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# Design and Analysis of Aged Exhaust Manifold

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**ABSTRACT:** In an automobile engine, exhaust system is an important part which carries hot gases from the cylinder to atmosphere and also reduces the noise of the engine. An exhaust system consist of cylinder head, manifold, turbocharger, catalytic converter and muffler. The objective of this project is to modal analysis of multi cylinder engine exhaust manifold used in TATA tipper BS-II. The manifold is to be analysed for aged exhaust manifold before coating and analysed for after aluminium coating. Compared the flow characteristics of non-coated and coated aluminium exhaust manifold.

**KEYWORDS:** Exhaust Manifold, aluminiumcoating, before coating and after coating.

## I. INTRODUCTION

An exhaust manifold is a series of connected pipes that bolt directly onto the engine head. it is an integral part of the exhaust system. hot exhaust gas from the exhaust ports on the engine's cylinder head is funneled through the pipes and into a single collector pipe. from there, it is sent to the exhaust pipe. exhaust manifolds are a necessary component of the exhaust system. their design is optimized to ensure exhaust gases flow efficiently from the engine combustion chamber without creating any back pressure. a properly functioning exhaust manifold is important to prevent uneven power and engine vibrations. there are two main design configurations for exhaust manifolds, four-into-one and four-into-two. each design has the same primary function, with the main differences being performance and cost. the other main difference among exhaust manifolds is their construction figure1.1. they are generally made from either cast iron or welded tubular steel. exhaust manifolds are made either from cast iron or one of a few types of steel. the majority of exhaust manifolds are made from cast iron, as it is relatively inexpensive and lasts a long time. the drawbacks to cast iron manifolds are that they are quite heavy and tend to get brittle with age and exposure to the heat cycles of an engine. tubular steel exhaust manifolds are known for having better exhaust flow and are, therefore, found on many performance vehicles. stainless steel exhaust manifolds are the most expensive, but are rust-resistant and extremely long lasting. less expensive aluminized steel manifolds offer many of the benefits of stainless ones, but will rust if the outer layer is scratched.

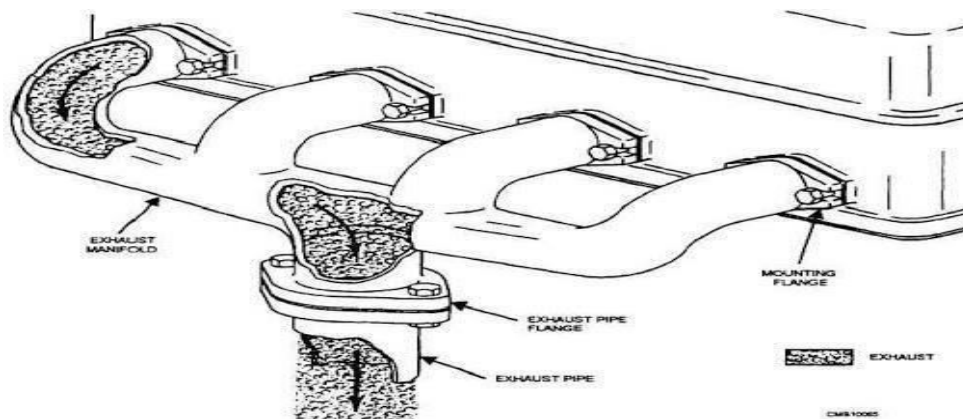


Figure 1.1

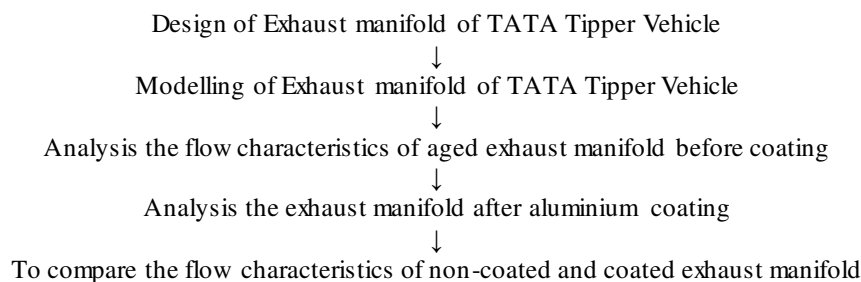
## II. RELATED WORK

Software used:

CREO for modelling

ANSYS for Heat transfer and Modal analysis

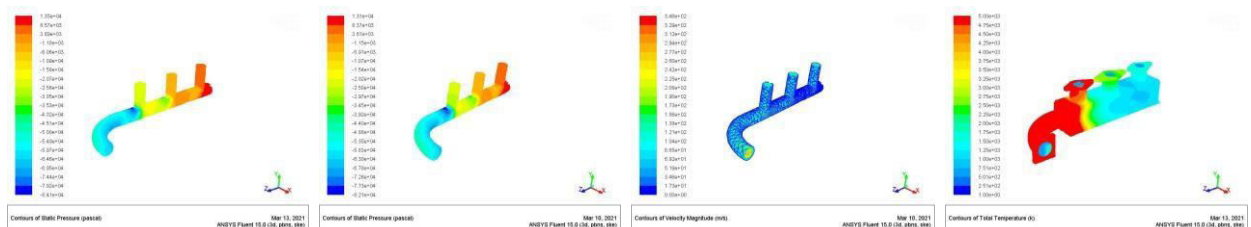
## III. METHODOLOGY



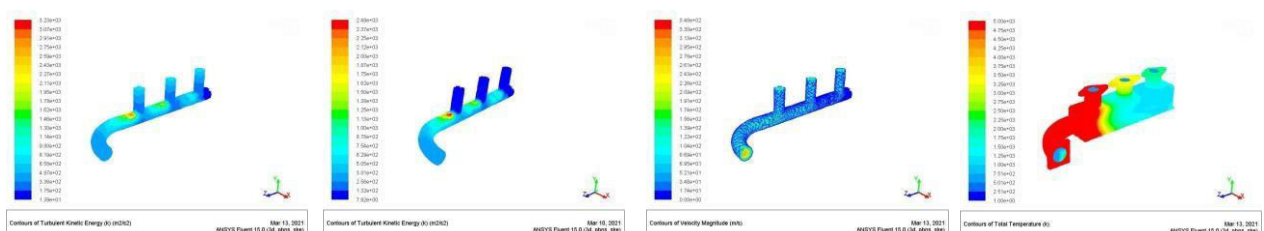
## IV. EXPERIMENTAL RESULTS

As a consequence of reducing the exhaust emission from the automotive engine, the exhaust gas temperature tends to be raised, and thereafter the durability of the materials of the exhaust components has to be improved. The present work applied the aluminising pack cementation to the steel exhaust manifold with the aim at increasing the high temperature corrosion resistance of this part.

Before coating:



After coating:



The exhaust manifold is designed and modelled using CREO software and CFD analysis is done for two cases such as with coating and without coating. The static pressure, Turbulent Kinetic Energy, Velocity, Total Energy, Mass flow rate are determined for two cases

RESULTS	CASE 1 (Non Coating)	CASE 2 (Coating)
Static Pressure (Pa)	1.35e4	1.31e4
Turbulent Kinetic Energy (m2/s2)	3.23e3	5.55e3
Velocity ( m/s)	3.48e2	3.71e2
Total Enthalpy (J/kg)	2.38e6	2.84e6
Mass flow rate (kg/s)	1.049	1.21

## V. CONCLUSION

It is identified that exhaust manifold with coating (CASE 2) has higher Turbulent Kinetic Energy, Velocity, Total Energy, Mass flow rate as compared to Non coating (CASE 1). After coating the static pressure also reduced. Hence the performance of exhaust manifold with coating is more than without coating

## REFERENCES

1. Muthaiah PLS, Kumar MS, Sendilvelan S. CFD Analysis of catalytic converter to reduce particulate matter and achieve limited back pressure in diesel engine. Global journal of researches in engineering A: Classification (FOR) 091304,091399, 2010; 10(5).
2. Kamble PR, Ingle SS. Copper Plate Catalytic Converter: An Emission Control Technique, SAE Number 2008-28-0104.
3. Beardsley MB et al. Thermal Barrier Coatings for Low Emission, High Efficiency Diesel Engine Applications, SAE Technical Paper 1999; 1: 2255.
4. JacobE, Lammermann R, Pappenherimer A, Rothe D. Exhaust Gas After treatment System for Euro 4: Heavy Duty Engines – MTZ 6/2005.
5. Jacobs T, Chatterjee S, Conway R, Walker A, Kramer J, Mueller-Haas K. Development of a Partial Filter Technology for Hdd Retrofit, Sae Technical Paper 2006-01-0213.
6. Lahousse C, Kern B, Hadrane H, Faillon L. Backpressure Characteristics of Modern Three-way Catalysts, Benefit on Engine Performance, SAE Paper No. 2006011062, 2006 SAE World Congress, Detroit, Michigan, April 36, 2006.
7. N. Sabareesh, P. Shiva Raju, M. Achuth Reddy, Srinivas A. S, “design and analysis of exhaust manifold”, International Journal of Advance Research in Science and Engineering, ISSN: 2319–8346, Vol. 6 Iss. 1, 2017.





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