

# MANUFACTURING AND TESTING OF EXHAUST GAS PURIFIER

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**Abstract:** An exhaust system is a device which helps in reducing the harmful exhaust gases into harmless gases. It also helps in reducing the noise level given quitter ride on road. The system helps in reducing the air pollution as well as noise pollution. The project is aim to design and fabricate special exhaust gas purifier with varied application and eliminating the drawback of earlier remedies provided for exhaust gas purification. The main functions of system is to reading exhaust gas up to such a limit that they will be totally purified it will result in reduction of air pollution and their by global warming. The current system of exhaust gas purification includes catalytic converter which involves reduction of exhaust gases into CO<sub>2</sub> & O<sub>2</sub> but tends to be inefficient and costly. Another system is spark arrestor which only eliminate the hydrocarbons. Thus fail to purify exhaust gases. The idea suggested for the problem was to make a system which will purify the exhaust gases up to its highest safety. The project initiated with the study of exhaust system, their emission norms.

**Keyword:** Ignition coil, catalytic converter, hydrocarbons, exhaust gases, honeycomb structure, global warming.

## I. INTRODUCTION:

An exhaust system is a device which helps in reducing the harmful exhaust gases into harmless gases. It also helps in reducing the noise level given quitter ride on road. The system helps in reducing the air pollution as well as noise pollution. Catalysis has provided one of the most realistic methods of decreasing the levels of exhaust gas species. However its efficiency of oxidation depends on amount of CO, HC and air and also temperature of exhaust gas. Catalytic converters

especially with the fuel enriched exhaust gas of small capacity carbureted two-stroke engine undergo rapid damage of perforation and clog by unburned oil. They can cause also threat of misfire. With its subsequent fuel enriching of exhaust gas causes a thermal shock to the substrate. In general the efficiency of the catalyst is dependent upon two parameters, namely the physical formulation and the nature of the flowing gas containing different chemical species. Recently widely applied fuel injection reduces to a large extend this phenomena. The project is aim to design and fabricate special

exhaust gas purifier with varied application and eliminating the drawback of earlier remedies provided for exhaust gas purification. The main functions of system is to reading exhaust gas up to such a limit that they will be totally purified it will result in reduction of air pollution and their by global warming. Engine performance changes as a result of negative effect of gas wave motion in exhaust system with monolith of converter, which should be fixed in exhaust pipe, where higher temperature takes place to initiate chemical reactions especially during engine start. Value of decreasing of engine torque and increasing of fuel consumption are the main parameters determining possibility of applying of catalytic converter in exhaust system. Most often catalytic converters in exhaust systems of two-stroke engines are placed before silencer. In presented system catalytic converter was mounted after silence box because of big dimensions of converter applied in the car from Daewoo. Big size of the converter and lower temperature of gas flowing out from silencer takes effect on longer time of heating and oxidation of exhaust compounds.

## II. PROBLEM STATEMENT:

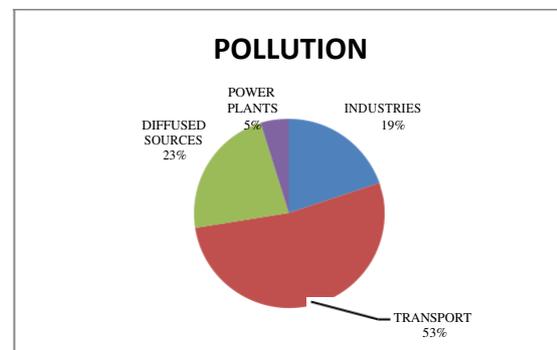
At present high levels of air pollution are recorded in many cities of different countries due to exhaust gases emitted by automobile. For example, in Delhi 53% of air pollution occurs due to automobile which is a major cause of air pollution.

## III. OBJECTIVES:

- The system can be commercialized so as to enhance its working ability the further research and development can make it much more efficient.

Another source contributing for air pollution is 19% of harmful gases which are released from industries. The proportion of gases from and industries are mainly concentrated on 3 types of pollutions such as CO, HC, NOx.

- **CARBON MONOXIDE:** The three major pollutants of CO are most dangerous because you can see or smell it. A concentration of (0.5%) CO in the air can make an unconscious person and in her within 10-15 min. Even a minor percentage concentration (0.04%) can cause headache and threatening life of person after several hours of exposure.
- **HYDROCARBONS:** Hydrocarbon emissions are unburned gasoline and oil vapors. Although not directly harmful, they are major contributors to smog and ozone pollution. Hydrocarbons react in the atmosphere with the sun and break to form other chemicals that irritate the eyes, nose, throat and lungs.



Current Scenario of Indian Air Pollution

- The system can prove as a good carbon capture technic thus helping to get a carbon credit.
- Pollution can be controlled by number of application of the system.
- To reduce the global warming problem.

**CALCULATIONS:**

<p><b>Dimensions of casing</b></p> <p><b>Diameter:</b> 30cm <b>Length:</b> 100 cm <b>Thickness:</b> 0.5 cm</p> <p><b>Volume of Casing</b></p> $\text{Pi} \times \text{diameter} \times \text{length} = 3.14 \times 30 \times 100 = 94.2 \text{ cm}^3$	<p><b>Dimensions of Stage I</b></p> <p>Diameter: 28cm Length: 34 cm</p> <p><b>Volume of stage I:</b></p> $\text{Pi} \times \text{diameter} \times \text{length} = 3.14 \times 28 \times 34 = 29.89 \text{ cm}^3$
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<p><b>Dimensions of Stage II:</b></p> <p>Diameter: 28cm. Length: 34 cm.</p> <p><b>Volume of stage II:</b></p> $\text{Pi} \times \text{diameter} \times \text{length} = 3.14 \times 28 \times 34 = 29.89 \text{ cm}^3$	<p><b>Dimensions of Stage III:</b></p> <p>Diameter: 28cm. Length: 34 cm.</p> <p><b>Volume of stage III:</b></p> $\text{Pi} \times \text{diameter} \times \text{length} = 3.14 \times 28 \times 34 = 29.89 \text{ cm}^3$
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**IV. WORKING PRINCIPLE:**

1. Ignition coil: To break bond between the exhaust gases and removal of hydrocarbon.
2. Honeycomb structure: The chemical reduction between honeycomb structure and exhaust gases.
3. Water jet impact on the exhaust gases, to lower the intensity of sound, to absorb the
4. Carbon particles through water.
2. This gases passes through multiple grids present in the 1<sup>st</sup> stage where the grid has high voltage supply 20,000 volt to 30,000 volt of spark grid, due to which the carbon bonds break and separate carbon and oxygen molecules.
3. The three grids are space into a specific distance so that it will result from each carbon particle which is present in exhaust gases.
4. After this process, flue gases are then passed to next stage.

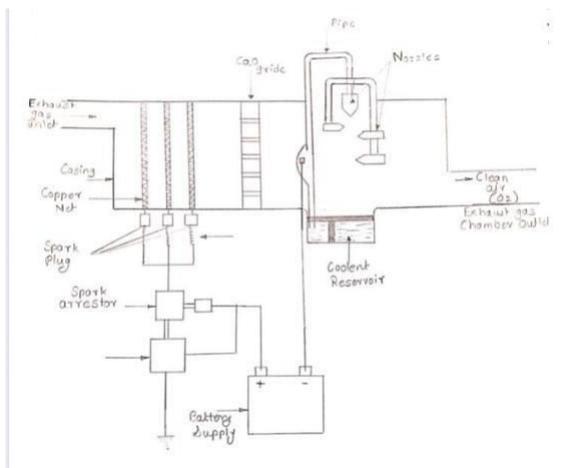


FIG - Working of Exhaust Gas Purifier

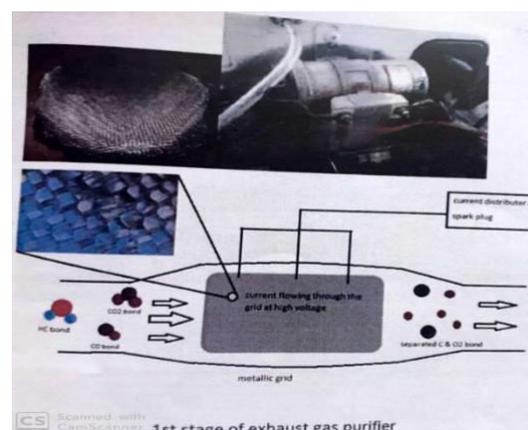


FIG - 1<sup>ST</sup> Stage of exhaust gas purifier

**A. 1<sup>ST</sup> STAGE SPARK EXHAUST:**

1. The exhaust gases enter into the muffler at 300<sup>0</sup>C temperature and pressure of 120-160 bar.

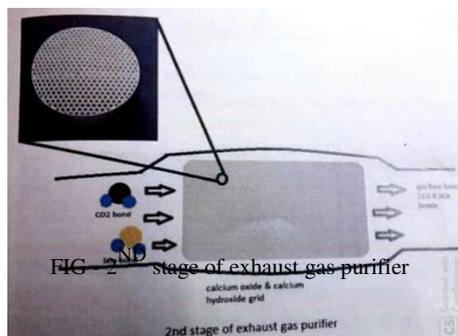
**B. 2<sup>nd</sup> STAGE CALCIUM OXIDE & CALCIUM HYDROXIDE FILTER:**

1. As a presence of spark exhaust, the temperature of exhaust gases is more.
2. In this process filter is made up of porous material of (CaO) or calcium hydroxide (Ca(OH)<sub>2</sub>).
3. The hot exhaust gases pass through this grid and get purified with the help of chemical reaction taking place inside core.

The following reaction will take



4. Due to this reaction the harmful gases will get trapped in the casing.



### C. 3<sup>rd</sup> STAGE WET EXHAUST:

1. The water or any other fluids tends to absorb or catch the heavy carbon particle or smoke more efficiently.
2. This water oil will finely spray in the casing of exhaust casing; these will trap the heavy carbon molecules or smoke particles.
3. The oil water can be periodically changed at service station.
4. This system will surely control the emission of black smoke in the atmosphere to avoid the formation of smog and other ill effects.
5. Nozzles will be used for spraying the liquid the path of exhaust gases.

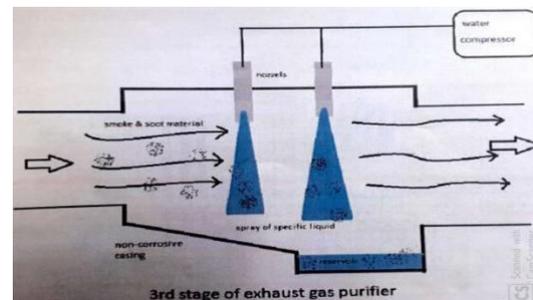


FIG - 3<sup>RD</sup> stage of exhaust gas purifier

## VI. SPECIFICATIONS:

### 1. Battery:

- Brand: Exide.
- Quantity: 1 unit.
- Product Dimensions: 20.3\*20.3\*10.2 cm.
- Item model number: Oriental\_38.
- Color: Transparent.
- Weight: 10 kilograms.
- Voltage: 12.5 volts

### 2. Spark Distributor kit.

### 3. Spark plugs:

- Brand: NGK.
- Dimensions: 8.4\*2.4\*2 cm.
- Item model number: CPR8EAIX-9.

- Quantity: 3 units.
  - Voltage: 20,000-30,000 volts
  - Material: Metal.
  - Weight: 59.78 grams.
  - Color: White.
- ### 4. Coolant:
- Coolant name: ethylene glycol in water.
  - Quantity: 2 liters.
- ### 5. Copper net:
- Diameter: 15cm.
- ### 6. CaO Grid:
- Material: Calcium oxide or Activated carbon.
  - Quantity: 1 unit.
  - Dimensions: 15\*34.13 cm.

**7. Casing:**

- Material: Mild Steel.
- Volume: 471.3 m<sup>3</sup>.

**8. Nozzles:**

- Brand: Generic.
- Quantity: 3 units.
- Dimension: 10\*5\*5 cm.

**9. Ignition coil:**

- Brand: PWX.
- Quantity: 1 unit.
- Item model: Spark all models.
- Inner material: Iron Core.
- Outer material: Plastic, rubber.
- Color: Black

**VII. ACKNOWLEDGMENT:**

The satisfaction that accompanies the successful completion of this seminar project would be complete without mention of the people who made it possible, without whose constant guidance and encouragement would have made effort go in vain. I consider myself privileged to express gratitude and respect toward all those who guided us through the completion of this Project Stage - I. We convey

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