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CFD ANALYSIS OF CATALYTIC CONVERTER

[1]BUDAMAKAYALA RAMESWARA REDDY, [2]P.HUSSAIN, [3]A.GOUSE PEERA,

[4]Dr.P.MALLIKARJUNA REDDY

[1]M.Tech Student, [2]Associate Professor, [3]Assistant Professor, [4]Professor

DEPARTMENT OF MECHANICAL ENGINEERING

SVR Engineering College, Nandyal

ABSTRACT:

Diesel engines have high efficiency, durability, and reliability together with their low-operating cost. These important features make them the most preferred engines especially for heavy-duty vehicles. The interest in diesel engines has risen substantially day by day. In addition to the widespread use of these engines with many advantages, they play an important role in environmental pollution problems worldwide. Diesel engines are considered as one of the largest contributors to environmental pollution caused by exhaust emissions, and they are responsible for several health problems as well. The four main pollutant emissions from diesel engines (carbon monoxide-CO, hydrocarbons-HC, particulate matter-PM and nitrogen oxides-NO_x) and control systems for these emissions (diesel oxidation catalyst, diesel particulate filter and selective catalytic reduction) are discussed. Each type of emissions and control systems is comprehensively examined. The present project deals with the fabrication of filter type emission controller suitable for clamping to diesel engine for optimizing the control of emissions before and after usage.

Keywords: Diesel engine, Emission control system

I. INTRODUCTION

Diesel exhaust soot is the visible cloud of black carbon-containing smoke that appears on engine start-up and during normal diesel engine operation. Black carbon is hazardous to health and presents a range of other issues, including visible product contamination and soiling. It is also believed that black carbon is a contributory factor in climate change. This technical paper aims to clarify the issues surrounding exhaust soot and presents information designed to assist in the decision-making process of how best to reduce black carbon emissions from diesel exhausts.

1.1 PARTICULATE MATTER (PM):

In a theoretically perfect combustion, carbon dioxide, water and nitrogen are the end products. In reality, the incomplete combustion of diesel fuel results in emissions that include oxides of nitrogen (NOx), carbon monoxide (CO), carbon dioxide (CO2), water (H2O) and unburned hydrocarbons (HC). There are also unborn carbon particles, as well as engine oils, debris, soot and ash particulates, which are known as particulate matter (PM). This diesel particulate matter (DPM) is the visible cloud of black smoke that appears from engine start-up and continues to appear when the engine is running. DPMs can be categorized into two groups

PM10 - Particles of 2.5 microns to 10 microns, and

PM2.5 - Particles of less than 2.5 microns in size. Although most Diesel Particulates are very small, more than 99% are in the sub-micrometer range.

1.2 THE CONCERNS ASSOCIATED WITH DPM:

Climate change is something that directly affects us all and is just one of the concerns associated with diesel exhaust emissions. The main issues surrounding black carbon soot being:

- **Health** DPM has been identified by health experts as contributing to a variety of lung related illnesses. Exposure to DPM has been linked to acute short-term symptoms such as headaches, nausea, and irritation of the eyes, nose and throat. Long-term exposure can lead to chronic and more serious health problems such as cardiovascular disease and lung cancer.

- **Inhalation** The smallest particles have the worst health implications because of their ability to penetrate deep into lung tissue. They easily bind with other toxins in the environment, thereby increasing the hazards of particle inhalation.

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• **Confined Spaces** Machinery operating in confined or enclosed spaces – for example in tunnels, mines, and quarries, or in factories and warehouses where ventilation is limited – pose a greater health risk to operatives and anyone in the vicinity of that equipment.

• **Air Quality** In addition to the health concerns mentioned above, the pollution emitted by diesel engines contributes greatly to air quality problems such as haze and smog, both of which restrict visibility and can cause irritation of the eyes, nose and throat. Furthermore, diesel exhaust fumes contribute to ozone formation, acid rain, and climate change.

Contamination DPM can also contaminate products and packaging in factories and warehouses where DPMs are present in the atmosphere. In the wider environment DPM contaminates foliage and soils buildings, an all too common sight in urban areas.

1.3 HOW CAN THE BLACK SMOKE BE REDUCED:

The industry has been developing innovative ideas to reduce exhaust emissions for many years. A number of solutions are available and these range from Exhaust Gas Recirculation (EGR) to Dual Fuel conversions. The most effective solutions are designed specifically to deal with particulates and can reduce the DPM emissions in the exhaust by up to 99%, from startup. These systems are known as Diesel Particulate Filters or Soot Filters.

1.4 WHAT IS A DIESEL PARTICULATE FILTER (DPF):

A Diesel Particulate Filter is a device that traps the exhaust stream particulate matter by means of physical filtration. This process is an established, efficient and effective way of removing DPM from the exhaust stream. Once captured, the accumulated DPM must then be dealt with in a safe and secure manner. All types of filters have a finite capacity. DPFs are no different and must be cleared of the accumulated DPM, either at regular intervals, or during operation. Failure to do so will eventually cause the filter to block. This can damage or destroy the filter and may also damage the engine due to increased backpressure. There are two solutions to this problem. One is to remove and replace the filter with a fresh one; the second method is to regenerate the filter so it can be reused

FIGURE.1. Diesel particulate filters

Non-Regenerative Generally constructed from fiber matting in which materials such as steel wool and fiber glass are used. Housed in a steel canister or similar, the DPM is trapped within the fiber matting. When full, the element must be replaced with a clean one. These types of filter have a life of around 300 working hours. Therefore they are suited to low usage applications such as standby generator sets, or on equipment that is used for short periods of time. Systems can also be bypassed so that they are only used when required (e.g. operating in confined spaces such as tunnels or warehouses

Regenerative Commonly produced from ceramic materials such as cordierite or silicon carbide. Constructed as a honeycomb monolith, channels are blocked at alternate ends (FIGUREure i) forcing the exhaust gasses to flow through the walls between the channels, known as 'wall-flow'. The particulate matter cannot pass through the walls and is deposited within the channels. As DPM is collected in the filter the carbon deposits are burnt away. This is known as 'regeneration'. Due to the high temperatures involved in regeneration, these filters are suited to high-usage applications where the exhaust gas temperature (EGT) is high (e.g. prime power generators or high usage materials handling equipment). Both Non-Regenerative and Regenerative solutions are effective at cold temperatures and capable of trapping up to 99% of DPM. The addition of either type of system will dramatically reduce black smoke at start-up, as well as during normal operation.

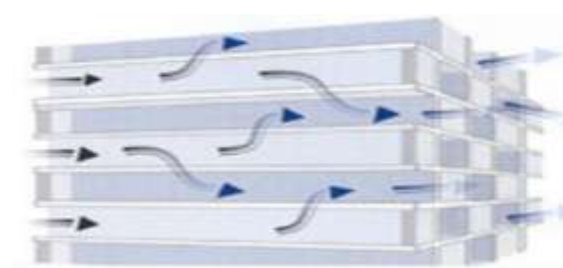

Figure 2 A Regenerative Filter Collects The Dpm, The Carbon Deposits Are Then Burnt Away

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1.5 PASSIVE AND ACTIVE REGENERATIVE SYSTEMS:

The DPM collected in a regenerative system burns at approximately 600°C, which is a temperature rarely reached in a diesel exhaust system. There are two main solutions to this problem, namely 'active' or ‘passive’ regeneration. A passive system requires no additional energy inputs and works by lowering the temperature at which the DPM will combust. An example of this is a fuel-borne catalyst, which reduces the combustion temperature to around 280˚C. An active system uses electric heating or a fuel burning system to increase the temperature in the filter when required and allows regeneration of the filter to occur.

DPF Applications Diesel Particulate Filters can be fitted to almost any piece of machinery or vehicle, for on or off-road use, that uses a diesel engine, such as

- Materials handling equipment Forklift trucks, side loaders and telescopic handlers.
- Power generation equipment Standby or prime power generators.
- Construction equipment & non-road mobile machinery (NRMM) Excavators, dumpers and earth moving equipment
- On-road vehicles On-road vehicles such as buses, coaches and HGVs.

The table below indicates which types of filters are recommended, based on engine usage and the type of emissions reduction required

	STANDBY/LOW USAGE	**PRIME/HIGH USAGE**
PM	Non-regenerative	Regenerative
CO	Catalytic converter	Catalytic converter
HC	Catalytic converter	Catalytic converter
PM,CO+HC	Non-regenartive+catalytic converter	Regenerative+catalytic converter

As each application is unique, the above table is for guidance only. GenCat engineers are happy to assist in the selection of appropriate Diesel Particulate Filters or Catalytic Convertors tailored to your specific requirements.

1.6 CATALYTIC CONVERTERS:

Catalytic converters are separate systems that reduce carbon monoxide (CO), unburned hydrocarbons (HC) and aldehydes. These exhaust emissions are generally associated with contributing significantly to atmospheric pollution problems and are responsible for irritation to the eyes and respiratory system. They can also cause nausea, headaches and tiredness. These effects are further compounded in enclosed spaces such as warehouses, tunnels and mines.

Health and Safety Guidance 187 HS (G)187 This guide, provides practical advice to employers on how to control exposure to diesel engine exhaust emissions (DEEE's) in the workplace, and so protects the health of employees and others who may be exposed. The guidance also details the use of diesel exhaust gas after treatment systems such as catalytic converters and diesel soot particulate traps to remove particulate matter. The Health and Safety Executive (HSE) The Diesel Engine Exhaust Emissions guidelines have recommendations for health protection against exposure to diesel fumes.

Low Emissions Zone (LEZ) To reduce the pollution into London’s air from vehicle exhausts, vehicles such as HGVs, vans, coaches and buses will have to be adapted to meet tightening standards or pay to drive through the capital Best Practice Guide (BPG) Outlines guidance for the control of dust and emissions from construction sites, paying particular attention to off-road machinery and plant. The guide also suggests fitting particulate filters to non-road mobile machinery (NRMM) to reduce particulate emissions for Transport The Emission Standards for Non-Road Mobile Machinery is dedicated to reducing emissions from NRMM is part of the EU’s strategy to reduce air pollution. These legislations tighten emissions from diesel engines

1.7 VEHICLES – LOW EMISSION ZONES:

A Low Emission Zone (LEZ) is an area where only vehicles that meet certain emission standards are allowed to enter. Common features of LEZs are:

- They can apply to all vehicles or only certain vehicle types (e.g. large vehicles)
- They set a minimum Euro standard that a vehicle must meet for one or all pollutants covered by the standard
- The standards become increasingly strict over time

• Enforcement is carried via number plate recognition cameras or issuing window stickers to be checked by on-street traffic wardens

• Large fines are given to non-compliant vehicles caught in the LEZ

Low Emission Strategies use planning conditions to help mitigate the air quality and greenhouse gas impacts of new developments. Air quality assessment in the planning system is frequently ‘adversarial’, with developers and the planning authority arguing whether the impacts of a development are acceptable. Low Emission Strategies take a different approach by looking at mitigation actions that can be taken to allow a development to proceed. Low Emission Strategies were pioneered by the London Borough of Greenwich and are now used by many local authorities all around the UK. Mitigation measures secured in Greenwich include:

• A temporary Low Emission Zone for the development and construction of the Warren development

• Emission based parking policies in the Greenwich Millennium Village

• Requirements for a new superstore to have 50% of delivery vehicles and 50% of home delivery vehicles associated with the store meeting the Euro 5 emission standard. The superstore was also required to report to the Council on the implementation of pollution measures and targets five and ten years after opening

1.8THE CLIMATE IMPACTS OF PARTICULATE MATTER EMISSIONS:

The world is already warming due to the impact of greenhouse gases (such as carbon dioxide and methane) released by human activities. Action to reduce black carbon emissions could reduce this rate of warming: a 2011 report by the United Nations Environment Programmed set out how measures to reduce black carbon (and other air pollutants with a warming impact such as ground level ozone) could radically reduce the amount of warming the globe will experience over the next 40 years. The Arctic would especially benefit from cuts in black carbon emissions, with the report calculating that the warming projected for the next 30 years would be cut by two thirds. Measures to reduce black carbon emissions can complement those taken to reduce emissions of carbon dioxide (CO_2), the main gas involved in the process of global warming. CO_2 has a long life in the atmosphere and there is therefore a long ‘lag time’ before measures taken to reduce emissions have an appreciable impact on the concentration of CO_2 in the atmosphere. By contrast black carbon is removed from the atmosphere in a matter of days. Measures taken to reduce black carbon emissions quickly cut the amount in the atmosphere and reduce the warming it produces.

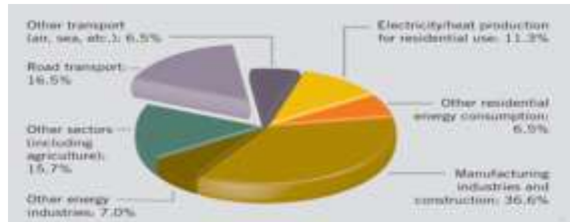

Figure 3. Climate Impacts Of Particulate Matter Emissions

II.LITARATURE REVIEW

Several techniques have been researched and developed to abate hazardous emission constituents from diesel engines at the source level. Some of such extensively investigated techniques are:

• Variations of Injection Pressure and Nozzle Geometry

• Pre-Mixed Combustion

• Water Injection or combinations of two or more of above.

• Retarded and split fuel injection

• Exhaust Gas Recirculation (EGR)

Climate change is being counted as a global environmental threat caused by people. It is seen as the second most serious issue that the world faces and has brought about results that affect life adversely (European Commission 2011). The major ones of these effects are average 0.8 _C global warming above pre-industrial levels, 0.09 _C warming and acidifying of ocean since 1950s, 3.2 cm sea levels rising per decade, an exceptional number of extreme heat waves in last decade, and drought affecting food crop growing areas (Levitus et al. 2012; Meyssignac and Cozenage 2012; McKenzie and Wolf 2010; Li et al. 2009;

[1] Heyder et al. 2011; Dai

Unless the current mitigation, commitments, and pledges are fully implemented, the negative effects of climate change will go on. It is expected that a warming of 4 _C and sea-level rise of 0.5–1 m can occur as early as 2060s (Huddleston 2012). The greenhouse effect is a natural process that plays a major role in shaping the earth's climate. Human activities, especially burning fossil fuels, have contributed to the enhancement of the natural greenhouse effect. This enhanced greenhouse effect stems from an increase in the atmospheric concentrations called greenhouse gases (Jain 1993; Saxena 2009). Greenhouse gases in the atmosphere lead to climate change. The major greenhouse gases emitted into the atmosphere through human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases (hydro fluorocarbons, per fluorocarbons, and sulfur hexafluoride) (Venkataraman et al. 2012;

[2] Wei et al. 2008;

Carbon dioxide (CO2) has the largest rate among the green house gases, and it is the main reason of global warming. The global emission of carbon dioxide has reached 34 billion tons with an increase of 3 % in 2011 (Olivier et al. 2012). Throughout the world, CO2 emissions are currently about 35,000 million metric tons per year. Unless the urgent policies are put in action, CO2 emissions will be projected to rise up 41,000 million metric tons per year in 2020s. In addition to warming in climate systems, the rising of CO2 concentration in the atmosphere leads ocean acidification as a result of dissolutions (The Potsdam Institute for Climate Impact Research and Climate 2012).

ALLANSSON ET AL. 2002

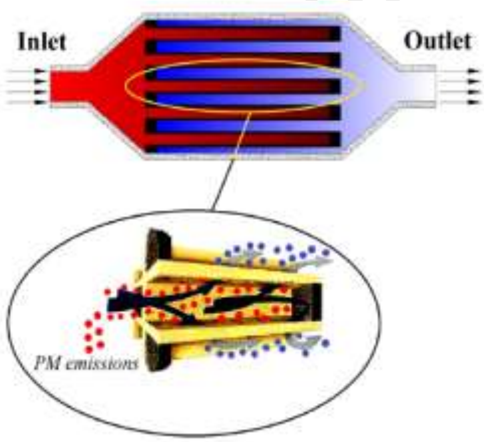

Figure.4.Shows That Filtration Of Dpf

There are subsequently two types of regeneration processes of DPFs commonly referred as active regeneration and passive regeneration. Active regeneration can be periodically applied to DPFs in which trapped soot is removed through a controlled oxidation with O2 at 550^{0}C or higher temperatures

JEGUIRIM ET AL. 2005

In an active regeneration of DPF, PM is oxidized periodically by heat supplied from outside sources, such as an electric heater or a flame-based burner. The burning of PMs, captured in the filter, takes place as soon as the soot loading in the filter reaches a set limit (about 45 %) indicated by pressure drop across the DPF. The higher regeneration temperature and large amount of energy for heat supply are serious problems for active regeneration. While the temperatures as high as melting point of filter generates to failure of DPF, the necessity of energy for heating increases the production cost of system due to complex supplements. These negative effects regard the active regeneration as being out of preference.

PROBLEM STATEMENT:

Many policies have been imposed worldwide in recent years to reduce negative effects of diesel engine emissions on human health and environment. Many researchers have been carried out on both diesel exhaust pollutant emissions and after treatment emission control technologies. The emissions from diesel engines and their control systems are reviewed and there is a need to develop of pollutant filtration in a practical testing system to check the minimum emission rate.

OBJECTIVES:

1. To study the present using emission control systems.
2. To study the fabrication process of making filter type emission control equipment.
3. To check the present emissions in diesel engine with chemical ratios.
4. To check the emissions after assembling new filter.
5. To compare both the emission ratios before and after practically.

III.MATERIALS DESIGN AND ANALYSIS.

3.1 MATERIALS:

STAINLESS STEEL 316

Stain less steels are iron base alloys containing 10.5% or more chromium. they have used for many industrial architectural chemical and consumer applications for over a half century Currently there are being marketed a number of stain less steels originally recognized by the American iron and steel intuits (AISI) as standard alloys .also commercially available are property stain less steels with special characteristics A stainless steel in the singular sense as if it were one material .actually there are over fifty stain less steel alloys there are classification are used to identify stain less steels

There are:

1. Metallurgical structure
2. The AISI numbering system (Namely ‘’200,300,400. Series numbers)
3. The unified numbering system

Figure.5. 316 Stainless Steel Metal

3.2 STAINLESS STEEL - GRADE 316 PROPERTIES:

Type 316 is an austenitic chromium nickel stainless steel containing molybdenum. This addition increases general corrosion resistance, improves resistance to pitting from chloride ion solutions, and provides increased strength at elevated temperatures. Properties are similar to those of Type 304 except that this alloy is somewhat stronger at elevated temperatures. Corrosion resistance is improved, particularly against sulfuric, hydrochloric, acetic, formic and tartaric acids; acid sulfates and alkaline chlorides. Type 316L is an extra-low carbon version of Type 316 that minimizes harmful carbide precipitation due to welding. Typical uses include exhaust manifolds, furnace parts, heat exchangers, jet engine parts, pharmaceutical and photographic equipment, valve and pump trim, chemical equipment, digesters, tanks, evaporators, pulp, paper and textile processing equipment, parts exposed to marine atmospheres and tubing. Type 316L is used extensively for elements where its immunity to carbide precipitation due to welding assures Optimum corrosion resistance.

THE 3.1 TABLE SHOWS THAT CHEMICAL PROPERTIES

Grade	c	MN	SI	P	S	CR	MO	NI	N
SS316	0.08MAX	2.0MAX	0.75MAX	0.045MAX	0.03MAX	MIN:2.0MAX:3.0	MIN:10.0MAX:14.0	MIN:10.0MAX:14.0	0.10MAX
SS102	0.03MAX	2.0MAX	0.75MAX	0.045MAX	0.03MAX	MIN:16.0MAX:18.0	MIN:16.0MAX	MIN:2.0MAX:3.0	0.10MAX

MECHANICAL PROPERTIES:

Grade	Tensile strength ksi(min)	Yield strength 0.2 % ksi (min)	Elongation %	Hardness(brinell) max	Hardness (Rockwell b)max
Ss316	75	30	40	217	95
Ss102	70	25	40	217	95

PHYSICAL PROPERTIES:

Density lb_m/in^3	Thermal Conductivity (BTU/h ft. °F)	Electrical Resistivity (in x 10^{-6})	Modulus of Elasticity (psi x 10^6)	Coefficient of Thermal Expansion (in/in)/°F x 10^{-6}	Specific Heat (BTU/lb/°F)	Melting Range (°F)
0.29 at 68°F	100.8 at 68 212°F	29.1 at 68°F	29	8.9 at 32 – 212°F	0.108 at 68°F	2500 to 2550

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3.3 DESIGN OF SMOKE FILTER:

INTRODUCTION TO CAD

CAD data exchange is a modality of data exchange used to translate data between different Computer-aided design (CAD) authoring systems or between CAD and other downstream CAD systems.

Many companies use different CAD systems internally and exchange CAD data with suppliers, customers and subcontractors.[1] Transfer of data is necessary so that, for example, one organization can be developing a CAD model, while another performs analysis work on the same model; at the same time a third organization is responsible for manufacturing the product.[2] The CAD systems currently available in the market differ not only in their application aims, user interfaces and performance levels, but also in data structures and data formats[3] therefore accuracy in the data exchange process is of paramount importance and robust exchange mechanisms are needed.[2]

The exchange process targets primarily the geometric information of the CAD data but it can also target other aspects such as metadata, knowledge, manufacturing information, tolerances and assembly structure.

There are three options available for CAD data exchange: direct model translation, neutral file exchange and third-party translators

THIRD-PARTY TRANSLATORS:

Several companies specialize in CAD data translation software that can read from one CAD system and write the information in another CAD system format. There are a handful of companies, including Datakit, Spatial Corp, and Tech Soft 3D, that provide low-level software toolkits to directly read and write the major CAD file formats. Most CAD developers license these toolkits, to add import and export capabilities to their products. There are also a significant number of companies that use the low-level translation toolkits as the basis for building standalone end-user translation and validation applications. Among these companies are International Technic Group Incorporated (ITI), Trans Magic, and Core Technologies. These systems have their own proprietary intermediate format some of which will allow reviewing the data during translation. Some of these translators work stand-alone while others require one or both of the CAD packages installed on the translation machine as they use code (APIs) from these systems to read/write the data.

Figure.6. Plane View Of The Smoke Filter

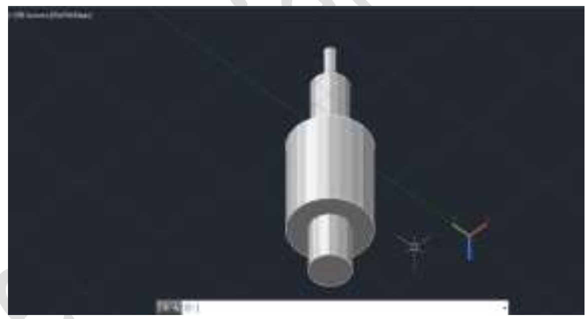

Figure 7. Shows That Smoke Filter Front View

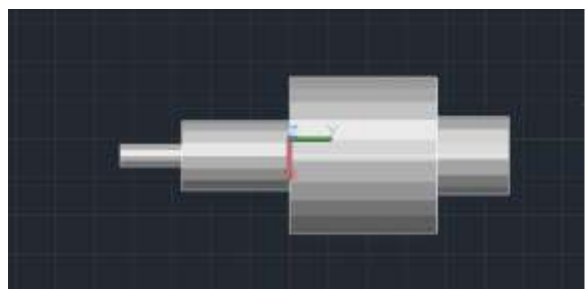

Figure.8.Shows That Smoke Filter Of The Cad Model

3.4 POLLUTION EMISSIONS FROM DIESEL ENGINE:

Diesel engines have high efficiency, durability, and reliability together with their low-operating cost. These important features make them the most preferred engines especially for heavy-duty vehicles. The interest in diesel engines has risen substantially day by day. In addition to the widespread use of these engines with many advantages, they play an important role in environmental pollution problems worldwide.

Diesel engines are considered as one of the largest contributors to environmental pollution caused by

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exhaust emissions, and they are responsible for several health problems as well. Many policies have been imposed worldwide in recent years to reduce negative effects of diesel engine emissions on human health and environment. Many researches have been carried out on both diesel exhaust pollutant emissions and aftertreatment emission control technologies. In this paper, the emissions from diesel engines and their control systems are reviewed. The four main pollutant emissions from diesel engines (carbon monoxide-CO, hydrocarbons-HC, particulate matter-PM and nitrogen oxides-NO_x) and control systems for these emissions (diesel oxidation catalyst, diesel particulate filter and selective catalytic reduction) are discussed. Each type of emissions and control systems is comprehensively examined

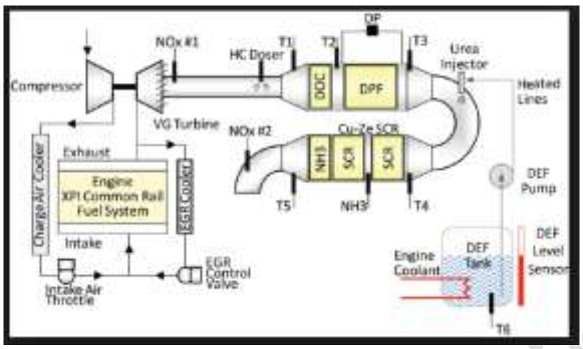

Figure.9.Diesel Engine Common Rail Smoke Filter System

3.5 ANALYSIS OF SMOKE FILTER:

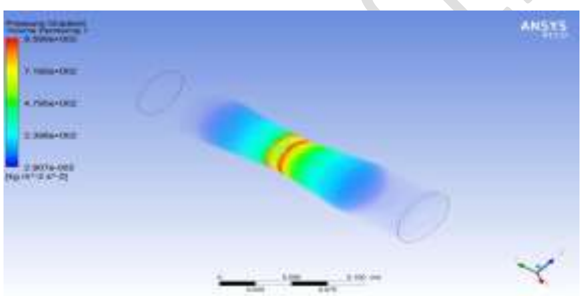

Figure 10. Pressure Gradeint Of The Smoke Filter

DISCUSSIONS:

The above FIGURE shows the pressure graident of the smoke done in ansys having rendring -1 shows the renderenc which has a maximum value at center postion indicated , and is getting varied with a difference 2 the next rendering is found in the next portion to the maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by ansys.

The maximum value obtained at center portion for pressure 9.590e^{+002}kg m^{a} -2 s^{L} -2.

The minimum value obtained at center portion for pressure 2.907e-002 kg m^{a} -2 s^{L} -2.

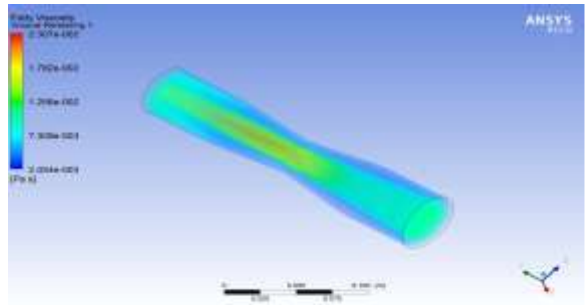

Figure.11. Shows That Velocity Gradient

DISCUSSIONS:

The above FIGURE shows the velocity gradient of the smoke done in ansys having rendering -1 shows the endurance which has a maximum value at center position indicated, and is getting varied with a difference the next rendering is found in the next portion to the maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by ansys.

The maximum value obtained at center portion for velocity 2.307 e^{-002}Pa s.

The minimum value obtained at center portion for velocity 2.054e-003 Pa s.

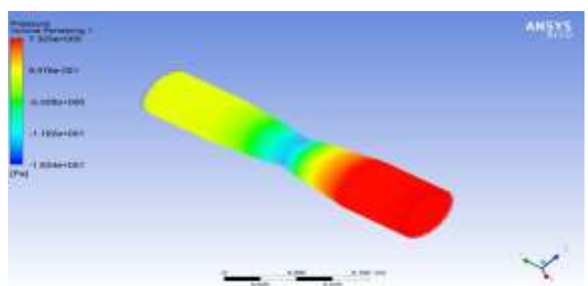

Figure 12. Shows That Pressure Volume Rendering Of The Filter

DISCUSSIONS:

The above FIGURE shows the mixture of pressure volume the smoke done in ansys having rendering -1 shows the endurance which has a maximum value at end position indicated, and is getting varied at different and with a difference the next rendering is found in the next portion to the

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maximum value and while coming to end the value is getting decreased which can be clearly observed in above FIGUREure done by Ansys.

The maximum value obtained at end portion for pressure emission is $7.323e^{+000}$ Pa

The minimum value obtained at end portion for volume emission is $1.834e^{+001}$ Pa.

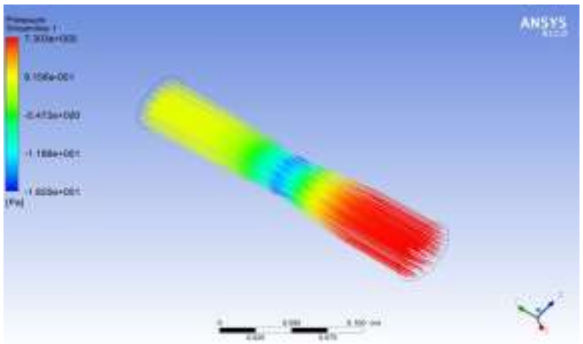

FIGURE 13. shows that Pressure streamline

DISCUSSIONS:

The above FIGURE shows the mixture of pressure steam line for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for pressure steam line is $7.303e^{+000}$ Pa

The minimum value obtained at the end portion for pressure steam line is $1.825e^{+001}$ Pa

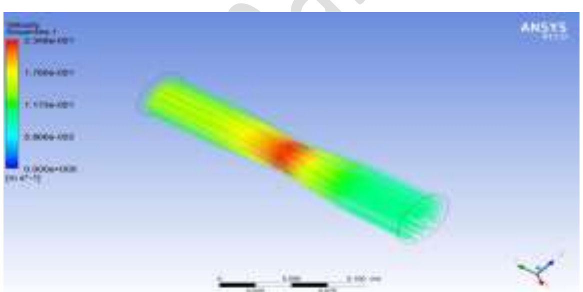

FIGURE 14. shows that filter velocity steam line

Discussions:

The above FIGURE shows the mixture of steam line for smoke filter done in ansys having endurance and emission of pressure at both ends velocity which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for velocity steam line is 2.346e-001 ms^{L-2}

The minimum value obtained at the end portion for velocity steam line is 0.00e+000 ms^{L-2}

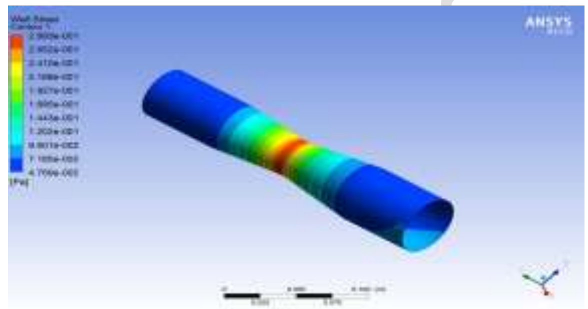

FIGURE .15. shows that filter wall stressing model

DISCUSSIONS:

The above FIGURE shows the mixture of for smoke filter done in Ansys having endurance and emission of pressure at both ends and which has a maximum value filter wall stressing model at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for is wall stressing model 2.893e-001 Pa

The minimum value obtained at the end portion for pressure steam line is 4.96 e-002Pa

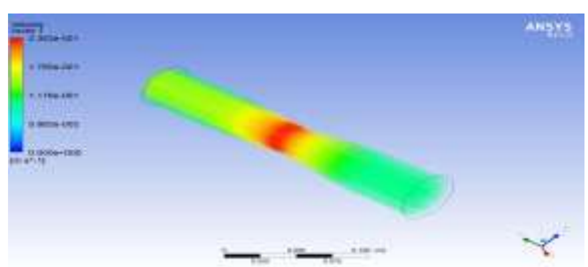

Fig: 16. shows that Smoke filter velocity vector

DISCUSSIONS:

The above FIGURE shows the mixture of filter velocity vector for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end

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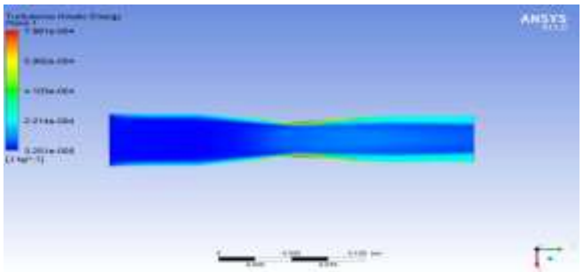
positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for filter velocity vector is 2.353e-001 ms^{L-1}

The minimum value obtained at the end portion for filter velocity vector is 0.000+000 ms^{L-1}



The FIGURE.17. shows that Turbulence kinetic energy

DISCUSSIONS:

The above FIGURE shows the mixture of Turbulence kinetic energy for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion for Turbulence kinetic energy is 7.881e-004j kg ^{L}-1

The minimum value obtained at the end portion for Turbulence kinetic energy is 3.251e-005 j kg ^{L}-1

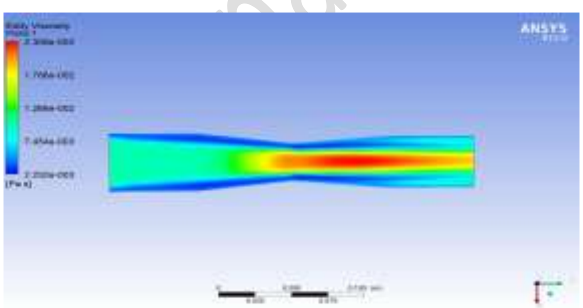


FIGURE .18. shows that Viscosity of the smoke filter

Discussions:

The above FIGURE shows the mixture of pressure steam line for smoke filter done in ansys having endurance and emission of pressure at both ends and which has a maximum value at end positions indicated, and is getting varied at different and with a difference the next rendering is found in the middle portion to the minimum value.

The maximum value obtained at end portion Viscosity of the smoke filter is Pa 2.306e-002 pa

The minimum value obtained at the end portion for Viscosity of the smoke filter is 2.252e-002Pa

IV.FABRICATION AND RESULTS

4.1 Fabrication of the smoke filter :

Stainless Steel Processes

The final operation after fabrication or heat treatment is cleaning to remove surface contamination and restore corrosion resistance of the exposed surfaces. Degreasing to remove cutting oils, grease, crayon markings, fingerprints, dirt, grime and other organic residues is the first step.

Degreasing:

Non-chlorinated solvents should be used in order to avoid leaving residues of chloride ions in crevices and other locations where they can initiate crevice attack, pitting, and/or stress corrosion later on when the equipment is placed in service.

Machined Components:

After degreasing, machined components are sometimes “passivated” in 10% nitric acid. Nitric acid enhances the natural oxide surface film.

Using the fabrication materials :

Stainless steel 316,

Stain less steel 102.

4.2 FABRICATIONS:

After degreasing, metallic surface contaminants such as iron embedded in fabrication shop forming and handling, weld splatter, heat tint, inclusions and other metallic particles must be removed in order to restore the inherent corrosion resistance of the stainless steel surface.

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Nitric-HF pickling, (10% HNO3, 2% HF at 49C to 60C (120 to 140F), is the most widely used and effective method removing metallic surface contamination. Pickling may be done by immersion or locally using a pickling paste.

Electro Polishing:

Electro polishing is using oxalic or phosphoric acid for the electrolyte; a copper bar or plate for the cathode can be equally effective. Electro-polishing may be done locally to remove heat tint alongside of welds or over the whole surface.

Both pickling and electro polishing remove a layer several atoms deep from the surface. Removal of the surface layer has the further benefit of removing surface layers that may have become somewhat impoverished in chromium during the final heat treatment operation.

4.3 WELDING PROCESS OF SMOKE FILTER

The normal TIG welding process of smoke filter using materials is ss316,ss102 normal **Gas tungsten arc welding** (**GTAW**), also known as **tungsten inert gas** (**TIG**) **welding**, is an arc welding process that uses a non-consumable tungsten electrode to produce the weld. The weld area is protected from atmospheric contamination by an inert shielding gas (argon or helium), and a filler metal is normally used, though some welds, known as autogenously welds, do not require it. A constant-current welding power supply produces electrical energy, which is conducted across the arc through a column of highly ionized gas and metal vapors known as a plasma.

FIGURE 20. shows that normal TIG welding process of smoke filter

DISCUSSIONS:

GTAW is most commonly used to weld thin sections of stainless steel and non-ferrous metals such as aluminum, magnesium, and copper alloys. The process grants the operator greater control over the weld than competing processes such as shielded metal arc welding and gas metal arc welding, allowing for stronger, higher quality welds. However, GTAW is comparatively more complex and difficult to master, and furthermore, it is significantly slower than most other welding techniques. A related process, plasma arc welding, uses a slightly different welding torch to create a more focused welding arc and as a result is often automated.

The FIGURE.19. shows that TIG welded component (SS316,SS102)

DISCUSSIONS:

Smoke sensor for diesel engines. The sensor is intended to provide a means of detecting smoke levels that exceed certain pre-defined limits. ...EGR levels were adjusted to vary exhaust smoke levels at a fixed speed/load test point. Smoke measurements were provided by an available FOR 415s variable sampling smoke meter. ...Engine dynamometer tests were carried out using a heavy duty diesel engine equipped with a laboratory EGR system. EGR levels were adjusted to vary exhaust smoke levels at a fixed speed/load test point.

4.4 GLASS BEAD OR WALNUT SHELL BLASTING:

Glass bead or walnut shell blasting are very effective in removing metallic surface contamination without damaging the surface. It is sometimes necessary to resort to blasting with clean sand to restore heavily contaminated surfaces such as tank bottoms, but care must be taken to be certain the sand is truly clean, is not recycled and does not roughen the surface. Steel shot blasting should not be used as it will contaminate the stainless steel with an iron deposit.

Stainless steel wire brushing or light grinding with clean aluminum oxide abrasive discs or flapper wheels are helpful. Grinding or polishing with grinding wheels or continuous belt sanders tend to overheat the surface layers to the point where resistance cannot be fully restored even with subsequent pickling.

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The FIGURE.21. shows that fabrication metarial of smoke filter

FIGURE.22.shows that smoke filter ss316 material

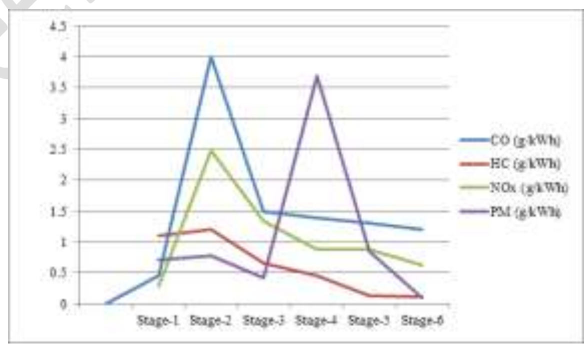
FIGURE.23. shows that housing of the smoke filter

FIGURE.24. shows that jolly of the smoke filter

FIGURE.25.shows jolly part of smoke filter

THE TABLE 4.1 SHOWS THAT PRACTICAL VALUES OF NORMAL DIESEL ENGINE COLD SHOT EMISSIONS

Emission percentages	CO (g/kWh)	HC (g/kWh)	NO_x (g/kWh)	PM (g/kWh)
Stage-1	0.45	1.1	0.28	0.712
Stage-2	4	1.2	2.48	0.776
Stage-3	1.5	0.68	1.336	0.418
Stage-4	1.4	0.48	0.88	3.69
Stage-5	1.3	0.13	0.888	0.84
Stage-6	1.21	0.11	0.621	0.09



The Graph.1. Shows That Practical Values Of Normal Diesel Engine Cold Shot Emissions

The Table 4.2 Shows That Practical Values Of Normal Diesel Engine Hot Shot Emissions

Emission percentages	CO (g/kWh)	HC (g/kWh)	NO_x (g/kWh)	PM (g/kWh)
Stage-1	5.17	1.27	3.15	0.27
Stage-2	38.3	38.3	36.34	37.3
Stage-3	24.15	1.62	22.14	0.62
Stage-4	17.25	5.28	15.23	4.28
Stage-5	16.1	5.05	14.01	4.03
Stage-6	14.95	1.48	12.91	0.48

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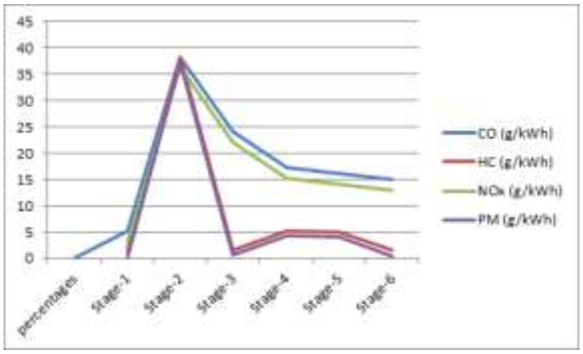
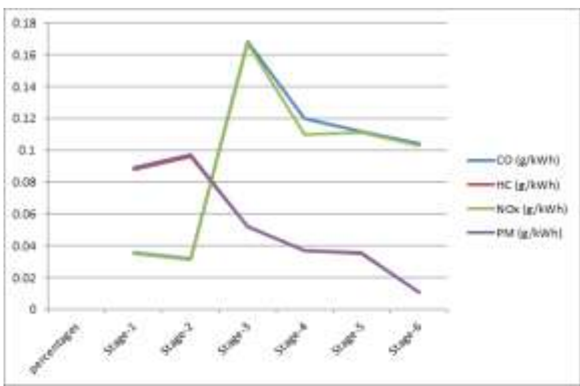


The Graph 2 Shows That Practical Values Of Normal Diesel Engine Hot Shot Emissions

Table 4.3 Shows That Normal Diesel Engine Cold Shot Emission

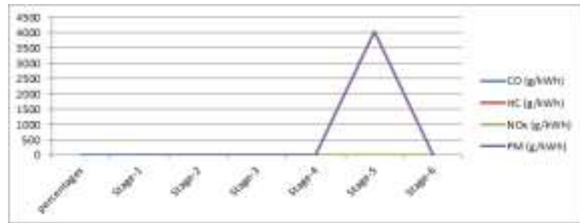
Emission percentages	CO (g/kWh)	HC (g/kWh)	NO_x (g/kWh)	PM (g/kWh)
Stage-1	0.036	0.088	0.035	0.089
Stage-2	0.032	0.098	0.031	0.097
Stage-3	0.168	0.052	0.167	0.0523
Stage-4	0.12	0.0368	0.11	0.0369
Stage-5	0.112	0.035	0.111	0.0356
Stage-6	0.104	0.0104	0.103	0.0105



The Graph 3 Shows That Normal Diesel Engine Cold Shot Emission

Table 4.4 Shows That Normal Diesel Engine Hot Shot Emission

Emission percentages	CO (g/kWh)	HC (g/kWh)	NO_x (g/kWh)	PM (g/kWh)
Stage-1	0.414	0.102	0.410	0.103
Stage-2	3.068	1.104	2.068	0.105
Stage-3	1.932	0.132	0.932	0.133
Stage-4	1.38	0.4232	0.38	0.4233
Stage-5	1.288	0.4048	0.288	04049
Stage-6	1.106	0.1196	0.196	0.1197



The Graph 4. Shows That Normal Diesel Engine Hot Shot Emission

V.CONCLUSION

The smoke filter characteristics of main pollutant emissions (CO, HC, PM, and NO_x) from diesel engines and control technologies of these pollutant emissions with standards and regulations. Among these pollutant emission, CO and HC are emitted because of incomplete combustion and unburned fuel while NO_x emissions are caused because of high combustion temperatures above 1,600 °C. As for PM emissions, the reasons of PM emissions are agglomeration of very small particles of partly burned fuel, partly burned lube oil, ash content of fuel oil and cylinder lube oil or sulfates and water.

These pollutant emissions have harmful effects on environment and human health. Even though many applications have been implemented on diesel engines to prevent harmful effects of these pollutant emissions and to meet stringent emission regulations, only after treatment emission control systems are of the potential to eliminate the pollutant emissions from diesel exhaust gas.

To control these pollutant emissions as desired is only possible with after treatment systems. Diesel exhaust after treatment systems include DOC, DPF, and SCR. These systems are the most requested components especially for heavy-duty diesel engines and usually a combination of DOC, DPF, and SCR has been respectively used for the simultaneous removal of main pollutant emissions from diesel engine exhaust.

The temperature of diesel exhaust gas has an important effect on reducing pollutant emissions. Besides catalyst type, space velocity of exhaust gas, and emission form are the other parameters affecting the efficiency. With the after treatment emission control systems, it is possible to reduce the damage of the pollutant emissions on air pollution, to meet emission standards and requirements, and to prevent the harmful effects of pollutant emissions on environment and human health. Due to these missions, emission control systems are utmost importance worldwide. For the complete destruction

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of polluting emissions from diesel engines, further studies and researches on the after treatment emission control systems should be intensified and continued.

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