# CONDITION MONITORING SYSTEM FOR A MEDIUM-SPEED INTERNAL COMBUSTION (I.C.) ENGINE

Ву

### SOPHOCLIS PANAYIOTOU ,

Project report
Submitted to

The Department of Mechanical Engineering of the Higher Technical Institute

Nicosia CYPRUS

In partial fulfillment of the requirements for the diploma of

TECHNICIAN ENGINEER

in

MECHANICAL ENGINEERING

June 1991

#### ACKNOWLEDGMENTS

I would like to express my sincere appreciation and gratitude to my project supervisor, Mr. Andreas Loizides, for his helpful guidance, advice and information given during my project.

Thanks are also expressed to my father for his encouragement and valuable help in providing copies and print-outs for my project.

Finally, I express my appreciation to the H.T.I.'s librarian for her assistance in finding the reference books used for my project.

#### SUMMARY

This project is dealing with the condition monitoring systems for a medium-speed Internal Combustion Engine (I.C.). The philosophy behind the arrangement for the maintenance is explained and the prospects of obtaining the greatest possible reliability in service and the best possible service economy are given together with the means which can be used to attain this objective. Specifically it includes:

- A survey on the various methods employed for monitoring the operating condition of Internal Combustion Engines.
- 2. A description of the various systems, components and fittings of a modern, fully automated, engine monitoring system.
  - 3. The design of a condition and performance monitoring system for a medium speed I.C. Engine.
  - 4. The procedure for optimizing the performance of the engine using the designed engine performance mance monitoring system.

## TABLE OF CONTENTS

	ACKNOWLEDGEMENTSi			
v	TABLE OF CONTENTSii			
	SUMMARY1			
	INTRODUCTION2			
	P.			
CHAPTER	R 1. Condition monitoring in general			
1.1	Objectives of monitoring systems7			
1.2	Applications of monitoring systems10			
1.3	Methods employed for monitoring15			
CHAPTER	R 2. Description of the design			
2.1	Components used in a monitoring system21			
2.2	Cabling system31			
2.3	Layout of the diagnostic system			
2.4	Hardware configuration38			
2.5	Software features43			
CHAPTER 3. Installation sub-systems				
	<i>;</i>			
3.1	Engine specifications46			
3.2	Survey on the crankshaft main bearings54			
3.3	Survey on the wear of the top piston rings60			
3.4	Survey on the exhaust valves66			
3.5	Survey on the supercharging system68			
3.6	Survey on the injection70			
3.7	Survey on the flow74			

3.8	Survey on	the	vibration78	
3.9	Survey on	sec	ondary parameters	
3.9.1	Survey on	the	oxygen content83	
3.9.2	Survey on	the	carbon dioxide85	
3.9.3	Survey on	the	viscosity87	
3.9.4	Survey on	the	angular velocity91	
3.9.5	Survey on	the	power92	
CHAPTER	R 4. Perfo	rmano	ce testing	
4.1	The M.I.P. Calculator97			
4.2	Preliminary check100			
4.3	Performance check			
4.4	Optimizat	ion.	107	
	CONCLUSIO	45	112	