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OPTIMISING THE COMPRESSION RATIO OF DIESEL FUELLED C.I ENGINE

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ABSTRACT

In order to find out optimum compression ratio experiments were carried out on a single cylinder four stroke variable compression ratio diesel engine. Tests were carried out at compression ratios of 13.2, 13.9, 14.8, 15.7, 16.9, 18.1 and 20.2. Results showed a significant improved performance and emission characteristics at a compression ratio 14.8. The compression ratios lesser than 14.8 and greater than 14.8 showed a drop in break thermal efficiency, rise in fuel consumption along with increased smoke densities.

Keywords: engine, diesel, compression, ratio, performance, smoke, density.

1.0. INTRODUCTION

The ever increasing demand for the petroleum based fuels and their scare availability has lead to extensive research on Diesel fuelled engines. A better design of the engine can significantly improve the combustion quality and in turn will lead to better break thermal efficiencies and hence savings in fuel. India though rich in coal abundantly and endowed with renewable energy in the form of solar, wind, hydro and bio-energy has a very small hydro carbon reserves (0.4% of the world's reserve) [1]. India is a net importer of energy. Nearly 25% of its energy needs are met through imports mainly in the form of crude oil and natural gas [2]. The rising oil bill has been the focus of serious concerns due to the pressure it has placed on scarce foreign exchange resources and is also largely responsible for energy supply shortages. The sub-optimal consumption of commercial energy adversely affects the productive sectors, which in turn hampers economic growth.

The present work deals with finding the better compression ratio for the Diesel fuelled C.I engine at variable load and constant speed operation.

2.0. EXPERIMENTAL SETUP

Experiments were carried out on the engine with the following specifications:

Make: Kirloskar

Compression ratio: variable from 13.2 to 20.2

Bore: 70 mm

Stroke: 110 mm

Loading: Eddy current dynamometer

Maximum power: 3.75 kW

The entire experimentation was carried out while keeping the cooling water temperature at 70^0c.

3.0. RESULTS AND DISCUSSIONS

3.1. Brake thermal efficiency

Figure-1 shows that the maximum brake thermal efficiency is obtained at a compression ratio of 14.8. The least brake thermal efficiency is obtained at a compression ratio 20.2. Hence with respect to brake thermal efficiency, 14.8 can be treated as optimum. This can be attributed to the better combustion and better intermixing of the fuel and air at this compression ratio.

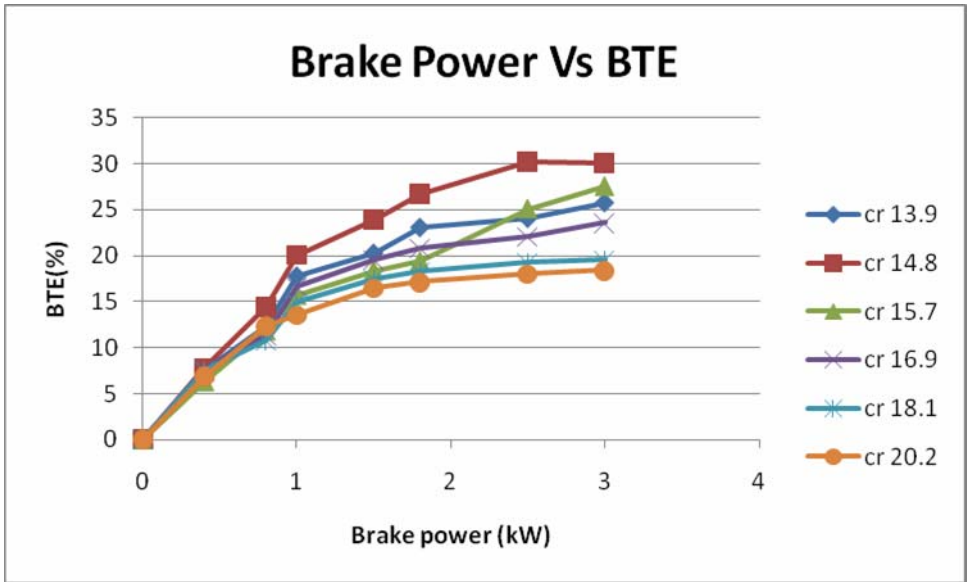

Figure-1. Brake power Vs Brake thermal efficiency.

3.2. Fuel consumption

The better fuel consumption was obtained at a compression ratio of 14.8 (Figure-2). The higher and lower compression ratios than 14.8 resulted in high fuel consumptions. The fuel consumption at a compression ratio of 18.1 and 20.2 was almost the same. The high fuel consumption at higher compression ratios can be attributed to the effect of charge dilution. At the lower sides of the compression ratios, the fuel consumption is high due to incomplete combustion of the fuel.

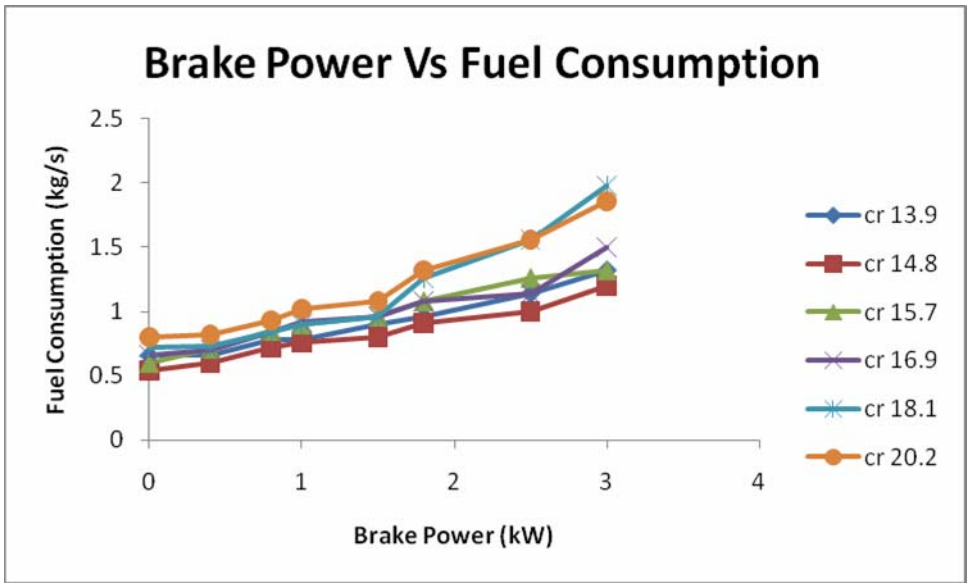

Figure-2. Brake power Vs Fuel consumption.

3.3. Exhaust gas temperatures

Exhaust gas temperatures were found to be increasing with the increase in load and the compression ratio (Figure-3). The highest exhaust gas temperature was recorded for the compression ratio 20.2 while the least was for 13.2.

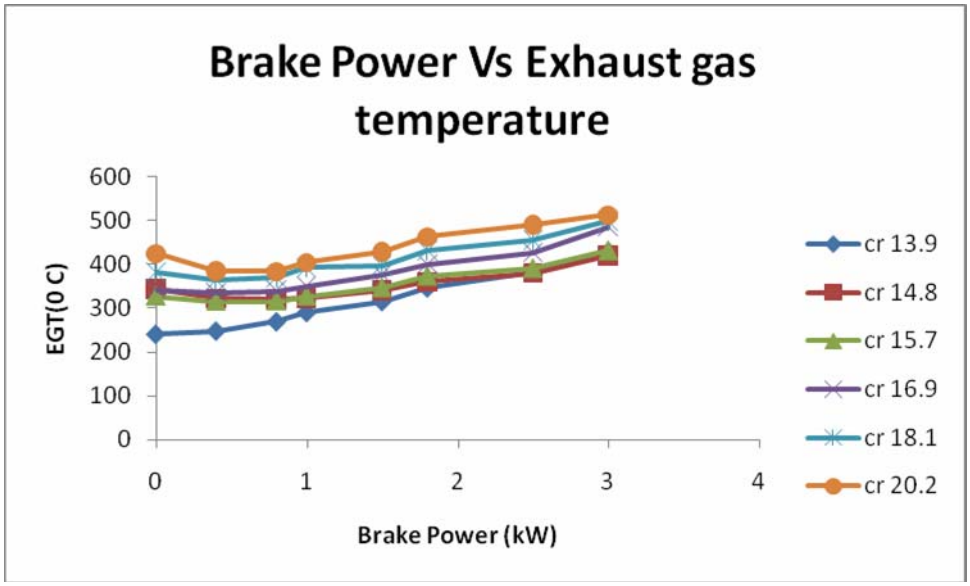

Figure-3. Brake power Vs Exhaust gas temperature.

3.4. Smoke density

Smoke density is measured with the help of Hatridge smoke meter which measures the smoke density in Hatridge smoke units (HSU). Figure-4 shows that the smoke density was less for the compression ratio 14.8 which is the optimum compression ratio for the C.I engine with diesel.

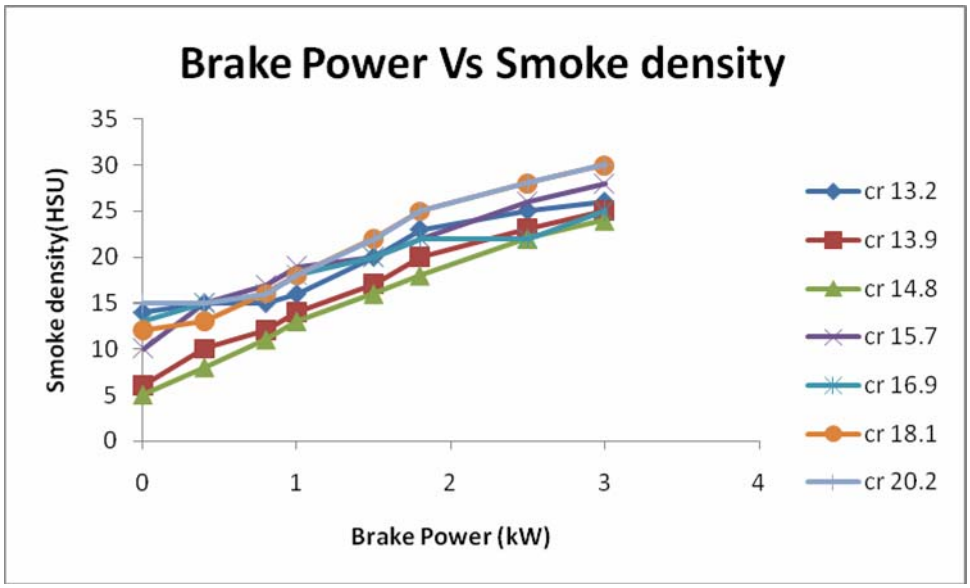

Figure-4. Brake power Vs Smoke density.

4.0. CONCLUSIONS

Following conclusions can be drawn from the experimentations carried out on the C.I engine with diesel at various compression ratios:

- 14.8 is the optimum compression ratio of operation for the given engine.
- Better economy is obtained at the compression ratio 14.8.
- Fuel consumption is less at compression ratio 14.8.
- Smoke density is less at compression ratio 14.8.
- Exhaust gas temperatures are moderate at compression ratio 14.8.

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