MODIFICATION IN EXHAUST SYSTEM FOR POLLUTION CONTROL

AMIT PUROHIT[1*], ESHAN SHARMA[2*]

[1*]*B.E student, Department of Mechanical Engineering, MMCOE, Pune-411052*

[2*]*B.Tech student, Department of Mechanical Engineering, VNIT, Nagpur-440001*

ABSTRACT

Reliable removal of exhaust gas is achieved by means of a good exhaust system in an automobile industry. Exhaust gas or flue gas is emitted as a result of the combustion of fuels such as petrol and diesel. According to the type of engine, it is discharged into the atmosphere through an exhaust pipe, flue gas stack or propelling nozzle. It often disperses downwind in a pattern called an exhaust plume. Harmful pollutants in these emissions include: Carbon monoxide, Nitrogen oxides, unburned hydrocarbons, Volatile organic compounds (VOCs) and Particulate matter. A case study is done in an automotive industry with the objective of reducing these exhaust pollutants inside the plant. Efforts are made to improve the current exhaust control system. The causes for failure of current system are identified and analyzed through DMAIC methodology. This research work is carried out at Volkswagen India Pvt. Ltd., Pune with a view of reducing the exhaust during the Engine Testing process carried out after the RBT (Roller Brake Test). The results revealed a remarkable decrease of pollution inside the plant and also a new device has been designed, developed and implemented to improve the current exhaust system.

Keywords: *Reduction of exhaust pollutants, DMAIC, Improvement in exhaust system.*

1. METHODOLOGY

Six sigma is a disciplined, data-driven methodology for eliminating defects in any process. To achieve six sigma quality, a process must produce no more than 3.4 defects per million opportunities.
Motorola recognized that there was a pattern to improvement (and use of data and process tools) that could naturally be divided into the five phases of problem solving, usually referred by the acronym DMAIC which stands for Define-Measure-Analyze-Improve-Control. DMAIC forms the five major phases of any six sigma project.
1. Define: The purpose of this phase is to clarify the goals and value of a project.
2.Measure: The purpose of this phase is to gather data on the problem.
3.Analyze: The purpose of this phase is to examine the data and process maps to characterize the nature and extent of the defect.
4.Improve: The purpose of this phase is to eliminate defects in both quality and process.
5.Control: The purpose of this phase is to lock in the benefits achieved by doing the previous phases.

2. CASE STUDY

Case study was carried out at Volkswagen India Private Limited, Pune. After the car being completely assembled, it has to go through various tests before getting dispatched. After the Roller brake Test, the Engine is tested. In this test different parameters of the engine like deviation of lambda control, catalyst converting capability, etc are checked. For this testing, the rpm goes up to 4800, which results in extreme pollution. For this, exhaust pipes have been provided to control this pollution. But these pipes did not work according to the convenience of the worker.

2.1. PROBLEM DEFINITION

Pollution during the engine test for the first half of 2015 is shown below. It can be seen that the pollution till the trolley was implemented was high. This was mainly due the following reasons:
1. Ineffectiveness of fume collectors.
2. Ergonomic issues for fitment and release of the pipe.
3. The process was time consuming which in turn affected production rate.
4. Maintenance issues.

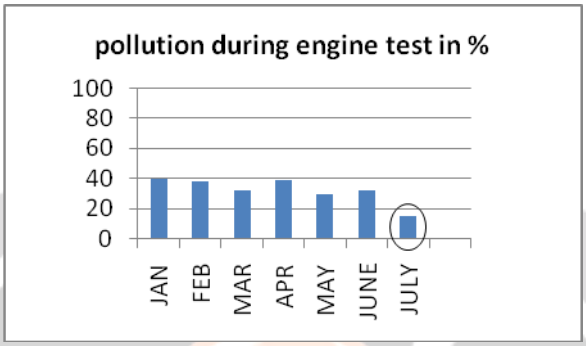

Chart 1: Graph for pollution in 2015

2.2. PROPOSED IMPROVEMENT

To overcome the above problems, a trolley was designed so that it can be placed under the car and the exhaust gases can be extracted more efficiently. The trolley was designed in such a way that the work efforts were reduced significantly & the vehicle ground clearance was taken care of. The material used for making this trolley is Aluminium. The trolley was provided with a handle and wheels for the easy movement of the trolley. The exhaust pipe is attached inside the hole provided and the trolley is slid under the car.

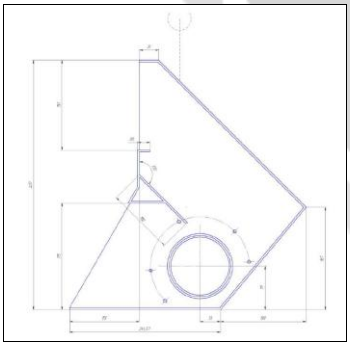

Fig 1: Side view of trolley

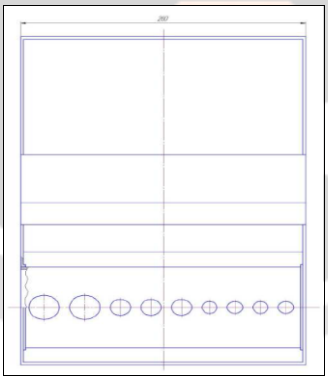

Fig 2: Top view of trolley

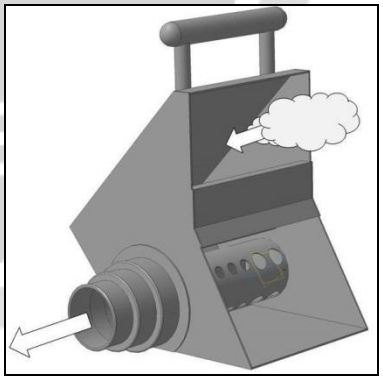

Fig 3: Proposed design of the trolley

3. RESULTS

The trolley has result in the following:
1. Decrease of fumes on the production line.
2. Improved work environment.
3. Ideal positioning of the extraction trolley guarantees perfect extraction efficiency.
4. Ergonomic issues for fitment and release were solved.
This trolley is highly reliable and can extract the fumes at very high rpm.

Fig 4: Final Trolley on the workstation

4. CONCLUSION

An attempt has been made to enhance the exhaust system used during the engine test in the plant. Also, in order for the project plan to be reliable, it needs to follow a control mechanism to achieve project goals. This research work emphasizes on finding a possible solution to the existing problem. Using aluminum helped in reducing the weight of the trolley. This solution was found to be cost efficient, as the alternative solution was to replace the whole system. The alternative solution would have cost a lot more. The overall equipment efficiency (OEE) was improved by making this change. With the objective of producing 34 JPH, this modification helped in saving time.

The mechanical design and material selection of the trolley is appropriate for its intended service. Hence in the month of July 2015 significant decrease in pollution was observed.

5. REFERENCES

Philip Stephen (2004), "*Application of DMAIC to integrate Lean Manufacturing and Six Sigma*" 4:13-28.