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Experimental and CFD Analysis of Muffler Guard of Two Wheeler for XTREME 200R Bike

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Abstract : The automotive exhaust system is exposed to high temperature as the hot gases passes through it. The uniform distribution of heat is needed to enhance life of exhaust system components. Controlling the exhaust gas temperature, higher performance of the engine can be achieved. Measuring the exhaust gas temperature from automotive exhaust system is useful to understand the engine processes. The muffler guard or heat shields are used to protect the components and human body touching over it. Generally muffler guard design based on ergonomic, aesthetic consideration and heat dissipation behavior. In this project to study and analysis of current design of muffler guard and modify design of muffler guard. Comparison of improved design with old design and effectiveness. In order to obtain the optimized thermal performance of muffler guard for XTREME 200R Bike carried out by experimental and using analysis tool likes CFD and FEA in ANSYS software. For this project performance parameters such as temperature, gap between muffler and muffler guard along that carried out the performance parameter at various plotting graphs. Generally, exhaust guards are designed based on both ergonomic and numerical design. Target of this study is to analyze the current design of the guard for Hero extreme using analysis tools like CFD and experimental trial to study different parameters of the heat shield design**.**

Index Terms–*Muffler guard, Temperature (In Degree Celsius) big end, short end, bottom end*

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I. INTRODUCTION

Heat shields protect an object or gaseous area from heat. More specifically, in many applications heat shields attempt to limit conductive, convective, and or radiant heat transfer. Conductive heat transfer refers to the transfer of heat across a medium, whether the medium is solid or fluid. Convective heat transfer occurs between a moving fluid and a surface of an object. Radiant heat transfer occurs when excited atoms emit electromagnetic radiation, which travels from the heat source to a distant object. One method used to protect against the transfer of heat is to place a barrier, such as a sheet of metal, which is generally thermally conductive material, between the heat source and the protected object or gaseous area. A surface of the barrier exposed to the heat source may reflect some indirect heat, but it also absorbs some of the heat. As some of the heat is absorbed, the exposed surface becomes heated. One disadvantage of this prior art is that the conductive properties of the barrier cause the surface heat to flow through the barrier by way of conduction, ultimately heating the opposing or protected shield surface. The elevated temperature of the protected surface then increases heat transfer from the protected surface of the barrier to the object or area that the barrier is trying to protect.The automotive exhaust system is exposed to high temperature as the hot gases passes through it. The uniform distribution of heat is needed to enhance life of exhaust system components. Controlling the exhaust gas temperature, higher performance of the engine can be achieved. Measuring the exhaust gas temperature from automotive exhaust system is useful to understand the engine processes. The exhaust gases coming out from engine are at very high speed and at high temperature. Exhaust system of an automobile from which exhaust gases coming out from combustion chamber have silencer or muffler which is integral part of exhaust system. High temperature in exhaust system leads to thermal, vibration and fatigue failures causing the cracks in silencer. So it is necessary to study the heat transfer analysis for hot section of exhaust system for better performance of automobile.

Heat shields are planned to shield a section from holding excess high temperature either by scattering, reflecting basically holding the hotness. In an auto controlled by an inward smouldering engine, the exhaust system from the engine ventilation framework to the tailpipe is the best creator of hotness after the engine itself. The surfaces of the parts that truly pass on the exhaust gasses can attain to temperatures up to around 900°C. Since a drain frequently passes close essential and thermally sensitive sections, it is especially basic to shield the fragile parts and modules from high temperature. Heat shields are also used to cool engine mount vents. When a vehicle is at higher speed there is enough ram air to cool the under hood engine compartment, but when the vehicle is moving at lower speeds or climbing a gradient there is a need of insulating

the engine heat to get transferred to other parts around it, e.g. Engine Mounts. With the help of proper thermal analysis and use of heat shields, the engine mount vents can be optimized for the best performances

II. OBJECTIVES

The key objectives of current work are as given below:

1. Study of the exhaust system of two-wheeler.
2. Study of the effect of the high temperature exhaust gases on other component nearby exhaust compartment.
3. Study of the thermal behavior of existing heat shields and different causes of failures of it.
4. Finite element analysis of heat shield of two wheeler using ANSYS.

Comparison of improved design with old and its effectiveness

III. EXPERIMENTAL SETUP –

For the experimental analysis of muffler guard of bike the require equipment are temperature sensor, thermocouple, muffler guard, screw for mounting, and the bike XTREME 200R . Muffler guard is mounted on the silencer with the help of screw properly. Initially we took the original design of muffler guard and mounted it, then for next 20 minutes the bike is kept in idling condition and the readings are noted down with the help of temperature sensor by pointing it to measure the temperature of big end, short end and then bottom end. Thereafter for next 20 minutes with an average speed of 40 Km/hr and measure the temperature. Again for next 20 minutes temperature at big end ,bottom end, short end of muffler are taken.

Then we modified the muffler in three different stages which are shown in following figures by cutting the big end and by providing the horizontal and vertical holes drilled on the muffler guard. The temperature at respective points are taken and this way the experimental analysis is carried out. Thereafter the CFd analysis is also carried out and the results are compared by using various bar charts.

Fig1 Original Muffler Guard(Case 1)

Fig2 Muffler Guard Cut At Big End(Case 2)

Fig3 Muffler Guard Cut At Big End With 4 Vertical Holes (Case 1)

Fig4 Muffler Guard Cut At Big End With 4 Vertical and 4 Horizontal Holes (Case 1)

ISSN: 2349-7947
44 – 48

IV. DESIGN OF MODEL FOR ANALYSIS

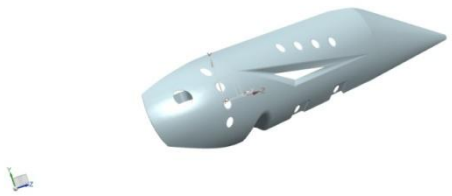


Fig 5 Model In Nx

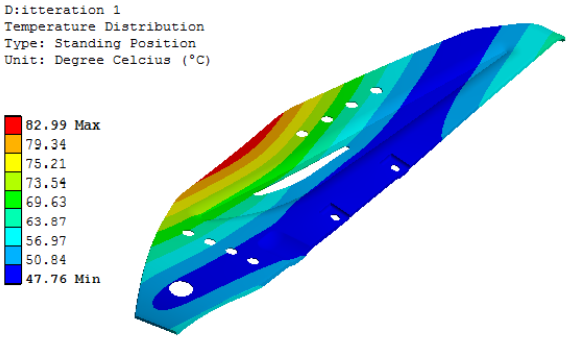
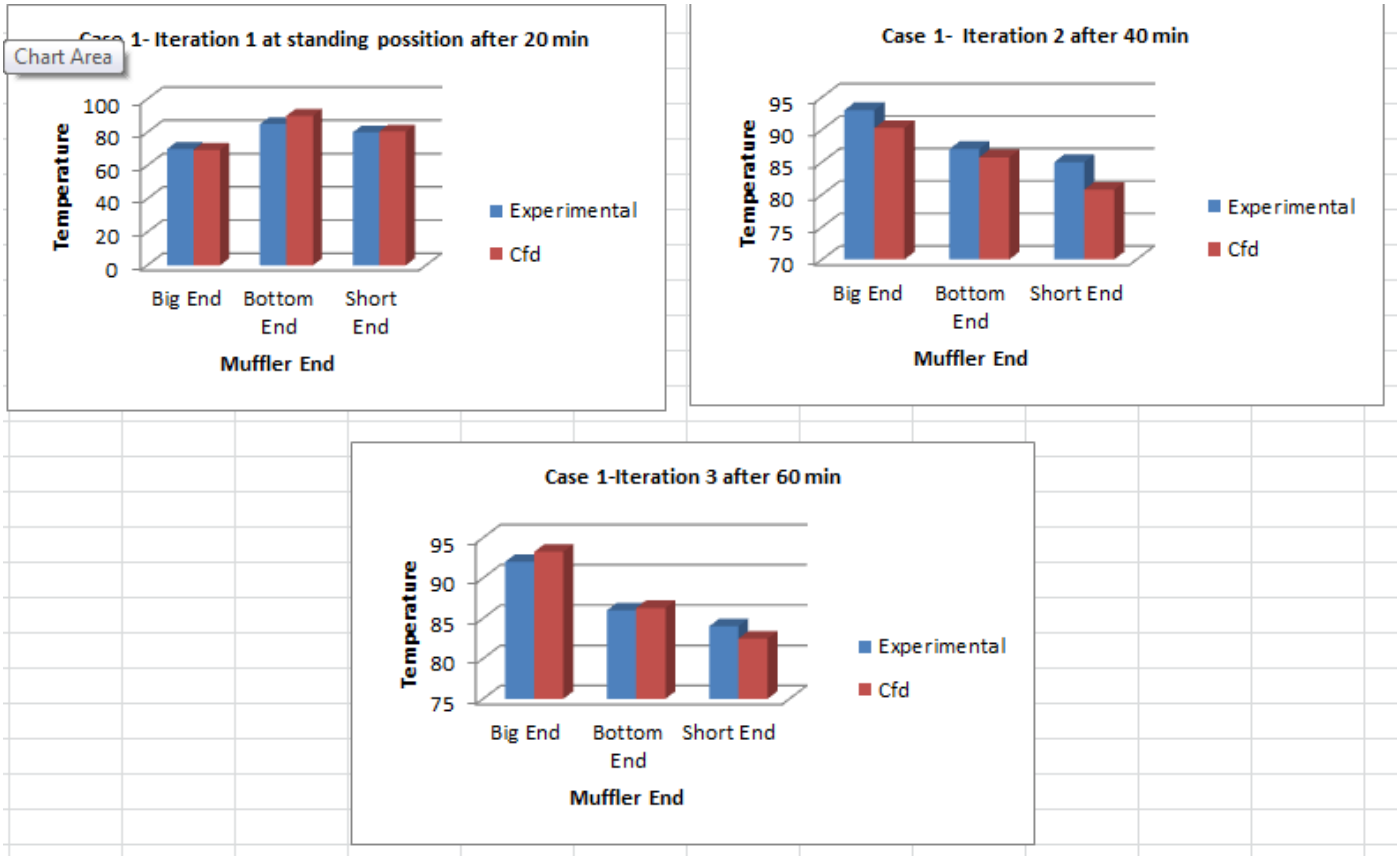


Fig 6 CFD Model Of Case 4

V. ANALYSIS OF EXPERIMENTAL and CFD RESULTS

For Case 1 –

In this case the muffler guard is fiteed as it is without doing any modification and readings are taken as shown in Fig 1 and readings are taken.

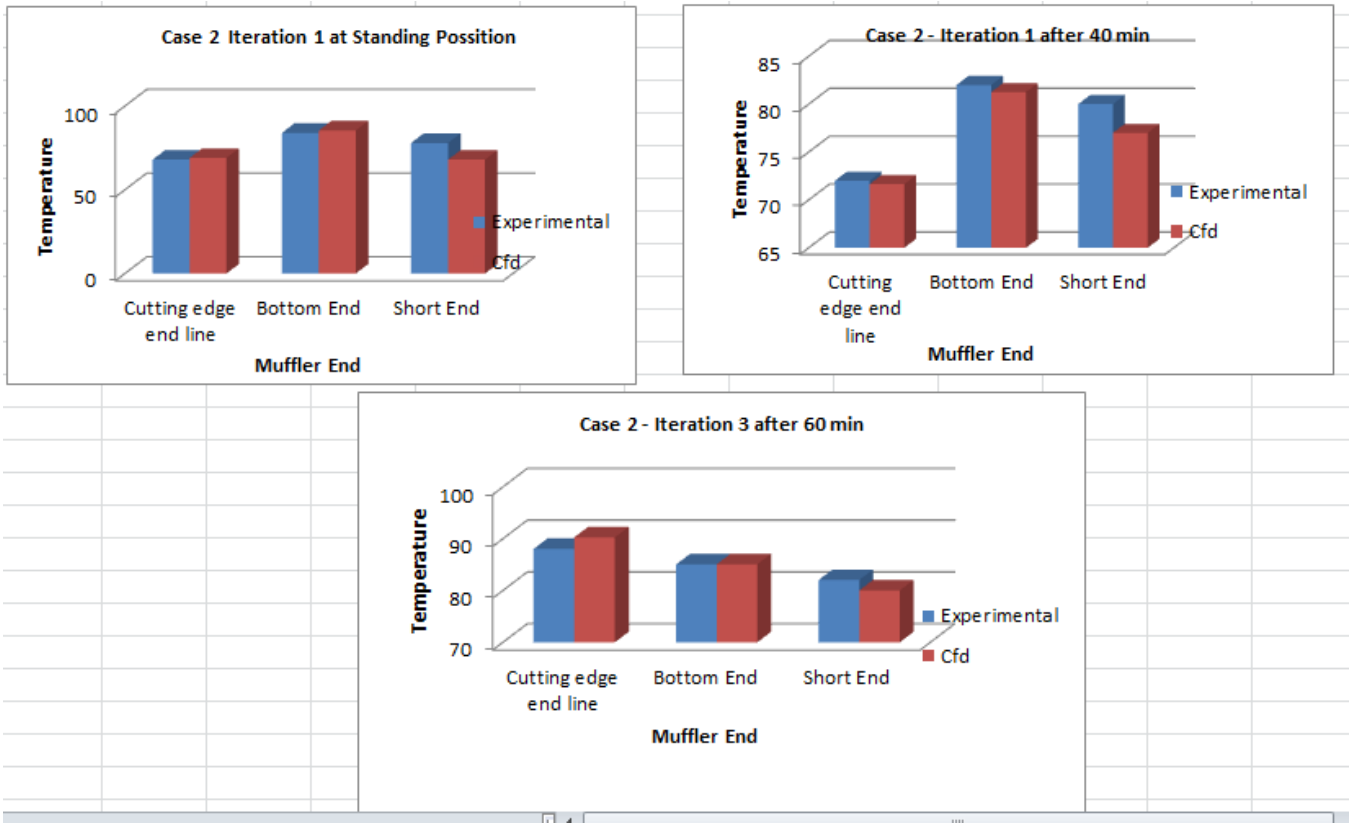


Graph No 01 – Case I (Standing, for 40 minutes and for 60 minutes)

For Case 2 –

In this case the big end of the muffler guard is cut and then fitted to silencer readings are taken.

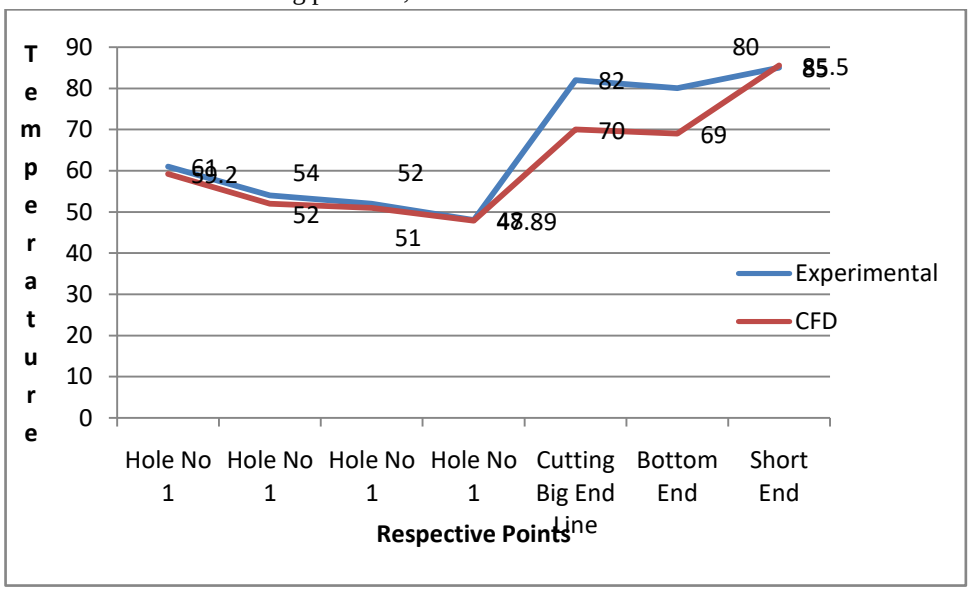
ISSN: 2349-7947
44 – 48



Graph No 02 – Case I (Standing, for 40 minutes and for 60 minutes)

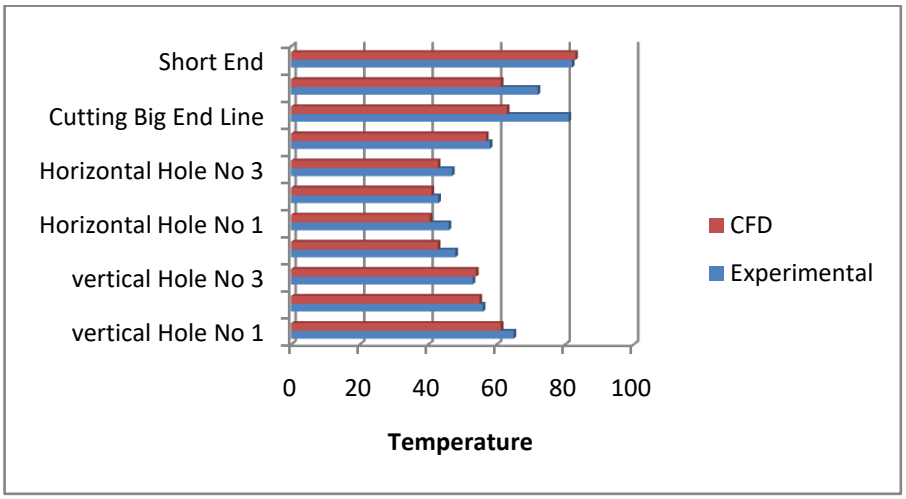
For Case 3 –

In this case four vertical hoes are drilled near to the cut big end and the same experimental procedure is repeated for further measurement. The first iteration is in idling position , for second iteration the bike is driven for 20 minutes amd readings are taken , for third iteration again the bike is driven for next 20 minutes. The graph shown below is of third iteration that is after 60 minutes readings are taken



Graph No 03 – Case III (for 60 minutes)

For Case 4 –



Graph No 04 – Case III (for 60 minutes)

VI.CONCLUSION

The automotive exhaust system is exposed to higher temperature as hot gases passes through it. The uniform dissipation of heat is needed for muffler guard and for this the gap between muffler guard and the silencer should be such that proper circulation of air should take place. After studying above mentioned results it comes to know that modification of muffler guard in different ways definitely results in maintaining the temperature of silencer.

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