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To Lower Down The Backpressure Generated In Muffler Of Maruti Omni Van

Anand Malli [1] , Bhavik Nakrani [2] , Shubham Patel [3] , Sagar Magnadia [4] , Vikas Gondaliya [5]
And Guide Assistant Proffesor : Mr. Amit Galphade

[1] Anand Malli , Mechanical Engineering , SRICT , Vataria (Gujarat)
[1] anandmalli86@gmail.com
[2] Bhavik Nakrani , Mechanical Engineering , SRICT , Vataria(Gujarat)
[2] bhaviknakrani.97@gmail.com
[3] Shubham Patel , Mechanical Engineering , SRICT , Vataria(Gujarat)
[3] shubhamjpatel115@gmail.com
[4] Sagar Magnadia , Mechanical Engineering , SRICT , Vataria(Gujarat)
[4] Sagarmagnadia@gmail.com
[5] Vikas Gondaliya , Mechanical Engineering , SRICT , Vataria(Gujarat)
[5] gondaliyavikas8980@gmail.com

Abstract : *Muffler is device use for noise reduction in internal combustion engine, while on other hand it also effect the back pressure generated by flue gases coming out of exhaust gases from the engine. The aim is to reduce back pressure generated in muffler of four stroke petrol engine . For this Maruti-omni van will be use for reference and experimentation.*

Keywords : *Muffler , Backpressure , Experimental Test , 3-D Modeling , CFX Simulation*

I. INTRODUCTION

The project is based on the user defined problem faced by the individual van driver in Ankleshwar GIDC.

Using petrol engines mostly as main power element has increased the importance of the technical specification of the petrol engine itself and its other during-and-after design belongings. The muffler is defined as a device used for reducing the noise emitted by a engine. The muffler is engineered as soundproofing device designed to reduce the loudness of the sound pressure created by the engine by way of Acoustic quieting. Due to increased environmental concerns requiring less noise emissions combined with reduced emission of harmful gases, it is becoming very crucial to carefully design the exhaust system mufflers for road transport applications.

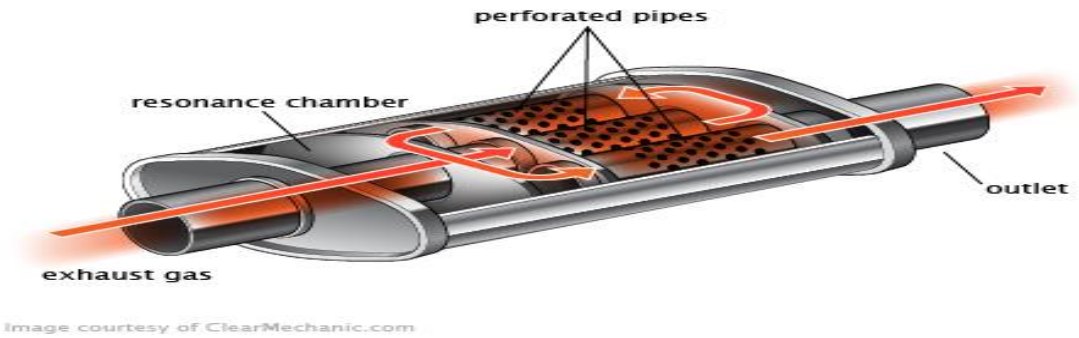

Figure 1 : Muffler

When the exhaust gases from inlet pipe pass through the perforations inside the shell, the gases get scattered in different directions. After reflection from the inside surface of the shell, the sound cancellation of waves occurs. The gases pass through the perforations multiple times and even get reflected from the shell surface. Due to the combined effect of these, the level of sound at the muffler outlet is reduced significantly.

There are two types of muffler : absorptive type & reactive type

In absorptive type , it is having straight pipe with holes drilled on it and covered outer body by noise absorbing material like steel wool or other fabric material . Whereas , in reactive there is series of pipes and chamber helps in reducing noise . it is seen that backpressure is significantly reduced more in absorptive type muffler compared to reactive muffler . but on other hand , noise is better reduced in reactive type compared to absorptive muffler .

Figure 2 : Absorptive Muffler

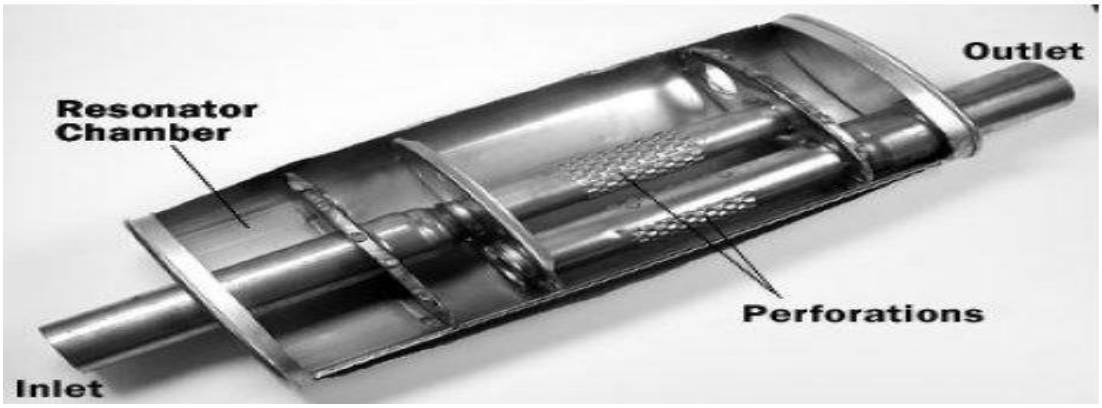

Figure 3 : Reactive Muffler

Backpressure usually refers to the pressure exerted on a moving fluid by obstructions against its direction of flow. The word back may suggest a pressure that is exerted on a fluid against its direction of flow indeed, but there are two reasons to object.

II. LITERATURE SURVEY

1) Ahmed Elsayed [1]et all had revealed that , the outlet exhaust gases temperature was found to decrease by 15% as the baffle cut ratio changed from 75% to 25% . The performance of a single hole regarding transmission loss was found to be better for single hole than higher number of holes.
2) Prakash Chandra Mishra [2]et all had revealed, chambered elliptic muffler developed least exhaust temperature ,whereas the gas density is least in case of turbo elliptic muffler but the velocity is highest in case of chambered elliptic muffler.
3) Takashi Yasuda[3]et all have propose that, it was found that the results of the simulation are in good agreement with experimental results at the middle order of the engine rotational frequency, although at the high order of engine, there exist differences caused by the flow noise which was not considered in the simulation.
4) M. Rahman[4]et all have propose that, the reactive portion of the muffler has been covered with a layer of absorptive material which considerably decreases the self generated noise of the muffler. The muffler is capable of attenuating noise by about 25 to 35 dBA.
5) Shubham Pal[5]et all have propose that, the length of resonator can be varied by pulling piston rod and can be set any position at which noise reduction is maximum by tightening of screw. The advantage of this is it can cancel noise of higher altitude,as they enter resonator. The resonator attenuate low frequency noise between 250Hz to 500Hz.
6) Daniel[6]et had revealed that, a vehicle muffler should be designed to meet all functional requirements as mentioned ,namely adequate insertion loss, minimal backpressure, space constraints be durable, produce desired sound, be cost effective.

III. EXISTING MODEL

First , same muffler was brought from scrap then , it was made to cut in order to measure the dimensions which would be needed in modeling the existing muffler in 3-D software . Dimensions were measured and recorded . After measuring dimension 3-D model was made in solidworks . After that , that model is to be converted into hollow to solid model ,in simple words hollow part becomes solid and solid part becomes hollow . Then after , model was converted in STEP file format in order to run in simulation software i.e. Ansys .

Figure 4 : Cut Section Of Scrap Muffler

Figure 5 : Measuring Dimension Of Existing Muffler

SR NO.	OBJECT	LENGTH	DIAMETER
1	MUFFLER	400	130
2	PIPE 1	255	35
3	PIPE 2	50	30
4	PIPE 3	250	25
5	PIPE 4	230	35
6	CHAMBER 1	190	130
7	CHAMBER 2	115	130
8	CHAMBER 3	95	130
9	BAFFLE 1	-	130
10	BAFFLE 2	-	130
(All dimensions are in mm)			

Table 1 : Recorded Dimensions Of Existing Muffler

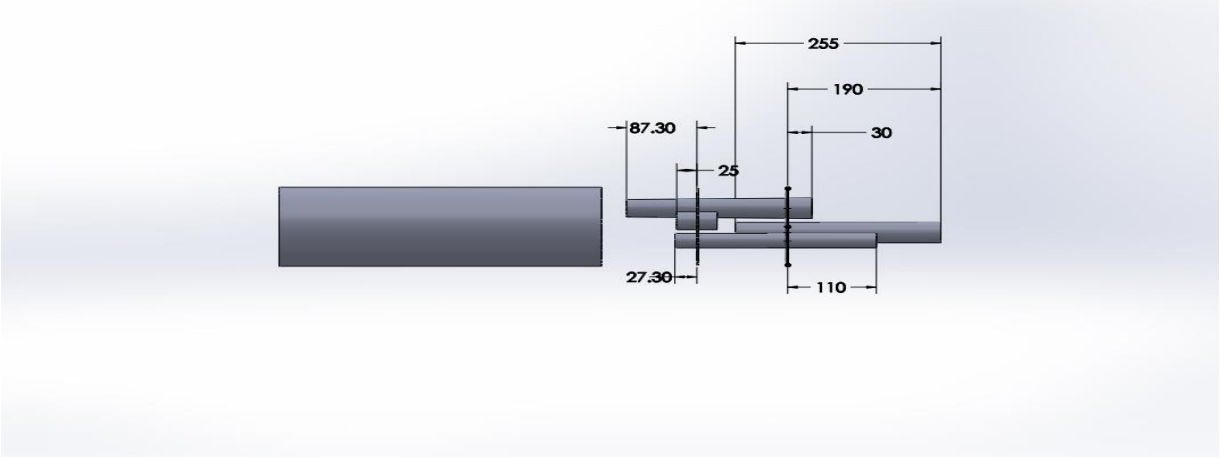

Figure 6 : Modeling Of According To The Above Dimensions Scrap Muffler

IV. EXPERIMENTAL WORK

Now , for simulation work , first solid to hollow model is saved or converted into STEP file form so that it can be easily imported in Ansys . But before that it has to be noted that ansys need some parameters to get run . For that it was measured experimentally and then recorded .
Parameter to be measured : pressure , noise , temperature , flowrate , velocity
Used instrument : pressure gauge , sound meter , thermometer , manometer

Figure 7 : Used Instruments

Sr No.	Parameter	Unit	Inlet	Outlet
1	Pressure	kPa	78.45	29.41
2	h_a	m	0.07	0.01
3	Velocity	m/s	43	17
4	Flow rate	m^3/s	0.0444	0.0101
5	Temperature	^0C	245	86
6	Sound	dBA	110	95

Table 2 : Experimental Measured Reading

V. SIMULATION WORK

Ansys software is used for CFX analysis .

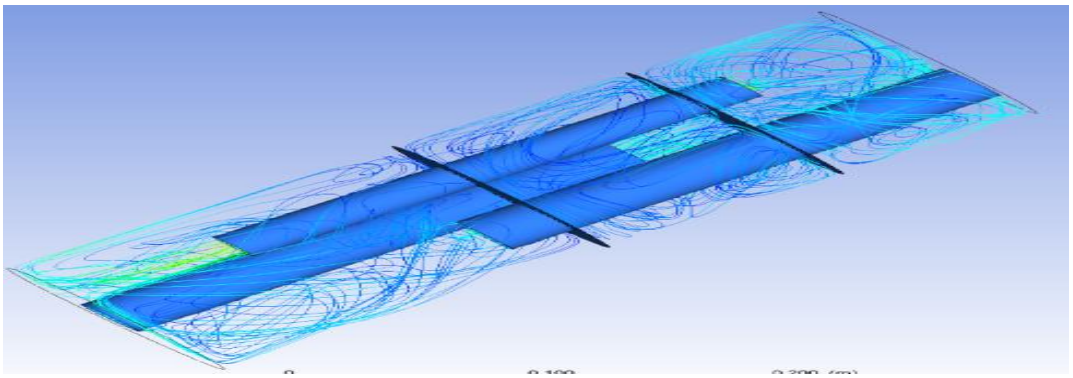

Figure 8 : Actual Model

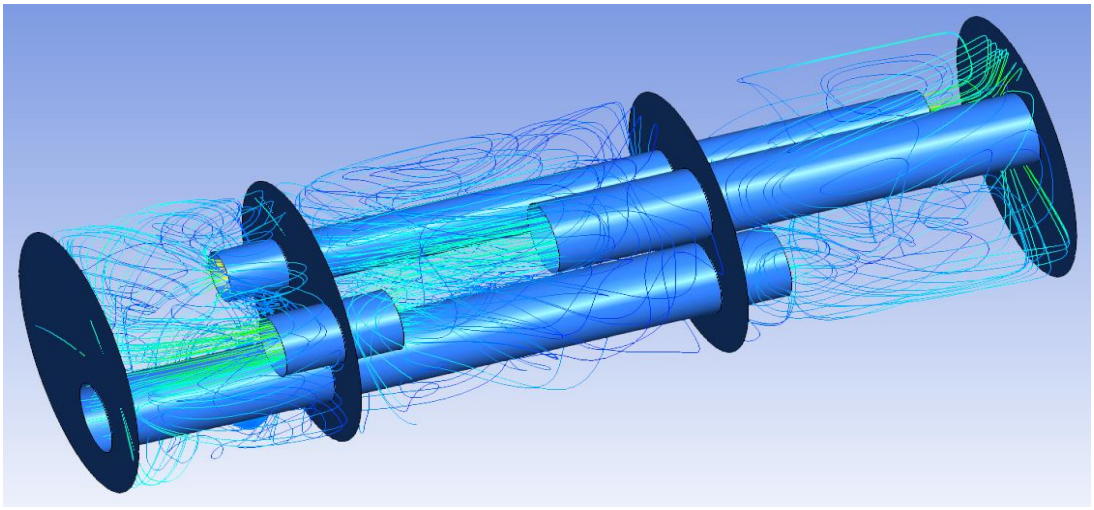

Figure 9 : Model 1

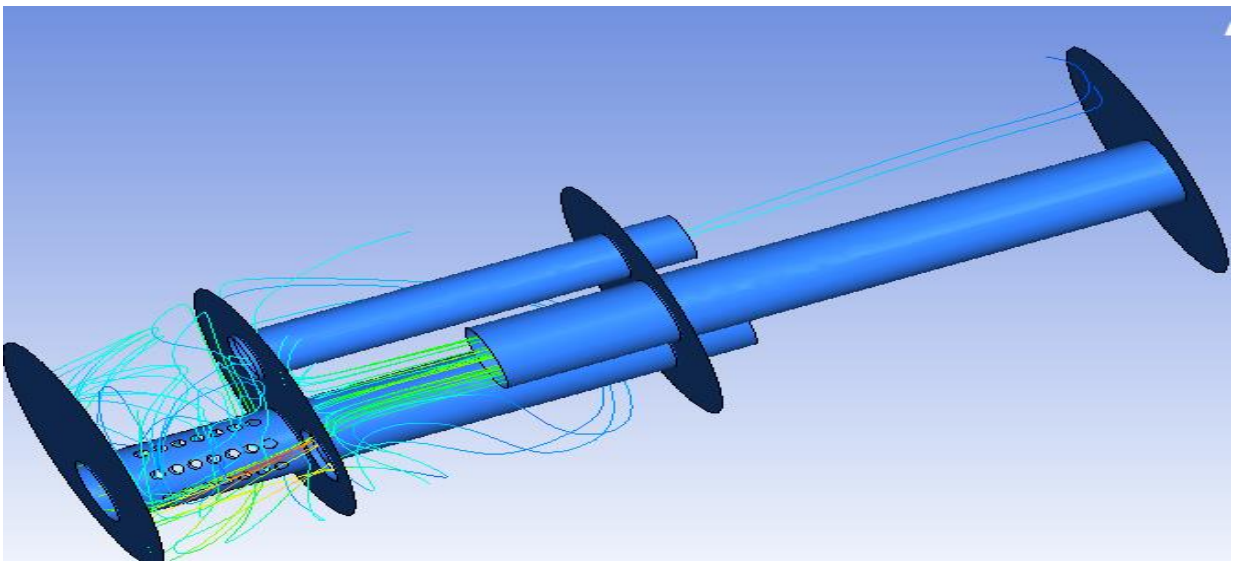

Figure 10 : Model 2

SR NO.	Model	Inlet	Outlet	Backpressure	Unit
1	Actual	45923.8	29038.6	16885.2	Pa
3	Model 1	46102	29012.5	17089.5	Pa
5	Model 2	39275	32422	6853	Pa

Table 3 : CFX Result Of Above Models

VI. CONCLUSION

From above research it is concluded that perforated pipes that we created in model 2 were more effective in reducing backpressure than tapered pipes which were in original muffler and on other hand changing chamber can also helps in lowering down backpressure in little amount .

VII. REFERENCE

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