International Journal of Scientific Research in Science, Engineering and Technology (www.ijsrset.com)
© 2020 IJSRSET | Volume 7 | Issue 1 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
DOI : https://doi.org/10.32628/IJSRSET20719

A Review on Study on Performance and Noise Analysis of 4 Stroke 4 Cylinder Diesel Engine

Surabhi Kumari, Prof. Suresh Kumar Badholiya
Department of Mechanical Engineering, RGPV/Bhopal Institute of Technology and Science, Bhopal, Madhya Pradesh, India

ABSTRACT

In our modern world, rapidly growing environment one of the developing problems is that of "Noise". This has lead to overcrowded or jammed roads and noise pollution. Engine noise is one of the major sources of noise in vehicles. So, it is necessary to study noise generated by four stroke four cylinder diesel engine at different loads. First the sound pressure level is measure in dB (A) near the engine at four different locations at distance of 1.5 m from centre of each side of an engine to find out that location where sound pressure level is maximum. Sound power is calculated using rectangular parallelepiped at different loads. Frequency spectrum analysis is done to measure sound pressure level in 1-1 octave band.

Keywords : Specific Fuel, Specific Energy, Noise, Four Stroke Four Cylinder Diesel Engines.

I. INTRODUCTION

1.1 Introduction

In our modern world, rapidly expanding environment one of the developing problems is that of noise. Apart from the pure annoyance factor of noise, exposure to an intense sound field over a long period of time presents the risk of permanent damage of hearing. This particular problem is becoming a source of serious concern to industrial corporations, trade unions and companies.

The object of this part is to discuss the concept of noise, problems of noise and its effect on man and environment both as annoyance and as a danger to health.

Noise : Noise is conveniently and concisely defined as "unwanted sound".

Sound: Sound waves are pressure variations produced as a result of mechanical Disturbance in a material medium.

Decibel: Decibel is the logarithm of a ratio of two quantities and therefore has no units. Decibel is defined by expression as $10 \log_{10} (P/P_O)^2$ P is the sound pressure amplitude of the measured sound P0 is a reference pressure, 20μPa.

1.1.1Sources of Noise

Sources of noise may be either natural are manmade. Natural sources include thunderstorm, volcanic eruption, earthquake, etc. but the main sources of noise which lead to noise pollution are manmade sources. they include noise from automobiles, such as cars, buses, trucks, fire engines, trains, aeroplanes, noise from factories industries, noise from constructional equipments, and noise from domestic application such as food mixers, washing machines, exhaust fans, vacuum cleaner, dish washers, T.V., radio, musical instruments etc.

These sources can be divided into following categories

(a) Traffic noise
(b) Industrial noise
(c) Noise due to constructional equipments
(d) Noise due to domestic application

(a). Traffic Noise

This includes noise from automobiles rail and aircrafts. Noise from these sources includes noise produced by their engines, exhaust, horns and sirens. Traffic noise, actually is the main menace of noise.

(b). Industrial Noise

In industries, noise is the by-product of energy conversion. High intensity noise produced by many machines which man has invented during his technological advancements.

(c). Noise Due to constructional Equipments

Heavy constructional Equipments used for building construction and infrastructure development produced heavy noise. They include welding generators, tower cranes, compressors, etc.

(d). Noise Due to Domestic Application

A number of domestic appliances are noise producers. A variety of appliances, e.g. food mixers, whistling kettles, electric drill, and hand operated lawn mowers, vacuum cleaners are capable for generating noise levels to the tune of 77-91 db.

Out of above three parameters, the source that affects the most is Traffic noise. In traffic noise, almost 70% of noise is contributing by vehicle noise. Vehicle noise, mainly, arises from two parameters i.e. Engine noise and Tire noise. The major traffic noise is includes

1. Road Traffic Noise
2. Rail Traffic Noise
3. Air craft Noise

Road Traffic Noise

The noise generated from road traffic is the measure source of air pollution. Various source of noise pollution. Various sources of noise in a vehicle are its engine, Transmission system, exhaust, horn and sirens. The volume of traffic noise increases with the increase in traffic speed. For example, a sports car produced 30 times more intense than a small passenger car. Traffic noise also depends upon the traffic density and the type and condition of vehicles. Heavy diesel vehicles such as trucks, busses, etc. are the noisiest vehicle on the road.

Rail Traffic Noise

Noise from rail traffic is not a serious as other traffic noises. The noise produced of lower frequency as compared to that of road traffic. Further the most of the railway tracks run through rural areas. The introduction of electric locomotive has also reduced rail traffic noise to great extent. The maximum impact of noise produced by train is felt by the buildings nearby the railway tracks. Hooting of train can rise noise level up to 130db which is much higher than the permissible limits.

Aircraft Noise

Aircraft noise is causing much more discomfort than that from road traffic noise. The source of noise has been increased during recent year, especially closed to the international airports. Noise produced by aircraft is intermittent as compared to continuous noise from road traffic it is much more disturbing and harmful. Further, advanced jet planes produced more intrinsic sound which can also damage hearing ability permanently.

1.2 Sound Sources

A distinction is made between three different types of sound sources:

1. Point source
2. Line source
3. Plane source

1.3 C.I. ENGINE NOISE AND FUELS

1.3.1 Performance Parameter of CI Engine

The various performance parameter used is CI engine is given as

1. Indicated thermal efficiency
2. Brake thermal efficiency
3. Mechanical efficiency
4. Volumetric efficiency
5. Relative efficiency
6. Mean effective pressure
7. Mean piston speed
8. Specific power output
9. Break specific fuel consumption
10. Calorific value of the fuel

II. LITERATURE REVIEW

Scarth Philip and Ortiz Diego [1] studied the idling noise of medium and heavy I.C. engines have become an important noise assessment criterion in the commercial vehicle sector. Starting and low idle noise is often the first impression a potential customer gains of the vehicle. A quiet and pleasant low idle noise is critical in giving the desired impression. In urban environments, with heavy traffic and consequently large amounts of non-moving vehicles, high levels of idle noise are a disturbance to the general public.

Kaminski T. and Wendeker M. [2] studied cycle to cycle variation of internal cylinder pressure. Combustion process in spark ignition engines is widely known as a nonlinear and noisy process. Instabilities, which are occurring as cycle-to-cycle variations of internal cylinder pressure, affect directly the power output. Examination of these variations can lead to better understanding of their sources and help in their elimination in a future engine control procedure.

Alt Norbert, Sonntag Hans-Dieter, Heuer Stefan and Thiele Rainer [3] studied the cold start noise behaviour of modern I.C. engines. The overall improved noise and vibration behaviour of modern I.C. engines has also contributed to this trend. Despite overall improvements in I.C. engine noise and vibration, certain aspects of I.C. engines continue to present significant challenges. One such issue is the presence of I.C. knocking that is prevalent during cold start and warm-up conditions.

Torregrosa A.J., Broatch A., Climent H. and Andres I. [4] estimated the flow of noise emission from rear mufflers in IC engine exhaust systems, through the analysis of measurements performed in a steady cold flow bench. First, the net acoustic power transmitted along the outlet pipe is obtained from in-duct pressure measurements.

Shrivastava A. and Dang M. [5] studied a novel setup for measuring sound power emitted by an automobile engine has been designed and fabricated in this study. Sound pressure levels have been measured to compute sound power level as per IS Standard 3744. A microphone traversing system has been designed and fabricated to measure sound pressure at various points on a spatial grid.

Higgs Benjamin and Rupke Ryan [6] designed the muffler. The primary goal of this project is to develop a muffler system to meet the demanding needs of a Formula SAE prototype race car.

Yong Hao Zhi, Yan Jin and Chen Yang [7] studied the total noise emission using continuous wavelet transform. Noise emission from Petrol engine is a complicated acoustic signal with many different components mainly caused by combustion and mechanism operations. The rapid rise of pressure in the cylinder caused by combustion of fuel near the top dead center (TDC) transmits to the engine structure surface and forms an important part of the total noise emission. The combustion can also cause the vibration of cylinder head, connection rods and crankshaft, with the vibration being also an important source of engine noise.

Litak rzegGorz, Kaminski Tomasz, Czarnigowski Jacek, Zukowski Dariusz and Wendeker Mirosław [8] studied the fluctuations of combustion using experimental time series of internal pressure in one of four cylinders in a spark ignition engine. Employing standard statistical methods like histograms and return maps, cycle-to cycle variations of heat release were analysed. A substantial difference in system behaviour corresponding to quality of combustion was observed with a changing spark advance angle. Examining recurrence plots for a higher spark advance angle formation of specific patterns of vertical lines characteristic to intermittent behaviour was found.

Experimental Set-up

To study the noise generated by an engine, the parameters like sound pressure Level are required to study in different conditions like speed and load. Experimental set up of four stroke four cylinder diesel

III. METHODS AND MATERIAL

Engine testing setup consisted of a stationary; four stroke four cylinder Loading was done using an mechanical load. Engine cooling was done by means of water. Figure 1 shows the schematic of experimental test rig whose technical specifications are given. This set up is used for investigating performance and SPL. SPL analysis is carried Sound Level Meter (SLM) which was used as a measurement system This combination of SLM with Filer set was used to measure SPL under various operating conditions of the engine when run on various blends of diesel fuels. These measurements are recorded in decibels (dB). Measurements were performed at 1.5m distance from the engine by placing SLM on the same horizontal plane of the engine. It was ensured that low environment noise was recorded during experiments.

Procedure of SPL Measurements

1. To start the engine.
2. Check the digital switch, if it is on than ok otherwise on the digital switch.
3. Set the speed rpm on the engine (N=1500 rpm).
4. Check load changing wheel.
5. Set the load on the engine.
6. Set the instrument (Sound Level Meter) at medium range of frequency band.
7. After some time starting the engine take the reading of sound pressure level (SPL) on the digitally on the instrument (Sound Level Meter).
8. Change the load through loading wheel the values of (SPL) is taken at different loading condition.
9. Stops the engine
10. Changing the fuel and removing the air in the diesel engine by using fuel pump.
11. Start the engine and run ideally after some time from engine start
12. Change the load and various value of SPL is calculated. This process is repeated
13. After taking all reading (diesel and Biodiesel fuel). Stop the engine.

IV. EXPECTED RESULT

The study of noise generated by four stroke four cylinder diesel engine is carried out diesel and biodiesel blended fuel. There are three different types of fuels (diesel and biodiesel) used in this study out of which two are biodiesel fuels and one is pure diesel. It is found that the best fuel pure biodiesel.

This experimental study supports the use of palm and jatropha combined biodiesel-diesel blends in diesel engine without any substantial engine modification.

V. REFERENCES

[1]. Scarth Philip and Ortiz Diego, "Idle Noise Reduction of Light, Medium andHeavy Duty I.C. Engines", THIESEL Conference on Thermal and Fluid Dynamic Processes in I.C. Engines (2004).

[2]. Kaminski T. and Wendeker M., "Combustion process in a spark ignition engine: Dynamics and noise level estimation", American Institute of Physics,Vol. 14, No. 2 (2004).

[3]. Alt Norbert, Sonntag Hans-Dieter, Heuer Stefan and Thiele Rainer, "I.C.engine cold start noise improvement", In: SAE 01-2490 (2005).

[4]. Torregrosa A.J., Broatch A., Climent H. and Andres I., "A note on the Strouhal number dependence of the relative importance of internal and external flow noise sources in IC engine exhaust systems", Journal of Sound and Vibration , Vol. 282 , pp. 1255–1263 (2005).

[5]. Shrivastava A., Dang M., "A novel Setup for Sound Power Level Measurement", IE(1), Journal-MC, Vol. 87 (2006).

[6]. Higgs Benjamin and Rupke Ryan, "Noise reduction and automotive muffler design", MME-419, April (2007).

[7]. Yong Hao Zhi, Yan Jin and Chen Yang, "Study of engine noise based on independent component analysis", School of Mechanical and Energy Engineering, Zhejiang University, Hangzhou, Vol. 8(5), pp. 772-777 (2007).

[8]. Litak Grzegorz, Kaminski Tomasz, Czarnigowski Jacek, Zukowski Dariusz and Wendeker Mirosław, "Cycle-to-cycle oscillations of heat release in a spark ignition engine", Meccanica, Vol. 42, pp. 423–433 (2007).

[9]. Tempest W, "Noise handbook", Academic Press New York, Second edition,(1988).

[10]. White R.G. and Walker J.G., "Handbook on Noise and Vibration", Ellis

[11]. Horwood New York, Third edition, (1991).

[12]. Shastri Satish Trivedi and Manjoo Bala, "Handbook on Noise pollution: it's

[13]. Scientific and legal Perspective", Divyajyoti Prakashan Jodhpur, Second edition, (1994).

[14]. Cyril M.Harris, "Handbook of Acoustical measurements and Noise Control',Mc-Graw Hills, (1991).

[15]. Nigam S.P., "Introduction to Noise", Noise control programme, Thapar University, Patiala, (2008).

Cite this article as :

Surabhi Kumari, Prof. Suresh Kumar Badholiya, "A Review on Study on Performance and Noise Analysis of 4 Stroke 4 Cylinder Diesel Engine", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 7 Issue 7, pp. 55-59, January-February 2020. Available at doi : https://doi.org/10.32628/IJSRSET20719
Journal URL : http://ijsrset.com/IJSRSET20719