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Exhaust Optimization for Formal Student Vehicle

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Abstract: ***The Exhaust manifolds collects the exhaust gases from the engine after the combustion process in cylinders and discharge burn gas carbon monoxide, sulfur dioxide to the atmosphere through the exhaust system. The engine efficiency, combustion characteristics can be depend upon how the exhaust gases were removed from the cylinder. Design of an exhaust manifold for the internal combustion engine depends on many terms such as exhaust back pressure, velocity of exhaust gases etc. In this literature review, as per recent research on design of exhaust manifold, their performance evaluation using experimental methods as Numerical methods (CFD), various geometrical types of exhaust manifold and their impact of the performance have been collected and discussed.***

1. Introduction

Formula Student is a student engineering competition held annually around the different parts of the world. Student Teams DESIGN, BUILD, TEST & RACE a small scale formula style racing car.

The cars are judged on a number of criteria as listed below:
Design Evaluation, Brake Test, Cost evaluation, Acceleration, Business preparation, Skid-Pad Autocross and finally Endurance.

The exhaust system of a vehicle has several inherent design problems that must be considered and we should reduce their noise.

These characteristics impose severe limitations on what can be done for reduce the engine exhaust noise: teams have given below we should follow the rule given by event originations

- Very High Noise (100 to 120 decibel)
- High Temperatures (950 to 105oF)
- High Velocities (5,000 to 15,000 fpm)

There are many types of design done for noise reduction main target we should maintain noise level with (100to110decibel)
As per Exhaust sound should be less than 110decibel

It should be a free flow exhaust (to reduce back pressure)

And the length should be less than 45 cm from the rear end of the chassis.

A. Material used
Glass wool & ceramic wool
Stainless steel tubes
Aluminum plates & tubes (For outer case)

B. Phase involved in this process
Design the packaging of the manifold keeping in mind all the specifications and clearances (distance from firewall, fuel tank, electrical, outlet of the manifold etc.). Try to keep the first bend as far as possible from the engine exhaust outlet or you'll have a massive back pressure problem.

Sound test: The sound test is a critical test for passing the scrutinizing at the event. So, choose a muffler which helps maintain a balance between back pressures, exhaust flow and noise abatement. Simulations on Ricardo will help in calculating the optimum length and sound of the exhaust but, the final engine tuning after a physical sound test will still be required.

Material Selection: Usually stainless steel should do, but do a thermal analysis and accordingly choose the diameter, thickness and material of your exhaust manifold.

Mountings: Please make sure that it is flexibly mounted onto your chassis to allow the expansion and contraction of the metal
Exhaust Spring stiffness: If the exhaust is connected to the engine via springs make sure that they are of the right stiffness.

C. The process have been done for final output
As per design the exhaust pipe contain three parts stages with tail tube (fig003)and baffler tube (fig004) in between layer three stage inside the tube outer stretcher of the baffler tube cover by aluminum (fig002) sheet in between the baffler tube and aluminum glass wool have used to absolve sound .

Parts to be used

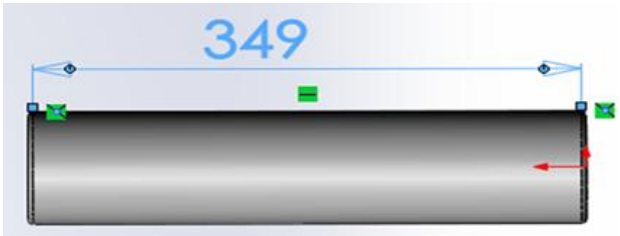

Figure 003

Figure 005

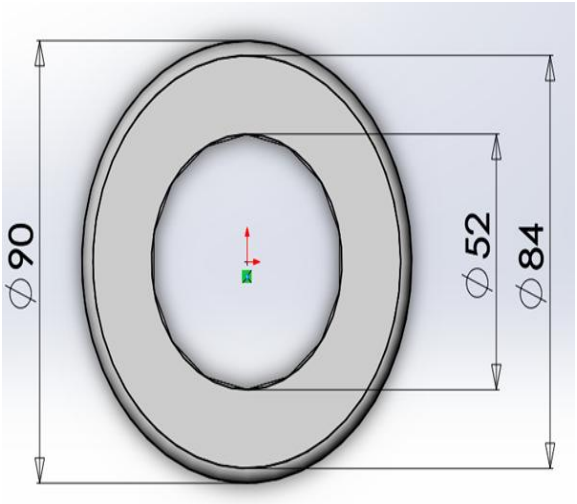

Figure 001

Figure 002

Figure 004