

Modification of Two Wheeler Silencer for Noise Reduction

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Abstract— With the increase in population day by day the number of vehicles also increases which have more contribution towards the increase in noise and air pollution. To reduce the same or to maintain it within the limit the researchers are taking efforts for finding some solution or alternate method, which leads to the development of new things or some modifications in the existing thing. As the major source of pollution are the vehicles, therefore by limiting the scope of pollution to the vehicles only the three different configuration of reactive silencer is designed by modifying the tuning chamber which is the main cause of attenuation and the result recorded for noise level production and pollutant produced and by compared with the standard silencer provided by the manufacturer and the optimum design of reactive silencer is proposed which has comparatively less noise at low back pressure with producing low pollutant.

Keywords: Two Wheeler, Silencer, Noise Reduction

I. INTRODUCTION

Silencer is also termed as muffler. It is used for reducing the noise emitted by exhaust of an internal combustion engine, which is a major source of noise pollution. It becomes a more vital concern when used in residential areas or areas where noise creates hazard. Generally, noise level of more than 80-90 dB is injurious for human being. The main sources of noise in an engine are divided in two parts, first are the exhaust noise and second are the noise produced due to friction of various parts of the engine. The engine exhaust noise is the most dominant. To reduce this noise, the most effective way of using a muffler in the engines. The level of noise reduction depends upon the design, construction and the working procedure of mufflers. If a car running without a muffler then the noise level is unbearable. The most of the advances in the acoustic filters and exhaust mufflers came out in last four decades. Hence good design of the muffler should give the best noise reduction and offer optimum backpressure for the engine. Backpressure is the extra static pressure exerted by muffler on the engine through the restriction in the flow of exhaust gases. The insertion loss is defined as the difference in the acoustic power radiated without and with the muffler fitted

A. Functions of Muffler:

- Mufflers serve to keep the exhaust quiet to acceptable levels.
- Bear in mind that the combustion process is a series of explosions that produces allot of noise.
- Most mufflers use baffles to bounce the exhaust around sending off the energy and quieting the noise.
- Some mufflers also use fiberglass packing that absorbs the sound energy as the gases flow through.

II. PROBLEM DEFINITION



Fig. 1: Pulsar 220 Silencer used for Case Study

In this work the modification of bike reactive silencer is made by modifying the tuning chamber and the results are measured and recorded so as to satisfy the requirements also considering increased demands on comfort, it is easily realized that designing exhaust systems has become much more difficult.

- To avoid loud noises several types of mufflers are used.
- But due too much load the regular mufflers can't be that effective.
- The size of the muffler should be optimum so that it can be easily mounted upon the machine.
- The noise produced is to be minimized as much as possible.

III. OBJECTIVES

The objective of this project is to reduce the exhaust gas noise level. The performance of the muffler is assessed by analysing exhaust gas flow pattern, length of expansion chamber. This project helps improve reduce the noise level and environmental noise pollution. The common goals and objectives of Project are -

- To design exhaust system for two wheeler silencer
- To select the modification in muffler grade
- Implementation of absorptive-reflective principle for chamber modification
- The main objective of this project is to reduce the exhaust gas noise level

IV. OUTCOMES

- The mufflers are generally used to reduce the noise from the engine.
- There are different types of mufflers used which can be differentiated in two Types absorptive type and reactive type.
- The absorptive type mufflers use the perforating material to reduce the noise level but in reactive type mufflers certain types of chambers and obstacles are provided in the exhaust chamber to reduce the noise level.
- But here we used both types of techniques inside a single muffler in order to achieve higher efficiency.
- As a result we get reduced noise level as compare to the regular mufflers and side by side the losses in the mufflers are too reduced significantly.

V. FABRICATION OF TUNING CHAMBER

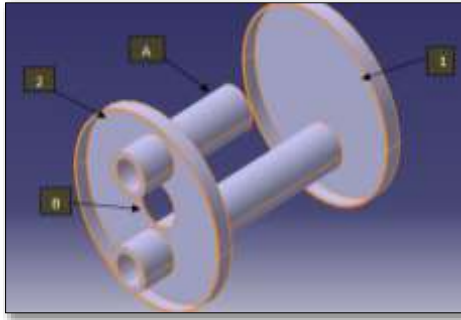


Fig. 2: CAD Model of Chamber

The configuration two of tuning chamber is made by increasing the distance between two baffle plates. The increase in length causes increase the flow area of the exhaust gases and the more pressure drops takes place between two plates with reaction of gases.

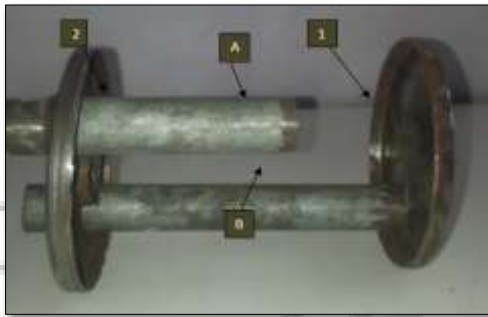


Fig. 3: Fabrication of Tuning Chamber

- There are two components in the Second configuration, Baffle plates and round pipes. The material used for these is Mild Steel plate and round pipe
- Pipe A is 70 mm in length with diameter as 22mm.
- Pipe B is 150 mm in length with diameter as 22mm.
- Baffle plate 1 is 98mm diameter having one holes.
- Baffle plate 2 is 98mm diameter having three holes.
- Distance between two plates is 110 mm.

VI. WORKING PROCESS OF TUNING CHAMBER

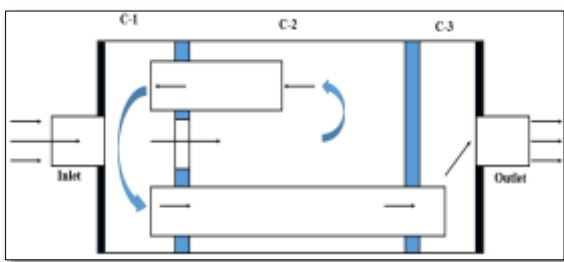


Fig. 4: Working Process Tuning Chamber

As the sound enters the chamber 1, it has one single pass way which is the middle hole of the Baffle plate (1) through which the sound passes. As the sound passes from the middle hole it enters the chamber 2 which is has only one gateway that is the pipe (a) which in turn returns the sound to the chamber 1. Hence in this way sound travels from chamber 1 to 2 and then again in chamber 1. The chamber 1 has other gateway which directly enters the third chamber which the pipe (b) which is 140 mm long which initiates from chamber

1 and exits at chamber 3. Hence there the sound passes to chamber 3.

VII. EXPERIMENTAL TESTING



Fig. 5: Experimental Setup

The internal geometry of the silencer of reactive silencer produces noise. As discussed all the sub components have their own effect toward production of sound. The emitted sound is to be reduced so as to have a desirable sound level. Therefore the sound produced by standard silencer and modified silencer assembly is recorded and the comparison is made to have a comparatively quit silencer.

VIII. RESULTS AN DISCUSSION

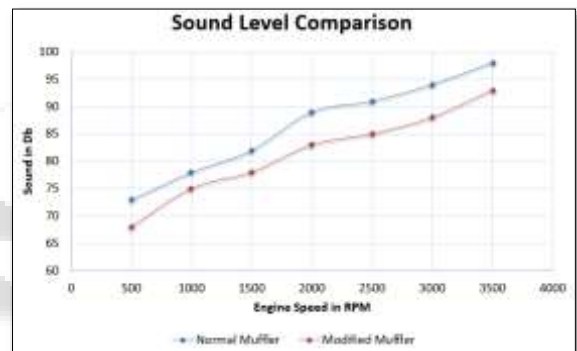


Fig. 6: Result Comparison of Experimental Setup

When the result obtained by decibel meter is compared it shows that the percentage of sound reduction of the modified muffler is more as that of the normal muffler. The plot shows the effect of speed on the decibel reading. As the speed goes on increasing, the sound emission also increases. It is observed that the second silencer has the least emission compared to all normal muffler.

IX. CONCLUSIONS

- With the data recorded and measured for noise level, emitted for different configuration of tuning chamber it is observed that these three modified configurations of tuning chamber has different reading
- It means that by designing the silencer with different configuration the said parameters can be increased or decreased.
- Also the measured value of modified silencer when compared with the value measured for standard silencer is lesser and hence the design of silencer can be proposed.
- With the plotted graph it is observed that with changing configuration the sound level is decreased from normal configuration to modified configuration

- With further reducing the sound level it is observed that there is rise in back pressure value and which causes more HC to release.
- Therefore by observing the plots it is concluded that the sound level of silencer can be reduced to some level only.
- Therefore the silencer configuration second is the optimum designed silencer as it has low noise level emission.

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