Performance Investigation and Redesigning of Tractor Engine Muffler

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Abstract

An automotive muffler (or silencer) is a device for reducing the amount of noise emitted by an exhaust gas of engine and the exhaust gas blows out through this device and at last it send to the environment. It has intricated inner elements like extended inlet and outlet tubes, thin baffles with eccentric holes, internal connecting tubes, perforated tubes, flow plugs, and sound absorbing materials. Mufflers are typically installed along the exhaust pipe as part of the exhaust system of an internal combustion engine (of a vehicle, or stationary) to reduce its exhaust noise. In this Paper, thermal analysis carried out with the help of temperature gun in the existing muffler of C.I. Engine. The various influencing factors such as thermal concentration; thermal stress and properties of material have been analyzed. Based on the results of analysis, a new modeled muffler is designed and fabricated in order to improve the life and performance of muffler.

Keywords- Taper Shape, outer Fins, Thermal analysis

1. Introduction

A Muffler is a device for reducing the amount of noise emitted by an exhaust gas of engine and to reduce the back pressure, it allows the exhaust gas blows out through this device with the help of perforated holes and finally to the atmosphere.

Mufflers are typically installed along the exhaust pipe as part of the exhaust system of an internal combustion engine to reduce its exhaust noise. The muffler accomplishes with a resonating chamber, which is specifically tuned to destructive interference of opposite sound waves that cancel each other, Catalytic converters also often have a muffling effect. The effect is mainly generated largely by restriction, rather than by cancellation.

2. General Information

Variety of Muffler
- Baffle.
- Wavebreak off.
- Rapport.
- Assimilator.
- Integrated Rapport and Absorber.

Factors Affecting Silencer
- Flue gastemperature.
- Flue gaspressure.
- Counter Pressure.
- Vibration.
- Wear and tear.
- Loss of load carrying capacity of a material unit.
- Cracking.
- Depending upon fuel

Disputes in old Muffler
The holes dia in the muffler may expanded due to the exhaust gas comes out with high heat and it leads to thermal expansion This results in vibration as well as noise in the muffler.1.

Maximum heat will be occurred at the strikers which is nearer to exhaust pipe inlet so that striker can be easily damaged because of thermal expansion.
Solutions for the Dispute
To run over the above said issues:

Outcome of the Analysis
• Due to heat expansion perforated holes are enlarged
• Material failure
• Crack formation
• Rust formed due to corrosion

Temporary Result
To minimize the temperature, some design changes are suggested below:

• In the muffler outer surface Fins provided
• Length of the pipe is little bit increased
• Changing the counter pressure field into a Taper structure (Diverging)

3. Fabrication of Mufflers

Engine specification

Engine: Four stroke single cylinder diesel engine
Speed: 1500rpm
Power: 5hp
Bore: 80mm
Stroke: 110 mm
Compression Ratio: 18:1

4. Checking the Feasibility of Muffler

Thermal analysis is made of both the models old and new, the new model muffler gives better result in all situations, especially heat emission is same everywhere in the muffler areas as well as fins. The outer fins took more amount of heat so that maximum heat flow to the muffler will be restricted. So thermal expansion is comparatively less because of fins provided at the new muffler.

• Based on the test result, the heat flow in this muffler model was minimum. It does not allow the peak flow through the muffler and some amount of heat is dissipated by the help of cooling air which was observed by fins. So it won’t affect the surface by high temperature of exhaust gas.

• One more benefit is less back counter because of taper structure of muffler. When exhaust gas comes out, due to the sudden enlargement the back pressure created is stopped. This will improve the muffler’s life period.
Based on the results of analysis, the new silencer model has been discovered as a perfect model which shows better result when compared with old model. The heat analysis was carried out at fixed position in both the models and outcomes were matched with old muffler.
5. Conclusion

The points listed below were made based on the results obtained by thermal analysis on both the original muffler and new muffler of a 4-stroke single cylinder diesel engine.

- The latest muffler might be replaced by the original muffler because it gives best result.
- The temperature reduction is more when compared with the original muffler. The value drop 24°C approximately.
- The thermal stress and thermal expansion developed is very less in the new muffler when compared with the existing muffler because the heat distribution is uniform due to outer fins.
- The failures such as outlet hollow dia enlargement and fracture are reduced in the new muffler.

- The counter pressure developed inside the muffler has reduced due to decrease of the exhaust gas velocity.

In general new model muffler i.e., optimum design muffler improves the performance and life with a meaningful deduction in muffler breakdown.

6. Bibliography


