AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING

A STUDY OF THE EFFECT OF EXHAUST GAS RECIRCULATION ON THE PERFORMANCE AND COMBUSTION OF DIESEL ENGINES

By

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A thesis
Submitted in Partial Fulfilment for The Requirement of
The Degree of Master of Science
in Mechanical Engineering

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Mechanical Power Engineering
Ain Shams University

(Cairo - 1995)


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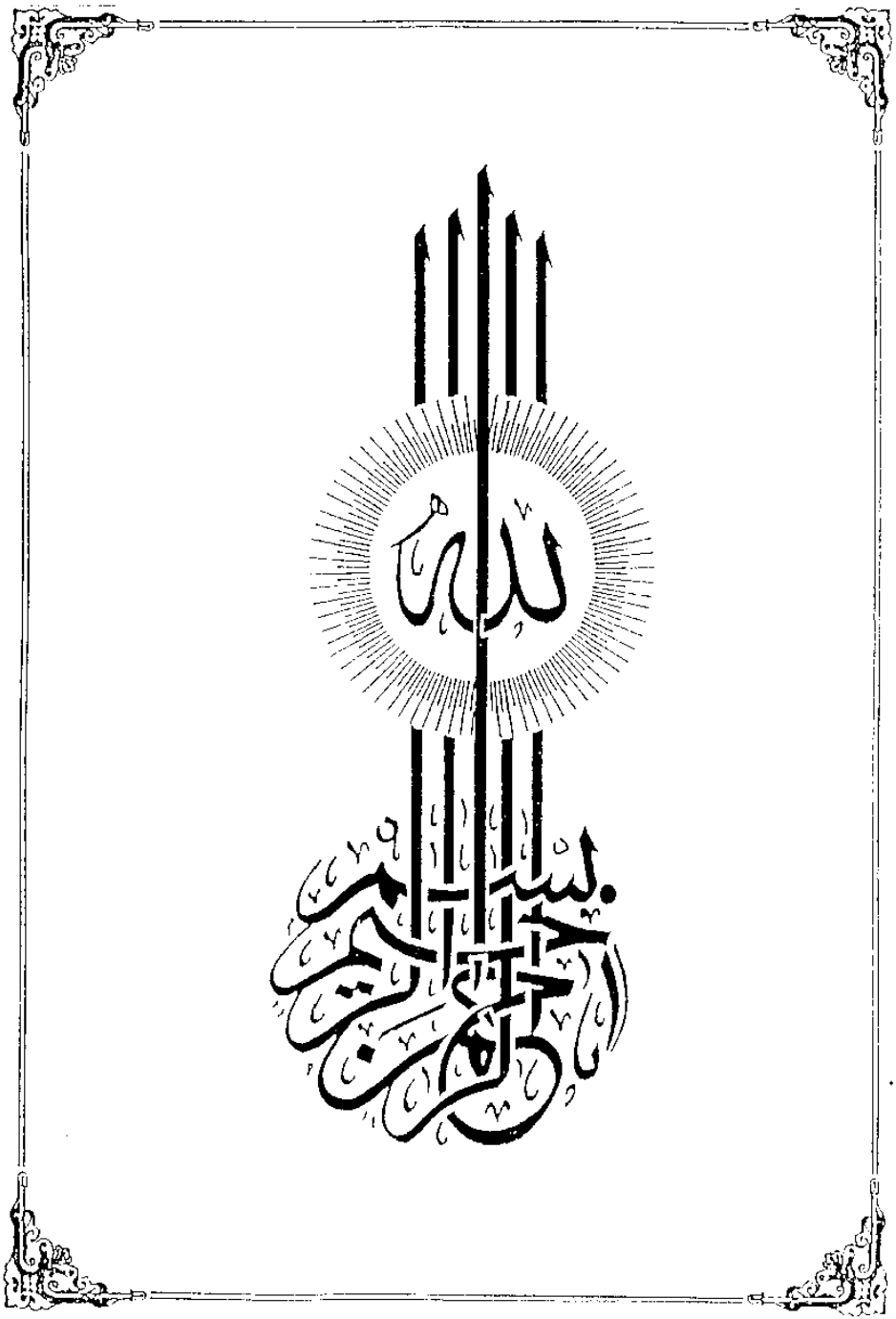

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Mechanical Engineering.

The work included in this thesis was carried out by the author in the Department of Energy and Automotive, Ain Shams University, from (27/12/1991) to (15/11/ 1995).

No part of the thesis has been submitted for a degree qualification at any other university or institution.

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بسم الله الرحمن الرحيم

In the Name of God Most Merciful
Most Compassionate

ACKNOWLEDGEMENT

My sincere gratitude to **Prof. Adel Abdel Malek Al-Ehwany** **Assoc. Prof. Dr. Gaafar Ahmed Husinen** and **Dr. Abdul Aziz Morgan** for their thoughful supervision and guidance through this work. I also wish to acknowledge the great dept. which I owe to col. Mohamed Abdul Ghany for his invaluable assistance. Thanks to the chief and staff of the chair of Mechanical power and Energy of Military Technical College, Cairo for their help.

I present this work to my mother and my wife, whose understanding, encouragment and sacrific could never be paid back.

Abstract

Ibrahim El-Dsoky Taha El-Keiy. A study of the effect of exhaust gas recirculation on the performance and combustion of Diesel engines. Degree of Master of Science. Ain Shams University / Faculty of Engineering. Department of Mechanical Power Engineering, 1995.

Experimental work has been carried out to investigate the effect of varying exhaust gas recirculation (EGR) on the performance and combustion developments of four stroke, six cylinder, Diesel engine. Special arrangements were constructed and then used in the experimental testes by which the EGR percentage could be controlled. During each test, measurement of engine air mass flow rate, EGR mass flow rate, fuel mass flow rate, speed, power and exhaust gas temperature were taken. Also the time of the delay period was computed from the knowledge of the cylinder pressure at specified crank angle positions and using Krigar - Borman method for calculation of Apparent Fuel Burning Rate (AFBR).

Due to the practical need of the interface between computer simulation model of apparent fuel burning rate and the pressure measurements, a data acquisition system has been used to record and analyze the test results at specific EGR percentages (0, 5, 15, 25, 40%), within reasonable range of engine running conditions.

Experimental results confirmed that EGR percentage has a great influence on the delay period, maximum pressure inside the cylinder, specific fuel consumption and engine power. At low EGR percentage up to 10% the delay period decreases for all engine speeds specially at part load. However at high EGR percentage over 20%. The delay period increases. The peak cycle pressure gradually declines as EGR percentage increases up to 20%, then it drops sharply as EGR becomes over 20%. The specific fuel consumption decreases by 3% at most as EGR percentage increases up to 5%. Meanwhile it has no effect on the engine power. As EGR percentage increases from 5% up to 15% the engine

power slightly decreases without any remarkable change in the specific fuel consumption. The engine power and specific fuel consumption deteriorate as EGR percentage increases more than 25%.

Therefore an improvement in the specific fuel consumption as much as 3% is achieved corresponding to 5% EGR percentage. The recommended range of the EGR is from 5 to 15%. The use of EGR more than 25% adversely affect engine power and specific fuel consumption.

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