

PERFORMANCE CHARACTERISTICS OF AN INTERNAL COMBUSTION ENGINE BY ARRANGING A WHIRL AIR FAN BEFORE THE INTAKE MANIFOLD

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ABSTRACT

In the gift context, the planet is confronted with the dual crisis of fuel and environmental degradation. The fuel economy is achieved by economical combustion within the cylinder that is feasible by uniform mixing of air and fuel within the cylinder. The swirl will be generated within the diesel motor by modifying three parameters within the engine; they're the head of the cylinder, the piston crown and the manifold of inlet. The target of the current study is to reinforce the swirl result within the cylinder that causes higher performance and reduces the emissions. During this work an endeavor is created victimization whirl air fan with completely different inclinations placed before the manifold for effective air swirl motion. For this, the experiment is finished on Kirloskar AVI water cooled, natural aspirated direct injection diesel motor with pure diesel.

Keywords: D.I. Diesel Engine, Whirl air fan, Swirl, Emissions

1. INTRODUCTION

In gift days developed and developing countries are using diesel engines in thermal power stations for various purpose like generating electricity and transportation. These engines consume serious amount fuel per hour; wherever these engines turn out the ability yet as they conjointly turn out the various kinds of toxicant gases that are harmful for our folks and atmosphere. Environmental pollution at this point is extremely significant issue for our folks and flora-fauna. The environment is contaminated day by day from industrial emissions and road vehicles emissions. Petrol engine and diesel motor created different kinds of harmful gases throughout combustion like NO_x, CO, CO₂, HC and a few amount of SO_x credit to poor fuel quality. These gases are created by completely different engine issue like consistent mixture, injection timing order, compression quantitative relation etc. These factors conjointly have an effect on the combustion potency, fuel consumption and engine brake power. Credit to heterogeneous commixture of air and fuel the thermal potency of diesel motor is nominal. So as to extend the potency and conjointly to cut back the pollutants an endeavor is finished for higher mixing of air and fuel by using a fastened falcate blade before the manifold. Completely different inclinations are adopted to realize the higher blade angle for better swirl motion. Swirl flow has been utilized in many various types of combustion engines due to their effects in increasing potency, reducing the noise and different emission pollutants conjointly to enhance combustion instability.

2. SPECIFICATIONS OF DIESEL MOTOR AND MEASURING INSTRUMENT

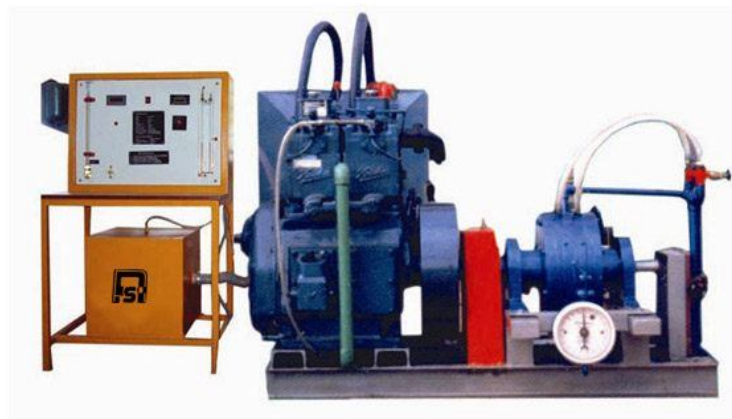


Fig 1

TABLE.1

Item	Specification
Kirloskar Diesel Engine Model	AV1
Engine power	3.7 kW
Cylinder Bore	80 metric linear unit
Stroke Length	110 metric linear unit
Engine Speed	1500 rev
Compression Ratio	16.5 : 1
Swept volume	553 cc
Stroke	Four
Injection Pressure	180 bar
Injection Timing	27 ⁰ b TDC
Number of hole of injector and size	Three x 0.25 mm
Dynamometer	Eddy current measuring instrument

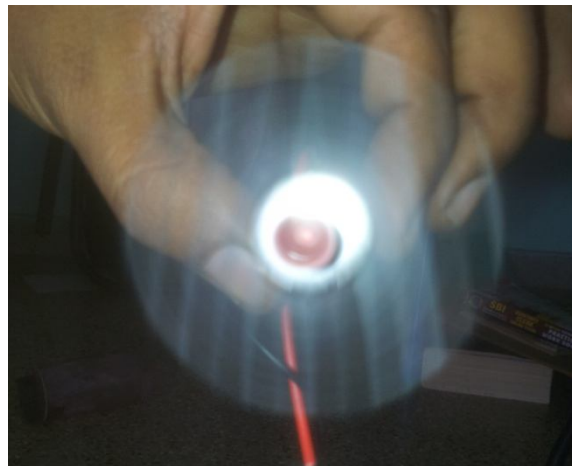


Fig 2

2.1 Experimental Process

The experiments are conducted on single cylinder four stroke water cooled direct injection diesel motor Kirloskar AV1 engine. The engine was coupled to connect in Nursing eddy current measuring instrument to live the output. Fuel flow rates were regular with calibrated measuring device. Exhaust gas analysis was performed by means of exhaust gas instrument. Within the gift work the consequences of air swirl in combustion chamber are experimentally studied by composition whirl air fan before the manifold. The experiment is performed on D.I .Diesel Engine at constant speed 1500 rev with injection pressure a hundred and eighty bar by victimization pure diesel. In first section the information recorded with routine engine and in second section the information recorded with whirl air blade angles respectively 24Deg, 28Deg, 32Deg and 36Deg. The ability of engine is measured by the Eddy current measuring instrument that's coupled to the engine and engine exhaust emission are measured by ARO five gas instruments at completely different masses. The performance and emission characteristic are compared with routine engine results.

3. RESULTS AND DISCUSSION

From the experimental information the graphs are drawn. These graphs show the variation in brake thermal efficiency, Brake specific fuel consumption (BSFC), Hydrocarbons (HC), Carbon monoxide gas (CO), gas oxides (NO_x) emissions at numerous blade angles.

The assorted configurations utilized in the current work are

1. Whirl air fan with blade angle twenty four Deg
2. Whirl air fan with blade angle twenty eight Deg
3. Whirl air fan with blade angle thirty two Deg
4. Whirl air fan with blade angle thirty six Deg



BLADE ANGLE = twenty four Deg



BLADE ANGLE = twenty eight Deg



BLADE ANGLE = thirty two Deg

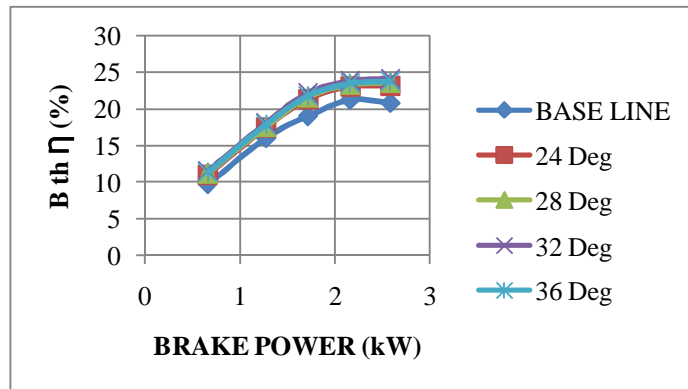


BLADE ANGLE = thirty six Deg

3.1 Brake Thermal potency

The brake thermal potency with brake power for various blade configurations is compared with the traditional engine and is shown in graph 1. The brake thermal potency for base line at $3/4^{\text{th}}$ of rated load is 20.799%. It will be discovered that the engine with blade angle of thirty two provide thermal potency of 24.144% at $3/4^{\text{th}}$ of rated load. It's discovered that there's a gain of 3.345% with thirty two Deg blade angle compared to traditional engine. It absolutely was inferred that

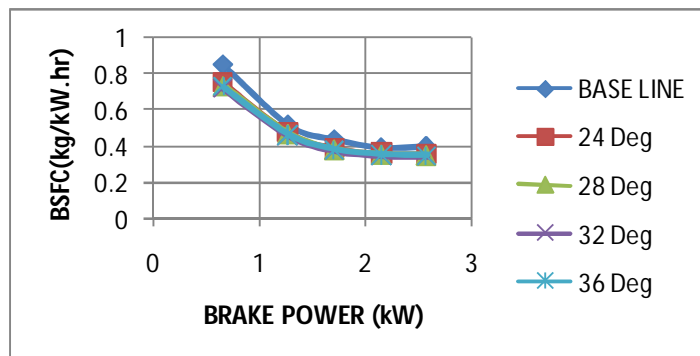
the brake thermal efficiencies were increasing with a rise in brake power for numerous configurations that will increase the performance of the engine. These configurations were found to supply higher thermal efficiencies than the traditional engine.



Graph 1

3.2 Brake Specific Fuel Consumption

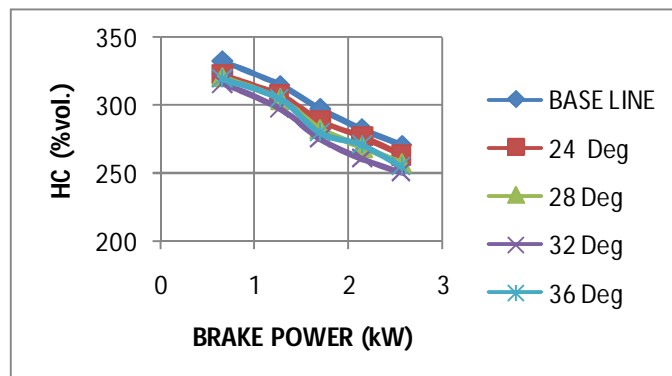
It is a crucial parameter that reflects the engine performance. It's reciprocally proportional to the thermal efficiency of the engine. In graph 2. The comparison of BSFC for whirl air fan with relevance to engine brake power is conferred. For thirty two Deg blade whirl air fan the BSFC reduced by 0.055 kg/kW.hr at 3/4th of rated load than the normal engine. From the graph it will be terminated that for thirty two Deg blade angle whirl air fan the fuel consumption is smaller amount than the traditional diesel motor.



Graph 2

3.3 Hydro carbon emissions

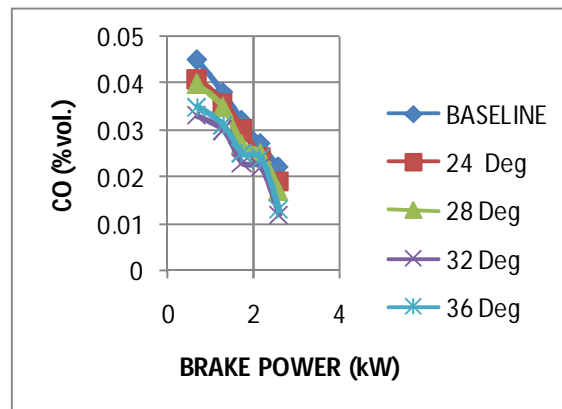
When organic compound emissions get in to the atmosphere, they act as irritants and odorants; some are malignant diseases. All components except CH₄ react with region gases to create photochemical smog. In graph 3 the comparison of HC with relevance engine brake power at numerous rotate blade configurations are presented. HC emission reductions at 3/4th of rated load considerably below normal engine. It's reduced by 21% vol. for thirty two Deg fastened falcate blade.



Graph 3

3.4 Carbon monoxide gas

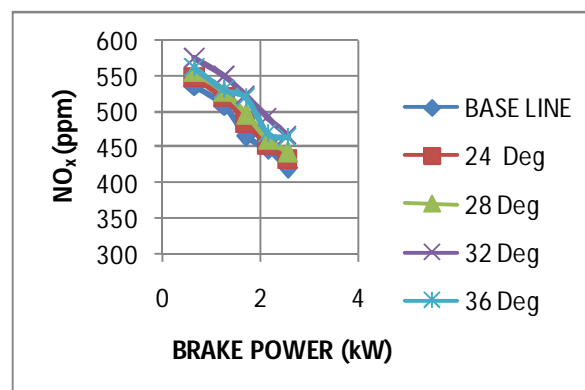
When there's not enough atomic numbers 8 to convert all carbon to greenhouse emission, some fuel doesn't get burned and a few carbon winds up as CO. Brake power Vs CO are conferred within the graph4 for numerous rotate blade configurations. It will be concluded that CO emissions reduces at 3/4th of rated load by 0.02 %vol. for thirty two Deg rotate blade angle compared with the normal engine.



Graph 4

3.5 gas Oxides

NO_x emission from engine depends on numerous factors like compression quantitative relation, temperature, piston bowl form, and injection pressure etc. Here a NO_x emission will increase at 3/4th of rated load higher than the base line engine. But it's enhanced by forty seven ppm for thirty two Deg rotate blade angle.



Graph 5

4. CONCLUSIONS

The following conclusions are drawn from the experimental work.

1. Whirl blade angle of thirty two Deg is the best for enhancing the performance of the engine when compared to various blade angles.
2. Brake thermal potency is enhanced by 3.345% compared to standard engine.
3. BSFC is reduced by 0.055 kg/kW.hr
4. CO emissions are less by 0.02 %vol.
5. HC emissions are reduced by twenty one percentages by volume.
6. Nitrogen oxide emissions are increased by forty seven ppm.

Future scope

Whirl air fan before the intake manifold enhances the air swirl within combustion chamber as well as increasing the air capacity. However, further investigations are required for the following configurations.

1. By varying injection pressure.
2. By varying no. of holes in the nozzle.
3. By varying the injection timing.

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