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Design and Fabrication of Exhaust Gas Recirculation and pollution Control System in Petrol Engine

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ABSTRACT

Exhaust gas recirculation was used by reducing to pollute of petrol engine. The principle was based on the thermodynamic properties of the exhaust gas, reduction in combustion temperature and hence reduces the emission of the oxides of nitrogen. The technical involves the recirculation of high heat capacity of the exhaust gas to dilute the charges 2.6% of the total exhaust gas from the engine was recycled from the exhaust gas discharge manifold to the intake manifold. The changes on the parameters of the engine were observed. The resulting data were analyzed by graphically. It has improved exhaust gas recirculation the brake specific fuel consumption, reduced the flame temperature and the Nox emission.

Keywords - Engine, Exhaust gas, Recirculate.

I.INTRODUCTION

Major problem faced by today's world is environmental pollution of these vehicular traffic is a major contributor .The majority of vehicles used by this method. We can use the petrol engine. This method used to control emission gas in a petrol engine. In this method worked at minimum speed .But don't worked at high speed. The petrol engine has used fuel and air by producing power. These explosions occur inside the engine cylinders. All petrol engines generate power by creating explosions using fuel and air mixture. These explosions occur inside the engine cylinders and push the pistons down, which turns the crankshaft. Some of the powers produced by prepare the cylinders for the next explosion .compressing the air or fuel-air mixture before the fuel is ignited. Petrol engines combine a fuel mist with air before the mixture is taken into the cylinder. Petrol engine use a spark plug to ignite the fuel-air mixture. Fuel-air can be creating power after burning the fuel-air mixture. 64% burned but 36%unburned.unburned gases CO, CO2, HC, and NOx. Mostly NOx exhausted. Nitrogen and Oxygen combine to produce NOx. This cause to improve Engine efficiency and to reduce the environmental pollution.

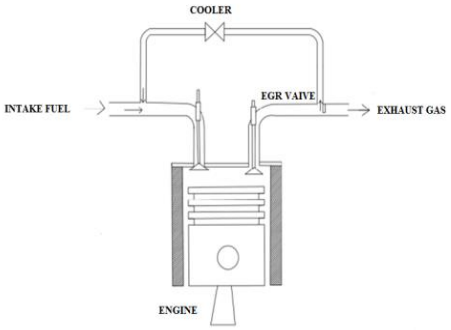

Fig.1 Process chart

Table 1 .Specification of the engine

Type	Air cooled
Number of stroke	4
Number of cylinder	Single cylinder OHC
Displacement	100 cc
Maximum Torque	0.82 kg-m(8.36 ps)@8000rpm
Maximum Power	6.15 kW (8.05 N-m)@5000rpm
Compression ratio	9.9:1
Starting	Kick-start, self-start
Ignition	DC-Digital CDI

Table 2.Nomenclature

Speed	N (rpm)
Fuel consumption	Vf (cm^3/min)
Exhaust gas temperature	Te(0C)
Brake specific fuel consumption	BSFC (g/KWh)
Hc	Hydro carbon
Co	Carbon monoxide
Co_2	Carbon di oxide
No_x	Nitrogen oxide

II.LITERATURE SURVEY

[1] Edwards et al have performed simulation for heavy-duty petrol engine using combined Miller cycle and internal EGR to reduce NOx emissions and specific fuel consumption. The disadvantages of external EGR and various configurations of valve timings to achieve internal EGR were discussed. It was concluded that secondary opening of the exhaust valve during intake stroke was the most efficient method of achieving EGR.

[2] Roy Kamo et al have conducted experimental investigation on turbocharged six-cylinder petrol engine converted to Miller cycle operation. Effects of intake valve closing time, injection time, and insulation of piston, head and liner on the emission characteristics of the Miller cycle engine were experimentally verified.

[3] HakanYilmaz and Anna Stefanopoulous have extended an existing crank angle resolved dynamic nonlinear model of a six-cylinder turbocharged petrol engine with exhaust valve closing (EVC) variability. Early EVC had achieved a high level of internal exhaust gas recirculation (EGR) or charge dilution in petrol engines, and thus reduced generated oxides of nitrogen (NOx). This model was validated in steady-state conventional (fixed EVC) engine operating points. They showed using simulations that the EVC can be used for management of EGR in turbocharged petrol engines.

[4] Benajes et al have performed experimental investigation on the potential of the Atkinson cycle and reducing intake oxygen concentration for pollutant control in a heavy-duty petrol engine. The analysis was mainly focused on in-cylinder gas thermodynamic conditions, combustion process, exhaust emissions and engine efficiency. In compression ignition engines, the Atkinson cycle basically promoted the premixed combustion, but in the range of these test conducted a complete premixed combustion was not attained.

[5] Abd-Alla has reviewed the potential of exhaust gas recirculation (EGR) to reduce the exhaust emissions, particularly NOx emissions, and to delimit the application range of this technique. In this work a detailed analysis of previous and current results of the EGR effects on the emissions and performance of petrol engines were introduced. The authors 9 have concluded that adding EGR to the air flow rate to the petrol engine, rather than displacing some of the inlet air, appears to be a more beneficial way of utilizing EGR in petrol engines.

III.EXHAUST GAS RECIRCULATION

The Exhaust Gas Recirculation system is used to reduce NOx emissions from the engine. It works by recirculate exhaust gas back to the engine. Intermixing the recirculate gas with incoming air reduces the amount of available O2 to the combustion and lowers the peak temperature of combustion. Recirculation has achieved in the exhaust area to the intake area.

Uses of Exhaust Gas Recirculation:

Exhaust gas recirculation reduces the concentration of exhaust gas in the fuel-air mixture. Likely NOx has controlling. NOx has controlled Since acid rain to be controlled. Egr works by reducing the amount of oxygen in the cylinder, which lowers combustion temperatures. It's an efficient process for reducing NOx .Exhaust gas recirculation is used to reduce the levels of NOx emitted by the engine. Low cost of the vehicle or engine. Increase the efficiency of the engine. Control of air pollution.

IV. FORMATION OF NITROGEN OXIDES (NOX)

The same factors that cause petrol engines to run more efficiently than gasoline engines also cause them to run at a higher temperature. This leads to a pollution problem, the creation of nitrogen oxides (NOx). Fuel in all engines is burned with extra air, which helps eliminate unburned fuel from the exhaust. This air is approximately 79% nitrogen and 21% oxygen.Fuel in any engine is burned with extra air and some of the oxygen is used to burn the fuel. When air is compressed in the cylinder of the petrol engine, the temperature of the air is increased enough to ignite petrol fuel after it is ignited in the cylinder. When the petrol fuel ignites, the temperature of the air increases to more than 1500°F and NOx formation

mechanism NO is formed inside the combustion chamber in the post- flame combustion process in the high temperature region. The nitrogen & oxygen formation and decomposition inside the combustion chamber can be described by extending Zeldovich Mechanism. Nox formation is very harmful for environmental.When the peak temperatures are high enough for long periods of time, the nitrogen and oxygen in the air combines to form Nitrogen oxides.

V.PROBLEMS OF NOX

NOx enters into the atmosphere; they are spread over a large area by the wind. When it rains, water, then combines with the nitrogen oxides to form acid rain. This has been known to damage buildings and have an adverse effect on ecological systems. Too much NOx in the atmosphere also contributes to the production of SMOG. When the sunrays hit these pollutants NOx is formed. NOx also affect breathing illness of the human lungs.

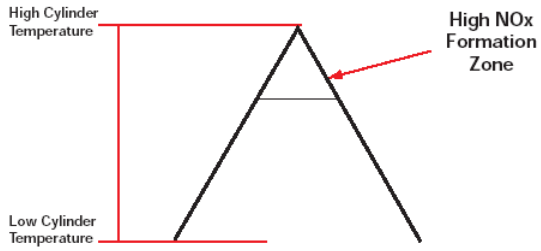

Fig.2. NOx formation zone.

VI.EPA EMISSION STANDARDS

The EPA has controlled heavy duty petrol engines since the 1970s. The following chart shows the trend to ever-lower emissions. Understanding the details of the chart is not of interest to most truckers. Even though the emissions standards become increasingly more difficult to meet, the diesel engine industry has always been able to continue to improve engine durability, reliability, performance, and fuel economy. A quick look at the bottom right hand side of the chart also shows that emissions from diesel engines built in 2007 and beyond will approach zero. NOx emission is closely related to it temperature and oxygen content in the combustion chamber. Any process to reduce cylinder peak temperature and concentration of oxygen will reduce the oxides of nitrogen. This suggests a number of methods for reducing the level of nitrogen oxides. The following are the three methods for reducing peak.

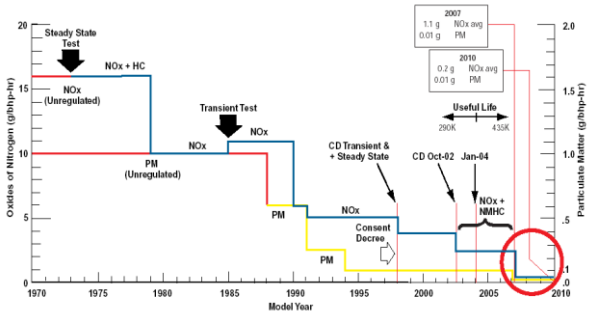

Fig.3. EPA Heavy Duty Engine Emission Standards

Enriching the air fuel (A/F) mixture to reduce combustion temperatures. However, this increases HC and carbon monoxide (CO) emissions. Also lowering the compression ratio and Retarded Ignition Timing makes the combustion process start at a less than the optimum point and reduces the efficiency of combustion.

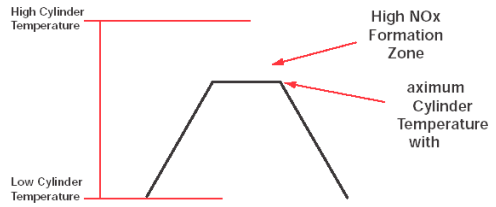

Fig.4. NOx reduction by lowering the temperature

VII.EXPERIMENTAL SETUP

The experiment is conducted to determine the effect of EGR on the performance and emission characteristics of the compression ignition petrol engine. The engine used is a four stroke, water cooled, single cylinder, indirect injection petrol engine. Exhaust gas recirculation reduces the concentration of oxygen in the fuel-air mixture. There is low oxygen available for the combustion reaction to proceed when replacing fewer of oxygen and inlet air with relatively O_2 with poor exhaust gas. The exhaust gas from the engine was recycled from the exhaust gas discharge manifold to the intake manifold. The same factors that cause petrol engines to run more efficiently than gasoline engines also cause them to run at a higher temperature. This leads to a pollution problem, the creation of nitrogen oxides (NOx).The mainly used for recirculate the unburned gas.

Fig.5. Overall Setup

VIII. EXPERIMENTAL CHART

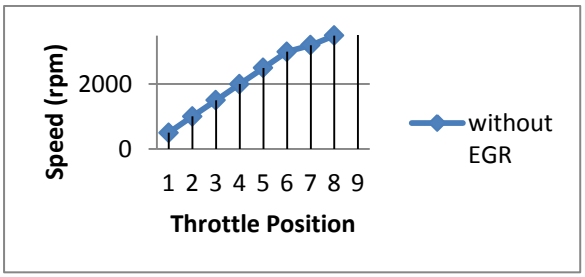

Figure 1. The effect of EGR on the speed

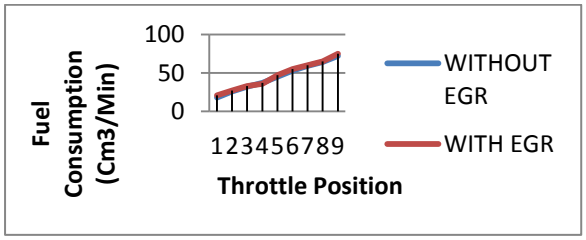

Figure 2. The effect of EGR on fuel consumption

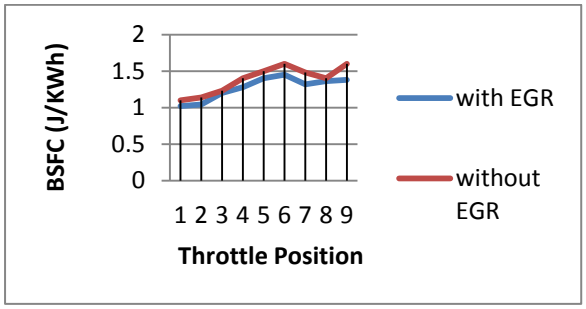

Figure3. Effect of EGR on the brake specific fuel consumption

CONCLUSION

Thus, as seen that the using Exhaust Gas Recirculation Technology in all engines, the emissions are controlled due to lower amounts of NOx entering the atmosphere. Thus the emission levels to be maintained are attained by the engines. As seen, Exhaust Gas Recirculation is a very simple method. It was very useful and it is being modified further to attain quality standards. This method is very reliable in terms of fuel consumption and highly reliable. Thus EGR is the most effective method for reducing the nitrous oxide emissions from the engine exhaust. Many of the four wheeler,used to increase the engine performance and reduce pollutants in the exhaust of the engine.

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