DESIGN AND EXPERIMENTAL ANALYSIS OF NOISE CONTROL IN MUFFLER OF AUTOMOBILES

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ABSTRACT

IC engines are one of the major sources of noise pollution. Mufflers are generally found with exhaust system.Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Therefore muffler design becomes more and more important for noise reduction. The objective of this study is to give general design guidelines for designing various parameters of muffler. This paper suggests suitable guidelines for selection of muffler grade, muffler length and diameter, Tail-pipe length according to engine cubic capacity and calculation of pressure drop in muffler on the basis of exhaust gas flow rate. It also explains the muffler design for sound modification.

Keywords: *Muffler, Exhaust gas, Backpressure, Noise pollution*

INTRODUCTION

Since the invention of the internal combustion engine in the latter part of the nineteenth century, the noise created by it has been a constant source of trouble to the environment. Significantly, the exhaust noise in terms of pressure is about 10 times the other entire noise combine. The design of muffler has been a topic of great interest for many years and hence a great deal of understanding has been gained. Hence good design of muffler should give the best noise reduction and offer optimum back pressure for the engine.

The performance of an exhaust system is assessed by a different factor; the most important factors are backpressure and the insertion loss of the system. High backpressure in an exhaust system affects the performance of the engine, decreasing power and increasing fuel consumption. Exhaust noise can be classified into two categories pulsating noise from the engine, and flow noise from high speed exhaust gasses flowing though and -exiting the exhaust system. Pulsating noise is generated when exhaust gases at high pressure are released from the engine cylinders through the exhaust valves. Flow noise is created by exhaust gas flow oscillating and impacting inside the exhaust system

The economical criterion is vital in the market place. A muffler must be inexpensive as possible while designing initial cost as well as operating cost must be considered. The various dimensions of the muffler are varied keeping some dimensions constant and then the effect on Backpressure is observed. It can be seen that the backpressure varies nonlinearly and it cannot be predicted by any equation. It can be concluded that the backpressure value is high for small diameters as compare to bigger diameter holes even if the porosity is double.

Analyzed muffler by changing the length of each expansion chambers to understand the effects to the flow characteristics of a cross-flowed perforated and 3-expansionchamberedreactive muffler. It is known that an increase in the total muffler axial length results in a better noise attenuation performance. The decrease in the length of

middle chamber prevents the cross flow. Thus, a greater pressure loss occurs at this model.

NECESSARY OF MUFFLER IN AUTOMOBILE:

The function of a muffler or a silencer in vehicle is to cool the exhaust gases by expansion through it and to reduce the noise of outgoing gases. The exhaust gases must be discharged into the atmosphere with minimum restriction. The restriction in flow of exhaust gases causes back pressure. The function of a muffler or a silencer in vehicle is to cool the exhaust gases by expansion through it and to reduce the noise of outgoing gases. The exhaust gases must be discharged into the atmosphere with minimum restriction. The restriction in flow of exhaust gases causes back pressure.

Sound is a pressure wave formed from pulses of alternating high and low air pressure. These pulses makes their way through the air at you guessed it the speed of sound.

EFFECT OF NOISE POLLUTION:

The key thing about sound waves is that the result at your ear is the sum of all the sound waves hitting your ear at that time. If you are listening to a band, even though you may hear several distinct sources of sound, the pressure waves hitting your ear drum all add together, so your ear drum only feels one pressure at any given moment.

LITERATURE REVIEW

Wei, 1975; De Nevers, 2000; Pundir, 2007; Rao and Rao, 2007 says that automotive exhaust gas emission is one of the main sources of air pollution in cities ZeynepParlar et al presented transmission loss of muffler using numerical approach as well as pressure acoustic approach. New designs were analyzed with respect to both acoustics and back pressure. New design of muffler shows maximum attenuation at minimum back pressure and it is validated using experimental investigation. S. P. Mogal et al the focuses on control of generator noise using anti vibration mounts. Different sound absorbing materials are studied to minimize indoor noise level. Absorptive type of muffler is used to reduce noise level by 2 dBA. Various anti vibration mounts showed reduction in sound pressure level to 1-5 dBA. D. Tutunea et al studied the reactive muffler using computation fluid dynamics (CFD). With this method the pressure, a velocity and temperature plot has been simulated for the muffler and and prediction of pressure loss has been carried for the muffler.

Vijay M Mundhe et al which depicts, muffler is an important part of an engine system used in exhaust system to reduce exhaust gas noise level. The literature review reveals that the exhaust gas noise level depends upon various factors. Muffler geometry, extension in inlet and outlet valves, number of whole perforations and its diameter are the factors which affects noise from engines. The objective of this study is to reduce exhaust gas noise level.

Ujjal Kalita et al represent a bibliographical review of the muffler used in automobile industry. Use of sound absorption material in an exhaust system dissipates the energy of the acoustic waves into heat and also store heat energy from the exhaust stream. Using an absorptive material can greatly increase the transmission loss of an exhaust system in the mid to high frequency ranges.

Dr. Suresh P. M. et al whose paper deals with the experimental modal analysis, also known as modal analysis or modal testing, deals with the determination of natural frequencies, damping ratios, and mode shapes through vibration testing. The exhaust muffler in an automobile plays an integral role in reducing the sound of the automobile, as well as the ride itself. In order to maintain a desired noise and comfortable ride, the modes of a muffler need to be analyzed.

PROBLEM IDENTIFICATION

Whenever the automobile operates there should be an exhaust so that the muffler is used to reduce noise.

If you've ever heard any automobile engine running without a muffler, you know what a huge difference a muffler can make to the noise level. This leads to irritation to every living organisms and this may cause major problems.

METHODOLOGY:

The best method of reducing the sound in muffler is by filling of Acousta-fill inside the layer of muffler.A very popular option, and one that more and more riders are using to get their noise levels down. Acousta-Fil is a product used to repack your motorcycle's exhaust silencer. It is designed to expand once it's heated, and in doing so it fills all remaining space in the can, providing great silencing characteristics. It is said to be very effective for motorcycle noise levels, with some riders claiming it can knock off 3db+ depending on the bike and silencer it's being used on.

Acousta-Fil is meant to replace the existing packing inside the exhaust (if there is any) between the inner tube and outer causing. Most riders will already have a baffle for their silencer, and if you do and you haven't fitted it then this is obviously going to be the easiest and cheapest way to reduce the noise level of your exhaust. Some riders however won't have a baffle as it may well have been removed by the previous owner and lost or given away

MODIFIED MUFFLER

The modified muffler design is shown in below

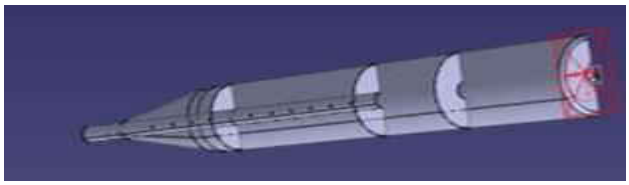
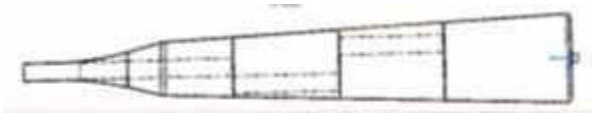


diagram in that the design is shown and then the varied sections are shown clearly



Design of modified muffler

Drafting of modified muffler

After modification of muffler

RESULTS AND DISCUSSION

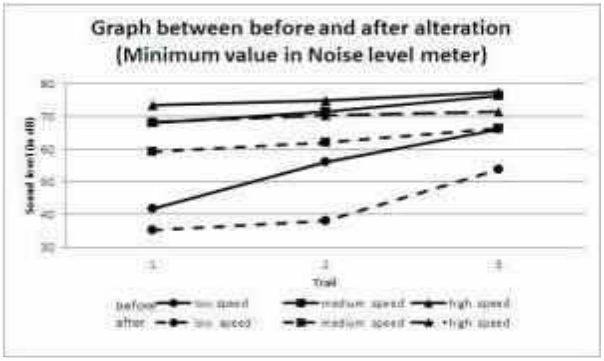
Tabulation of noise level reading of actual

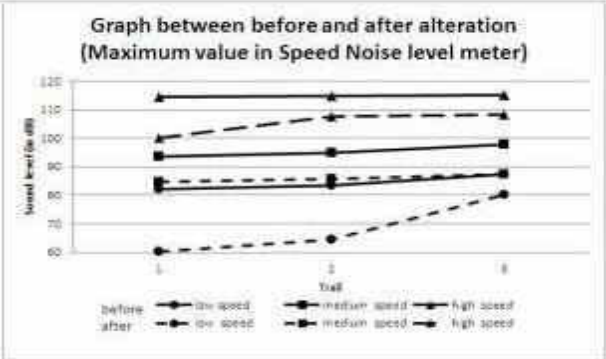
S.NO	SPEED LEVEL	NOISE LEVEL METER READING (DB)	
		MINIMUM SPEED	MAXIMUM SPEED
1	LOW	41.8	82.2
		56.1	83.5
		66.1	87.2
2	MEDIUM	68.1	93.6
		71.3	94.8
		76.3	97.9
3	HIGH	73.4	114.3
		74.8	114.7
		76.9	115.2

muffler:

Tabulation for noise level reading of modified muffler:

S.NO	SPEED LEVEL	NOISE LEVEL METER READING (dB)	
		MINIMUM SPEED	MAXIMUM SPEED
1	LOW	35.4	60.2
		38	64.4
		53.7	80.2
2	MEDIUM	59.2	84.7
		62.1	85.8
		66.2	87.4
3	HIGH	68.4	100.2
		70.2	107.6
		71.4	108.2





From experimental analysis it is found that the average noise reduced is 7-10dB

CONCLUSION

Every motorcycle has a problem of increasing exhausting noise. Main drawback of this exhausting sound makes trouble to environment and makes noise pollution. This is hazardous to human being. There are certain laws to modify the sound control level in India. Though there is an accordance of particular noise level limitations, still the reduction of noise can be modified which will be very useful. The main scope of our project is that we need to control noise pollution, but nowadays people used to create more noise in automobiles, hope this may get change in future.

In order to reduce the sound level in the motorcycle exhausting system there are different method to modify it. In this project we have introduced a two filter which was inserted inside the muffler of perforated tube. By this method the final delivery sound of the muffler is reduced simultaneously. At final stage, by starting the motorcycle the sound level is measured by the sound level meter. From the experimental readings and graphical analysis the sound of muffler is reduced upto7-10dB.

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