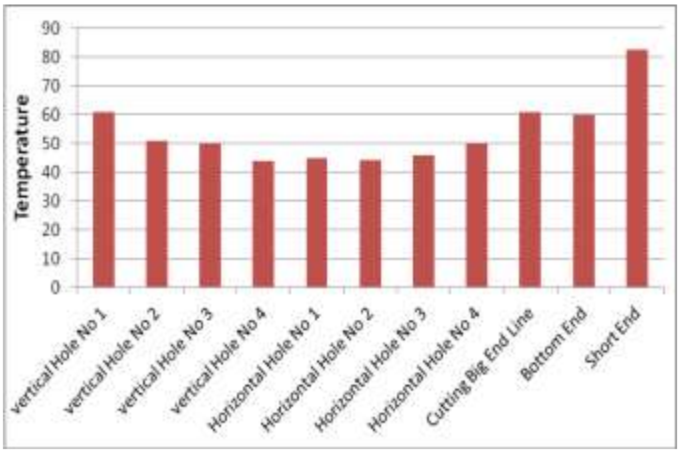


Fig-6- Temperature distribution after 20 minutes

Muffler Guard Respective Points	CFD (°C)
vertical Hole No 1	61
vertical Hole No 2	51
vertical Hole No 3	50
vertical Hole No 4	44
Horizontal Hole No 1	45
Horizontal Hole No 2	44.12
Horizontal Hole No 3	46
Horizontal Hole No 4	50
Cutting Big End Line	61
Bottom End	60
Short End	82.45

Table-5- CFD Values of Temperature for Iteration 2



Graph-5- Temperature vs. Respective points for Iteration 2

Iteration 3

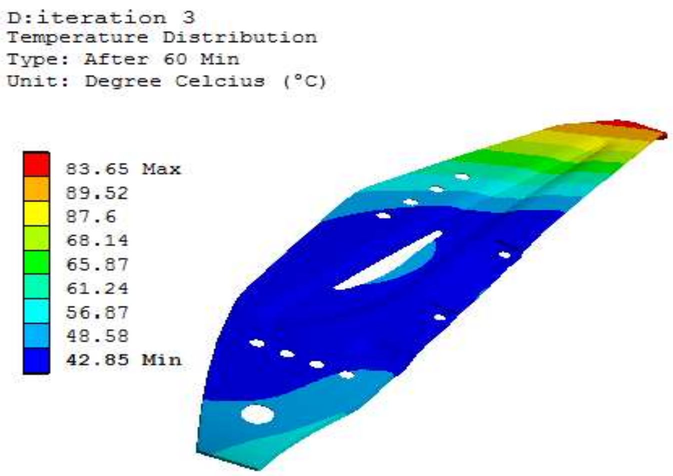
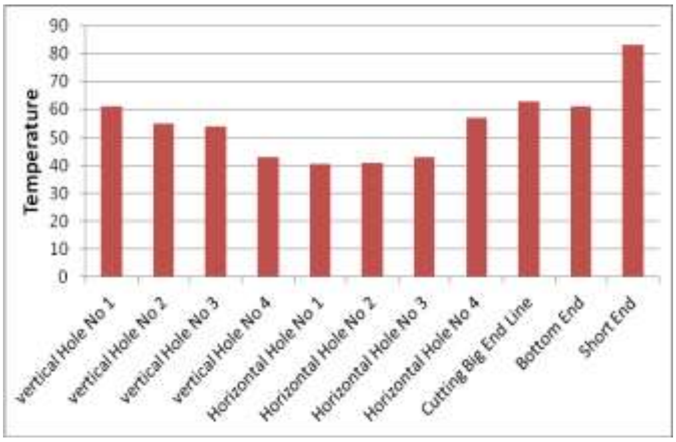


Fig-7- Temperature distribution after 60 Minutes

Muffler Guard Respective Points	CFD (°C)
vertical Hole No 1	61.24
vertical Hole No 2	55
vertical Hole No 3	54
vertical Hole No 4	42.85
Horizontal Hole No 1	40.5
Horizontal Hole No 2	41
Horizontal Hole No 3	42.85
Horizontal Hole No 4	56.87
Cutting Big End Line	63
Bottom End	61.24
Short End	83

Table-6- CFD Values of Temperature for Iteration 3



Graph-6- Temperature vs. Respective points for Iteration 3

4. CONCLUSIONS

The thermal analysis of muffler guard following results drawn after observing the graphs plotted from CFD analysis are,

1. Graph No.3 for temperature with muffler end the basic design of muffler guard shows temperature value increases.
2. Graph No.6 for temperature with respective points the modified design of muffler guard shows temperature value decreases.

Using CFD analysis we tried to validate results for muffler guard.

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