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RESEARCH ARTICLE

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THERMAL STRESS AND DEFORMATION ANALYSIS BY FINITE ELEMENT METHOD

ANKIT SHUKLA[1], Prof. VISHAL ACHWAL[2]
[1]PG Scholar, Automobile Engg., SIRT, Indore (M.P.),India
akki120791@gmail.com
[2]Professor, Mechanical Engg. Department, SIRT, Indore (M.P.),India
vishalachwal60@gmail.com

ABSTRACT
An exhaust manifold system collects the exhaust gases from multiple cylinders into one pipe. Exhaust manifolds are generally simple cast iron or stainless steel units which collect engine exhaust gases from multiple cylinders and deliver it to the exhaust pipe. The performance exhaust headers is mainly to decrease flow resistance, and to increase the volumetric efficiency of an engine, resulting in a gain in power output. The exhaust manifold has to withstand the pressure of exhaust gases and amount of heat generated in the engine. A parametric model of exhaust manifold has been developed to predict the thermal stress and deformation behavior. The parametric model is created in 3D modeling software Pro/Engineer. Present used materials for exhaust manifold are cast iron or stainless steel. Static analysis is done on the exhaust manifold to determine variation Stress and Deformation. The analysis is to be done using Stainless Steel are present used materials. And also we are doing analysis using stress and deformation. We compare the results to verify the best material for exhaust manifold. The accurate static simulation could permit critical design parameters to be identified for improved life. The analysis is done using ANSYS on workbench of Static analysis performed for calculating the Stress and Deformation.
Keywords-Exhaust Manifold, Analysis, Deformation, Stress

INTRODUCTION

A Exhaust Manifold or header gathers the fumes gasses from different barrels into one pipe. Ventilation systems are for the most part straightforward cast iron or stainless steel units which gather motor fumes gasses from numerous chambers and convey it to the fumes pipe. The objective of execution fumes headers is principally to diminish stream resistance , and to expand the volumetric productivity of a motor, bringing about a pick up in control output. The Exhaust Manifold needs to withstand the weight of fumes gasses and measure of warmth created in the engine. A parametric model of Exhaust Manifold has been produced to anticipate the transient warm conduct. The parametric model is made in 3D displaying programming Pro/Engineer. Introduce utilized materials for Exhaust Manifold are solid metal or stainless steel. Relentless warm examination is done on the Exhaust Manifold to decide variety temperature circulation after some time. The investigation is to be finished utilizing Stainless Steel are available utilized materials. And furthermore we are doing examination utilizing stress and misshaping. We contrast the outcomes with check the best material for ventilation system. Relentless warm examination decides temperatures and other warm amounts that change after some time. The variety of temperature dissemination after some time is of enthusiasm for some applications, for example, with cooling. The exact warm reattachment could allow basic outline parameters to be distinguished for enhanced life. The investigation is finished utilizing ANSYS on workbench of Steady state warm examination performed for computing the warmth flux and warm distinction or logically warm flux is likewise figured in this investigation. Select the ideal outline and its conduct of physical properties.

Figure1: Exhaust Manifold Model

II Problem Definition

Motor Exhaust Manifold are the metal parts that are in charge of gathering debilitate gasses and transporting them to the fumes for ejection from the tailpipe. They are dashed to the motor barrel head(s) and are fixed utilizing a gasket known as the Exhaust Manifold gasket. The Exhaust Manifold gasket is generally a multi-layered gasket that contains metal and different materials that are intended to give the most ideal seal. As the Exhaust Manifold gasket is the first in the fumes framework, it is an imperative seal that ought to be examined if any issues emerge. When it comes up short or has any issues, it can cause a wide range of issues for the vehicle. Generally an awful or coming up short Exhaust Manifold gasket will create a couple of side effects that can alarm the driver of a potential issue.

1. Excessively noisy engine
2. Decrease in power, acceleration, and fuel efficiency
3. Burning smell coming from the engine bay

Material Properties

There are four EXHAUST Manifolds on which the analyses are going to perform, one is Exhaust Manifold and other are modified Exhaust Manifold. The mechanical properties of the Aluminum Alloy material being used in this analysis are show in Table no-5

Table 1 Material Properties

Material properties	Value
Density	2770 Kg/m^3
Young's modulus	71 Gpa
Poisson's ratio	0.33
Shear modulus	2.6692E+10 Pa
Tensile yield strength	280 Mpa
Tensile ultimate strength	310 Mpa

III. FE ANALYSIS ON THERMAL ANALYSIS

Apply boundary condition for different geometry is Exhaust Manifold.

Internal temperature=600C,800C,1000C

Thermal Conductivity=25W/m^{2}c

Surrounding temperature=25c

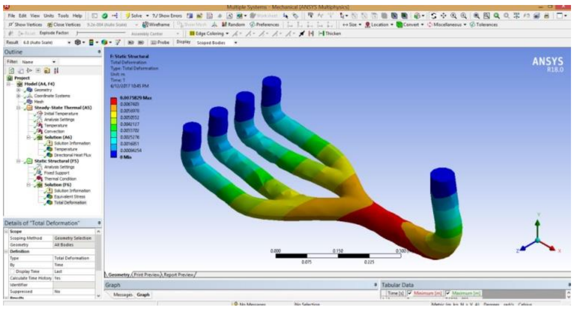

Figure 2a Deformation of Exhaust manifold at 600^{o}c

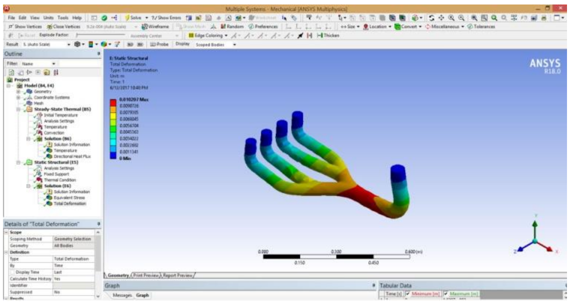

Figure 2b Deformation of Exhaust manifold at 800^{o}c

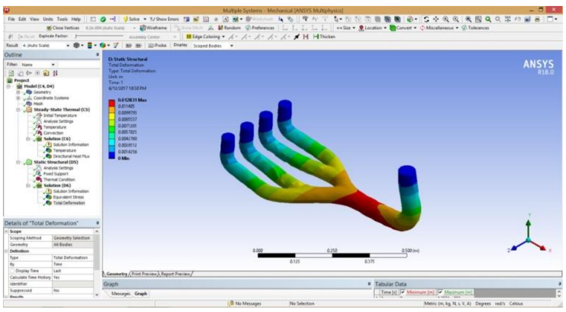

Figure 2c Deformation of Exhaust manifold at 1000^{o}c

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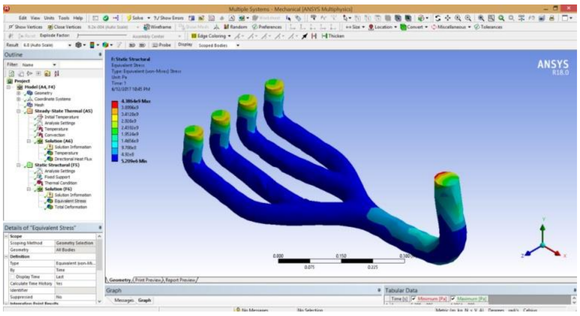


Figure 3a Stress of Exhaust manifold at 600°c

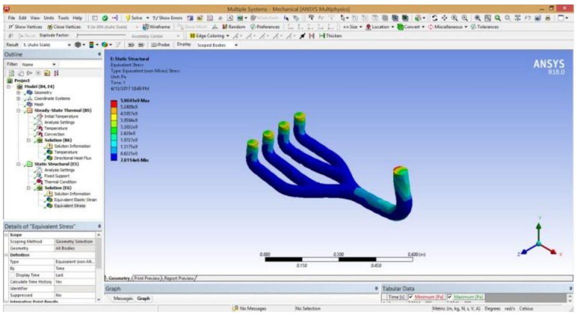


Figure 3b Stress of Exhaust manifold at 800°c

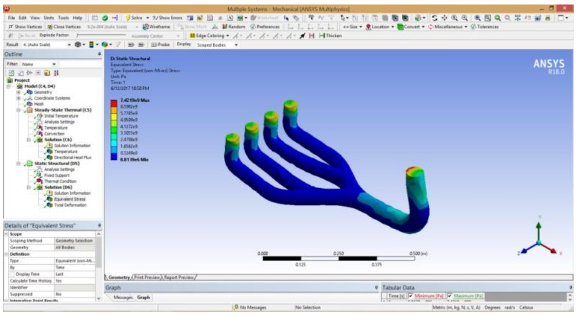


Figure 3c Stress of Exhaust manifold at 1000°c

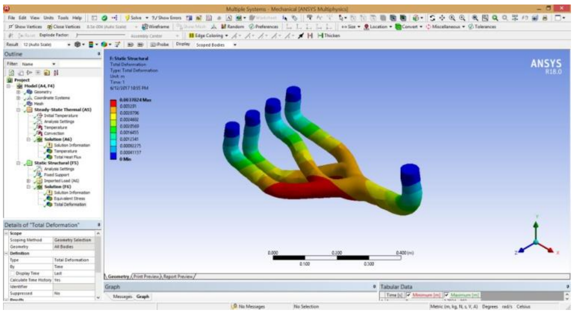


Figure 4a Deformation of Exhaust manifold at 600°c

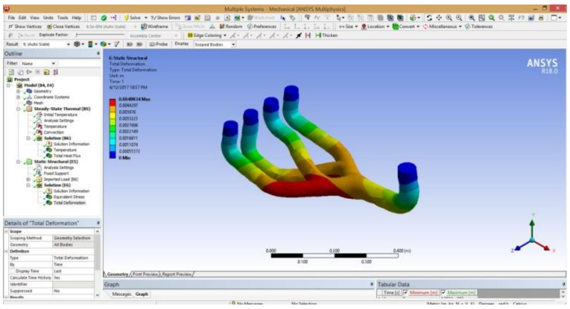


Figure 4b Deformation of Exhaust manifold at 800°c

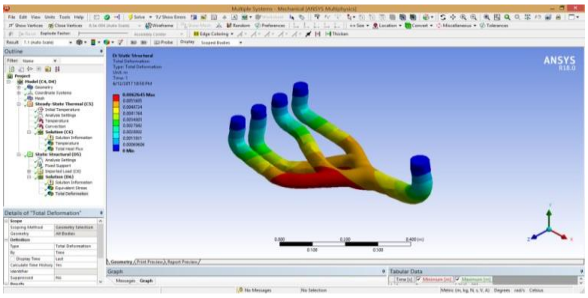


Figure 4c Deformation of Exhaust manifold at 1000°c

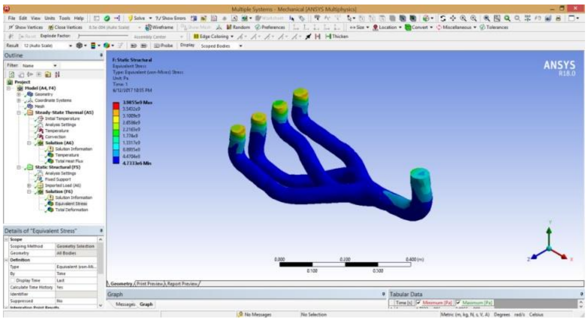


Figure 5a Stress of Exhaust manifold at 600°c

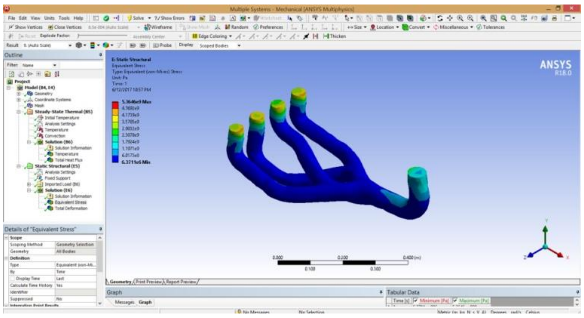


Figure 5b Stress of Exhaust manifold at 800°c

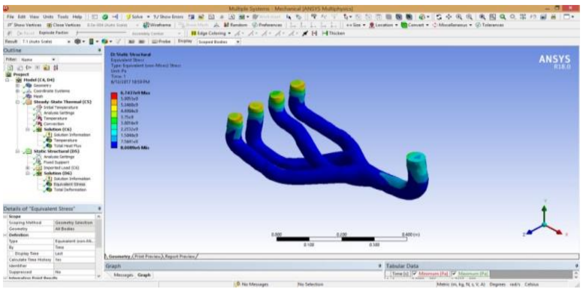


Figure 5c Stress of Exhaust manifold at 1000°c

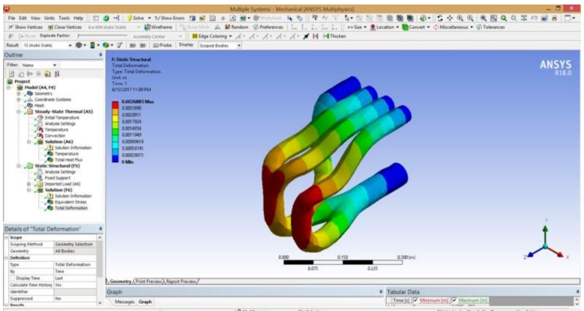


Figure 6a Deformation of Exhaust manifold at 600°c

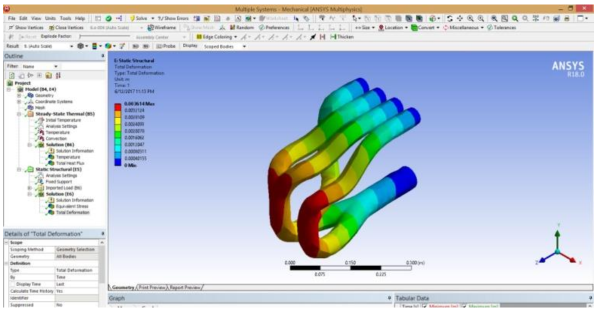


Figure 6b Deformation of Exhaust manifold at 800°c

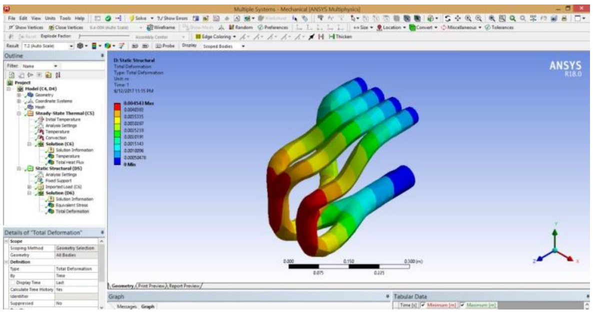


Figure 6c Deformation of Exhaust manifold at 1000°c

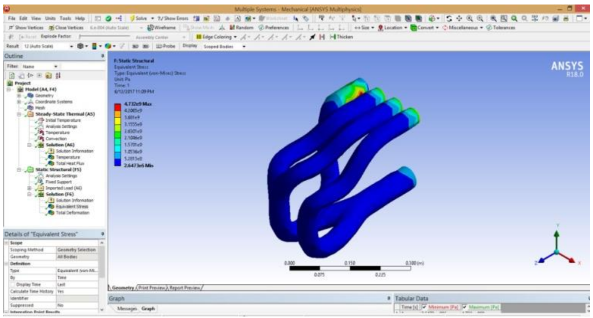


Figure 7a Stress of Exhaust manifold at 600°c

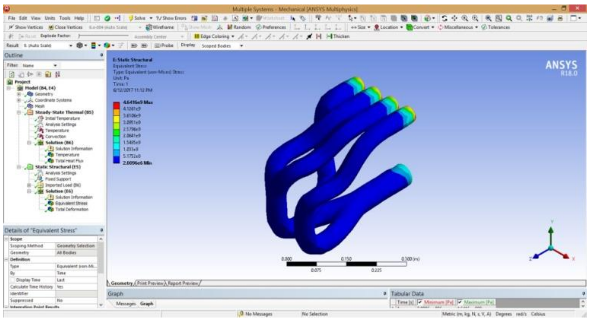


Figure 7b Stress of Exhaust manifold at 800°c

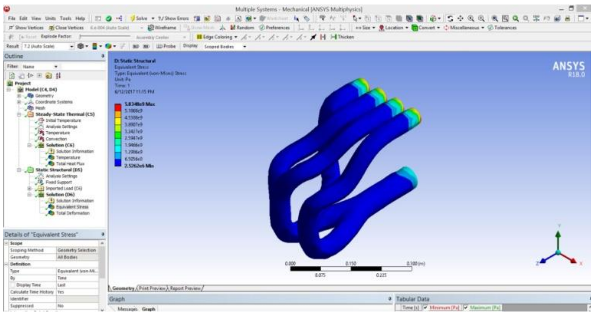
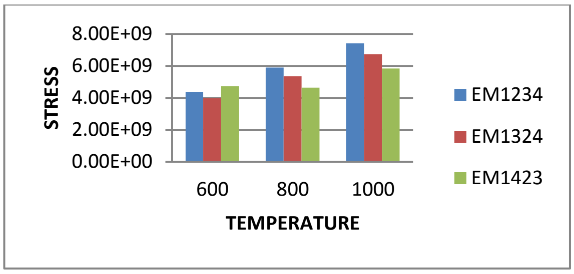


Figure 7c Stress of Exhaust manifold at 1000°c

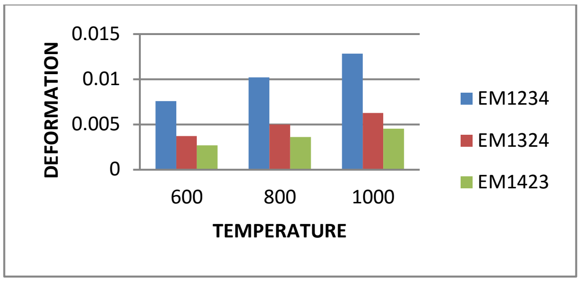
IV. Discussion of Results

In Figure 12, show the compression between the all different geometry.

Graph 1 between stress and temperature



Graph 2 between stress and temperature



V Conclusions

In this thesis, Exhaust Manifold is designed and analysed for LCV. The Exhaust Manifold is designed for the static condition. Static analysis is conducted on exhaust manifold. The results show: The stresses in the Exhaust Manifold1423 of design are much lower than that of the allowable stress. A comparative study has been made between Exhaust Manifold for deflection, stresses. From the results, of static analysis we observed that the Exhaust Manifold is lighter and more economical than the others manifolds with similar design specifications. This study will help to understand more the behaviour of the Exhaust Manifold and give information to improve the static condition of the exhaust manifold using CAE tools. It can help to reduce cost and times in research and development of new product. Finite element method using CAE tool like ANSYS-18 Workbench prove the reliability of the validation methods based only on simulation, thereby saving time, This work will help to understand linear static behavior of the composite Exhaust Manifold and simulation data for the researcher's to improve the fatigue life of the Exhaust Manifold using Computer Aided Engineering tool.

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