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A Review on Performance and Testing of Diesel Engine

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Abstract: ***An experiment carried out the performance evaluation of four stroke double cylinder reciprocating diesel engine. Diesel has obtained by distillation of crude oil. It is generally mixture of hydrocarbons. The prime advantage for using diesel as fuel for IC engine as its suitability related to the cetane number, fuel volatility, density, viscosity, cold behaviour and low toxicity. Diesel engine has more efficient because its calorific value is about 44.55 MJ/KG, which is lower than petrol, since diesel engine is denser than petrol and contain 15% or more energy by comparison of its volume. By considering factor that the efficiency which obtained by diesel is about nearly 15 - 25% more than petrol engine. Since diesel engine are widely used in almost all sectors such as transportation and power generation etc. Hence it is essential to know about working of diesel engine and about its performance. This paper shall help to get idea about diesel engine working and various parameters related to performance of diesel engine.***

Keywords: Diesel engine, Performance, IC engine.

I. INTRODUCTION

The need of performance and testing of engine to find its efficiency, brake power, brake specific fuel consumption (BSFC). By knowing such facts, we can able to compare with theoretical or ideal, so according to this we make modification in various factors include in engine such as fuel, methodology, environment, etc. Diesel engine testing are carried out to the actual condition of engine performance with various input and output as compression ignition (IC) engine has higher thermal efficiency has compared to spark ignition (SI), because of higher compression ratio. Form the performance parameters we also predict the amount of heat supplied by fuel and how much work we get and find the sources of heat loss, so we can make modification to overcome that.

A. Disel Cycle

This cycle can operate with a higher compression ratio than the Otto cycle because air is compressed and there is no risk of auto-ignition of the fuel. Hence for a given compression ratio the Otto cycle has higher efficiency, because the Diesel engine can be operated to higher compression ratio, the engine can actually have greater efficiency than an Otto cycle. Diesel cycle shows in below fig. shows us the combustion process of engine that heat is converted into work

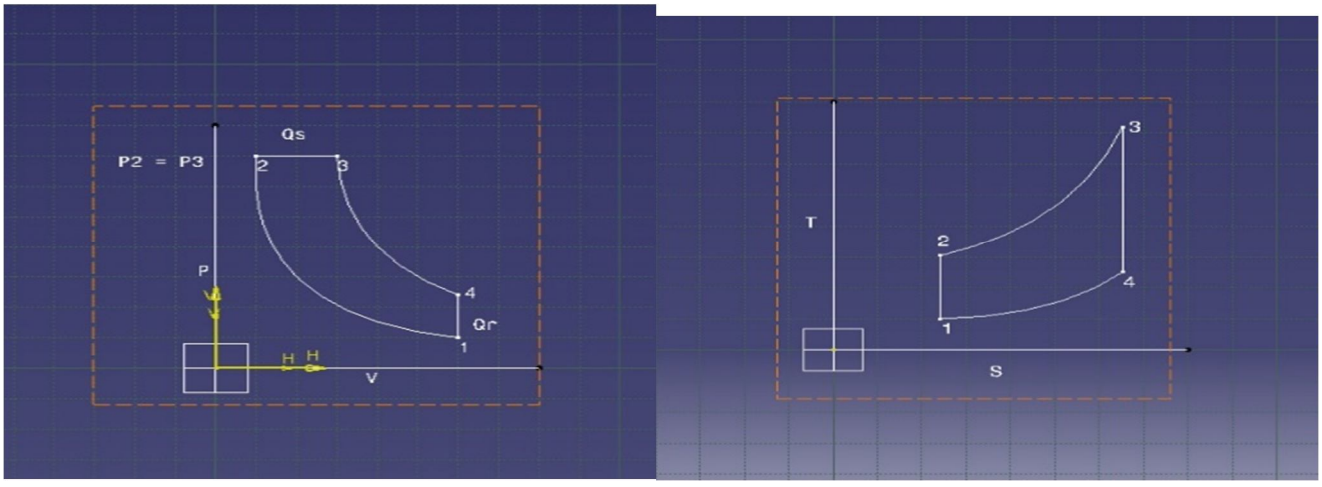

Fig 1. PV TS Diagram of Diesel Cycle.

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1) Processes in Diesel Cycle

a) Process 1-2: Isentropic compression
b) Process 2-3: Constant pressure heat addition
c) Process 3-4: Isentropic expansion
d) Process 4-1: Constant volume heat rejection

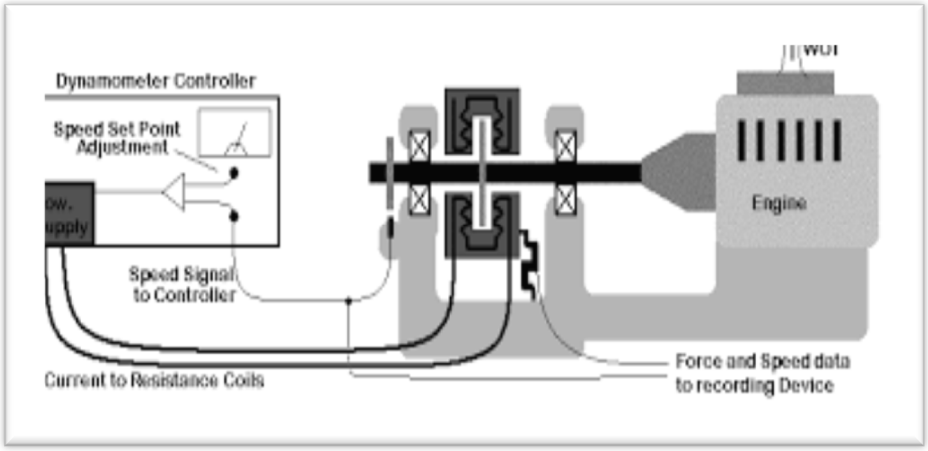
B. Working Principle Of Diesel Engine

A four-stroke diesel engine is internal combustion engine in which the piston complete four separate stroke while turning the two revolution of crankshaft to obtain one power stroke. A stroke refers to the full travel of the piston from top dead center otto the bottom dead center cylinder, in either direction. It works on compressing the air at high temperature inside the cylinder which the piston completes four separate strokes while turning and inject diesel in combustion chamber at that point ignition take place and desired work obtained at crankshaft. The four separate strokes are as follows:

1) Suction Stoke
2) Compression Stroke
3) Power Stroke
4) Exhaust Stroke

II. METHODOLOGY

A. Experimental Setup



B. Specification of Testing Engine

Specification	Engine Details
Engine	Double cylinder, high speed diesel engine
Cooling	Water cooled
Compression ratio	16: 1
Bore	79.5 mm
Stroke	76 mm
Capacity	735.65 CC
Bhp	10
Rated Speed (RPM)	1500
Manufacturer	Comet Engineering

C. Experimental Procedure

Test Rig Consist Following Elements

1) Temperature measuring unit.
2) Load and Speed measurement unit.
3) Water measurement arrangement.
4) Fuel consumption unit.
5) Exhaust gas calorimeter.
a) Checking all switches and starting the diesel engine setup.
b) Exserting the load on engine using dynamometer arrangement with the help of dimmer and load cell.
c) Note down all parameters listed below

- Time for 10ml fuel consumption in sec.
- Exhaust Gas Temperature.
- Load on Dynamometer
- Temperature of inlet and outlet cooling water.
- Temperature of exhaust gas outlet from calorimeter.

d) Repeat same procedure for various load and note down various readings.
e) Experiments performed at starting from no load observations to be having for at different loads. Observations are listed down as per parameters.
f) Various performance parameters to be measured at each load. Using measured data, so we can able to find out brake power, brake thermal efficiency, brake specific energy consumption to following parameters

D. Calculation Related Formulae

Formulas to calculate brake power, brake thermal efficiency and brake specific energy consumption are described below:

1) Brake Power

B.P.= $2\pi NT/60000$ KW

$T = F \times g \times$ Arm Length

T= Torque, Nm.

N = RPM of engine crankshaft

2) Brake Thermal Efficiency

BTE = B.P/mf×C.V

$mf = vol \times \rho / t$

mf = mass of fuel supplied, kg/sec

ρ = Density of Diesel, Kg/m3

t = Fuel flow time, sec.

C.V = Calorific value of fuel, j/kg

B.P. = Brake power, kw

3) Brake Specific Fuel Consumption

BSFC = mf × 3600/B. P kg/kWh

mf = Mass of fuel supplied, kg/h

B.P = Brake Power, kw

4) Sample Calculations of Parameters

Standard data:

Specific density of diesel = 830 Kg/m3

Calorific Value of diesel = 42000 KJ/Kg

Arm length = 0.185 m

a) Brake Power

T = F × g × Arm Length
= 12×9.81×0.185
= 21.78 Nm.

B.P. = 2πNT/60000 KW
= 2π×1500×21.78/60000
= 3.42 KW

b) Brake Thermal Efficiency

BTE = B.P/mf×C.V
mf = vol × ρ/ t
= 10×10^{-6} × 830/24.3
= 0.000341 Kg/sec
BTE = 3.42/0.0003×42000
= 0.2356×100
= 23.56 %

c) Brake Specific Fuel Consumption

BSFC = mf × 3600/B. P kg/kWh
= 0.0003412×3600/3.42
= 0.356 KJ/Kg.h

III. CONCLUSION

With the help of above experimental procedure and formula, we can find Brake Power, Brake specific fuel consumption and Brake Thermal Efficiency. Since, from the above data we can predict the performance of the specific diesel engine.

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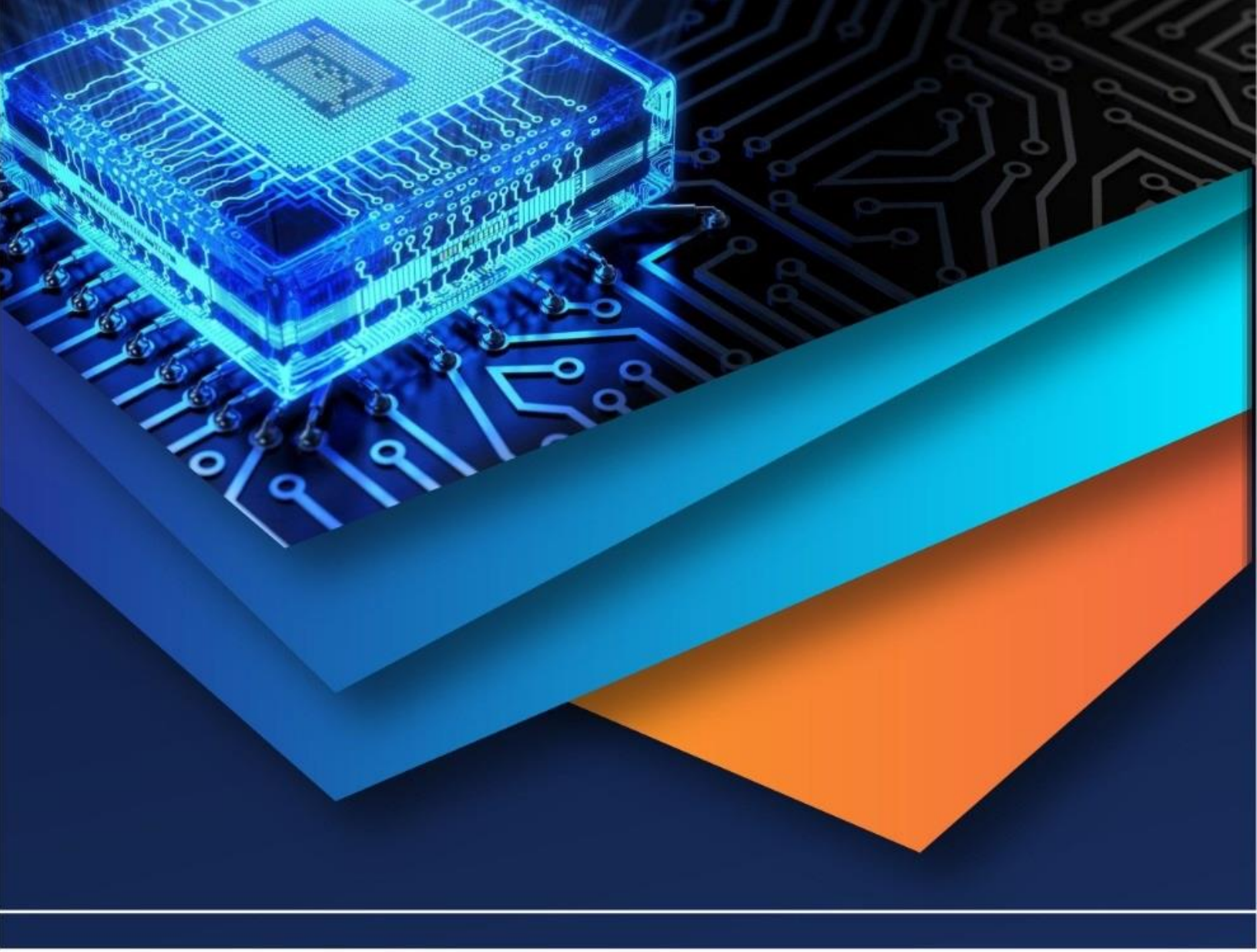

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