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# Investigation on Effect of Extended Inlet and Outlet Tubes on Single Expansion Chamber muffler for Noise Reduction

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***Abstract****: The major source responsible for noise pollution is internal combustion engine. These engines are used for various purposes such as, in automobiles, locomotives, and in various manufacturing machineries. In an engine, the exhaust noise and the noise produced due to friction of various parts of the engine share maximum contribution to noise pollution. Muffler is a device used to reduce noise within the exhaust system. It is arranged along the exhaust pipe for the purpose of noise attenuation. The paper describes the acoustic Analysis of Single Expansion Chamber Reactive Muffler having extended inlet and extended outlet. The approach is useful in the acoustic analysis of single expansion chamber muffler for maximizing Sound Transmission Loss. The purpose of paper is to study the effect of extended inlet and extended outlet on transmission loss of Single Expansion Chamber reactive muffler with the help of theoretical as well as numerical analysis.*

***Keywords****: Single Expansion Chamber Reactive muffler, Transmission Loss, Theoretical analysis, Numerical analysis*

## I. Introduction

Sound waves propagating along a duct can be attenuated using either an absorptive or a reactive muffler. Absorptive muffler uses sound absorbing material to absorb energy from the acoustic in the wave, when it propagates through the muffler, while reactive muffler works on impedance mismatch principle. Muffler is a device used for reducing the amount of noise produced by the exhaust of an internal combustion engine. The acoustic analysis of exhaust muffler is characterized by numerous parameters like insertion Loss (IL), Transmission Loss (TL). The frequently used parameter to evaluate the sound radiation characteristics of muffler is Transmission loss (TL) [1]. Transmission Loss is defined as difference between power incident on muffler proper and power transmitted downstream into an-echoic termination. The transmission loss is independent of source and it presumes an-echoic termination at tail pipe. [2] Exhaust noise from engines is one of the components of noise pollution to the environment. Exhaust systems are developed to attenuate noise meeting required dB levels and sound quality, emissions based on environment norms. Noise levels of more than 80 dB are injurious for human beings. Design of mufflers is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Hence muffler design becomes important for noise reduction [3].

Hence to reduce noise from internal combustion engines they are equipped with an important noise control element known as silencer or exhaust muffler which reduces the acoustic pulse generated by the combustion processes [4]. Numerical methods are often useful for optimization of model with complicated shapes and also where the cost is involved. So it is essential to optimize the model by Numerical Analysis and validate it by experimental methods [2]. The internal changes in the geometry of the muffler are made to develop the impedance mismatch for maximizing the transmission loss. In this study, the extended inlet and extended outlet, is placed in single expansion chamber reactive muffler. The muffler is simulated using COMSOL to predict muffler transmission loss performance.

## II. Modeling

The muffler transmission loss for the single expansion chamber reactive muffler is evaluated using finite element analysis. The software used for the analysis is COMSOL Multiphysics.[8].The design conditions used for evaluating transmission loss of single expansion chamber reactive muffler are listed as follows

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