

Effect of Fuel Injection Pump on the Engine & Simplified Pump Setting Procedure

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Abstract— In Diesel Engine, Pump was a device used to transfer the fuel from fuel tank to the engine. In diesel engine fuel was directly injected inside the engine during power stroke of each cylinders. The timing of injection were set manually with the crank rotation. FIP Cam was normally used in the diesel engine to operate the fuel pump. The FIP cam was driven by crankshaft, so the fuel was injected directly in the engine during the time of injection. In our project we changed the timing of fuel injection and we have analysed the problems occurs on the engine during the process. Normally they are testing the 210 angle for the process, but we have changes the angle with 230 and 190 with the process and analysed the problems occurs during running. 230 angle shows that the fuel was injected in engine in advance position, and the 190angle shows that the fuel was injected in retarded position. The exhaust gas components such as hydrocarbons, CO₂, CO, SO_x emissions are quiet decreased with the base fuel.

Key words: Changing the Injection time will increase the efficiency and reduce the fuel consumption

I. INTRODUCTION

Initially in a design and development stage an engineer would design an engine with certain aims in his mind. The aim may include variables like indicated power, brake power, brake specific fuel consumption, exhaust emissions, cooling of engine, maintenance free operation etc. The other task of the development engineer is to reduce the cost and improve power output and reliability of an engine. In trying to achieve these goals he has to try various design concepts. After the design the parts of the engine are manufactured for the dimensions and the surface finish may be with certain tolerances. In order verify the design and the engine developed one has to go for testing and performance evaluation of the engines.

Thus, in general, a development engineer will have to conduct a wide variety of engine tests starting from various loads and we have tested all the parameters. Traditionally, the injection pump is driven indirectly from the crankshaft by gears, chains or a toothed belt that also drives the camshaft. It rotates at half crankshaft speed in a conventional four-stroke diesel engine. Its timing is such that the fuel is injected only very slightly before top dead centre of that cylinder's compression stroke. It is also common for the pump belt on diesel engines to be driven directly from the camshaft.

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The injection pump's camshaft is driven by the diesel engine. 4-stroke engines, pump speed is the same as engine camshaft speed, in other words half crankshaft speed. The drive between injection pump and engine must be as Torsional rigid as possible if today's high injection pressures are to be generated. There are a number of different sizes of in-line injection pumps for the various engine outputs. The injected fuel quantity depends upon the swept volume of the injection-pump barrel, and maximum (pump-side) injection pressures were 120 bar.

The main objective of this study was to study the performance, emission and combustion characteristics of different angles of injection timing and to compare these results with diesel fuel in three cylinder 4 stroke diesel engines at varying load conditions with varying engine Speed (1400-2400rpm).

II. METHODS



Fig. 1: Experimental Setup

Parameters	Values
Type Of Engine	Direct Injection Diesel Engine
HP	22
No. Of Strokes	Four Stroke
No. Of Cylinders	Three Cylinders
Bore	73mm
Stroke	78mm
Fuel Nozzle Injection Pressure	120bar
Max Engine Speed	3200rpm
Compression Ratio	23:1

Table 1: Engine Specifications

We have tested the 22HP Engine in the Engine Test Bed with the Normal Pump Setting and in Advanced Pump Setting and in Retarded Pump Setting. Before start to calculate Engine was allowed to warm for 20min. And we have calculated the SFC, Power, Torque. Normally in the test bed, Dynamometer was connected with the fly wheel of the engine and the dynamometer were connected with Digital CATS Engine Test Systems.

In normal pump setting the angle were be 210 + and in advanced pump setting the angle were be 230 and in retarded pump setting the angle were be 190. For 210+ shim size would be 0.4 and for 230 shim size would be 0.2 and for 190 shim size would be 0.8. We have tested the engine with various speeds between the range of 1400rpm to 2400rpm. As a result of our test, we got different Power and Torque and SFC. And the graphs were shown below.

III. PROCEDURE OF EXPERIMENT

Normally in engine, before inserting the pump on the engine block we are adding the shim for the pump setting. For each angle shim size will be varied. It will be in the range of 0.1,0.2,0.4. 230 angle shows that the fuel was injected in advanced position and the 190angle shows that the fuel was injected in delayed or retarded position.

For 22HP Engine, for pump setting of 210+, we are adding the shim size would be 0.4 and for the pump setting of 230, we are adding the shim size would be 0.2 and for the pump setting of 190, we are adding the shim size would be 0.8. As a result of angle change we got different power and different sfc and different torque for the three angles for the different speeds.

IV. TEST COMPARISON

210+ ANGLE:

FACTORS	MAXIMUM	MINIMUM
TORQUE	5.74kg-m	4.81kg-m
POWER	22.43hp	9.40hp
SFC	221.57gm/bhphr	208.24gm/bhphr

Table 2: Test Comparison

190 ANGLE:

FACTORS	MAXIMUM	MINIMUM
TORQUE	5.91kg-m	5.16 kg-m
POWER	22.41hp	10.12hp
SFC	213.08gm/bhphr	193.56gm/bhphr

Table 3: Test Comparison

230 ANGLE:

FACTORS	MAXIMUM	MINIMUM
TORQUE	5.84kg-m	4.69 kg-m
POWER	22.82hp	9.17hp
SFC	213.66gm/bhphr	200.13gm/bhphr

Table 4: Test Comparison

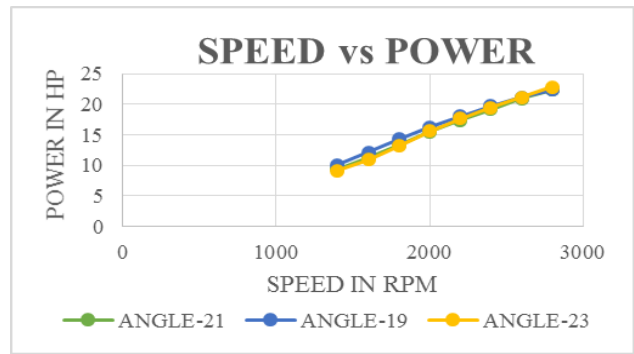


Fig. 1: GRAPH 1

The above graph shows the power and the speed of various crank angles. The green colour line shows the result of 210angle and the blue colour line shows the result of 190 angle and the yellow colour line shows the result of 230 angle. From the result we have get the high power in 230 angle and low power in 190.

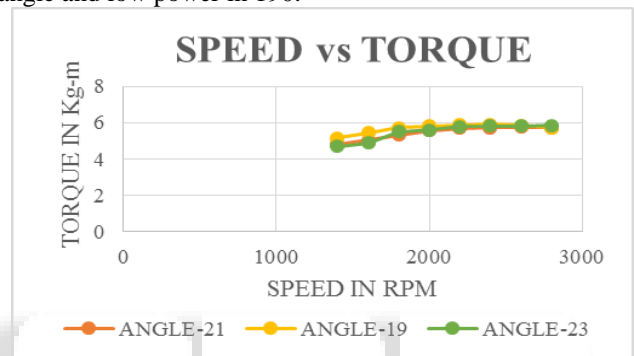


Fig. 2: GRAPH 2

The above graph shows the torque and the speed of various crank angles. The orange colour line shows the result of 210angle and the yellow colour line shows the result of 190 angle and the green colour line shows the result of 230 angle. From the result we have get the high torque in 190 angle and low torque in 210.

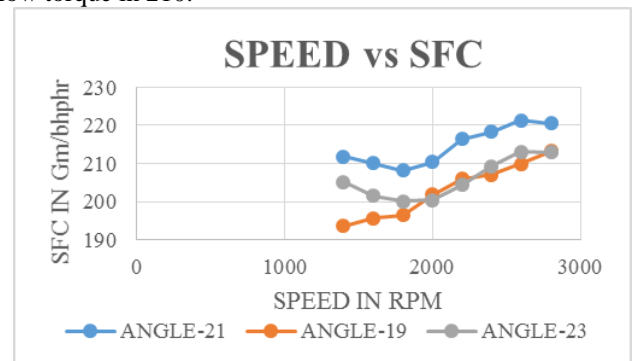


Fig. 3: Graph 3

The above graph shows the SFC and the speed of various crank angles. The blue colour line shows the result of 210angle and the orange colour line shows the result of 190 angle and the ash colour line shows the result of 230 angle. From the result we have get the high SFC in 190 angle and low SFC in 210.

V. RESULT

As per the test on the 22HP Engine we got different result for different angles. For angle of 210+ black smoke comes on the silencer and torque, power were low when compared to other angles and SFC were high. And for the angle of 190 white

smoking were occurs on the silencer and misfiring occurs inside the engine so the atmosphere will pollute and buffing sound were occurs on the silencer. And for the angle of 230colourless smoke occurs on the silencer and fuel was burning properly, and also the SFC were less when compared to other angles and the torque and power were high.

VI. CONCLUSION

IC Engines are among the most important engineering applications. Now the world was fully focused with the emission control and to reduce the fuel consumption and to get the high power and torque in the vehicles .As per our experiment 22HP Engine with 230angle will shows the high power with high torque with low SFC. So 22HP Engine with 230angle is the best angle than the others in diesel engine.

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