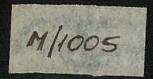
MODIFICATION OF A CONVENTIONAL WATER - COOLED ENGINE TO AN AIR - COOLED ONE

BY VANNAS IOANNIS

HIGHER TECHNICAL INSTITUTE

MECHANICAI. ENGINEERING DEPARTMENT



JUNE 2005

#### MODIFICATION OF A CONVENTIONAL WATER – COOLED ENGINE TO AN AIR-COOLED ONE

By

## Ioannis Vannas

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 DEPARTMENT

M/1005

June 2005



#### ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my project supervisor, Dr Lazaros Lazaris, Lecturer, Higher Technical Institute, for his help, advice and constructive criticism and comments generously given throughout the project work. Also Dr. N. Angastiniotis, Lecturer, Higher Technical Institute for his valuable suggestions and constructive comments.

I would like to thank the following persons, who in various ways have helped and contributed to this research project:

- Mr Andreas Vannas, garage owner, for his permition to work and use his machinery. Also for his support and help during engine trials.
- The Industrial Training Supervisor Mr. Stavros Panayiotou for his permition to use the drilling machine of the Hotel that he is responsible.
- Mr. Charalambos Kaloyirou, Senior lab assistant for his help, advices and support during the engine trials.
- Mr. Charis Charidemou, lab assistant for his help to the measurements taken during the engine trials.
- Dr. Polyvios Elephtheriou, Senior Lecturer for the provision of the H.T.I. knowledge.
- Mr. Ioannis Michael, my electrician, for his advices and quick service offered during the engine preparation.
- Mr. Doros Apostolou, for his help to complete the typing of the project.
- Finally I would like to express my thanks to all people involved in the practical approach of this project.

#### SUMMARY

The title of the project is "Modification of a conventional water-cooled engine to an air – cooled one".

The objectives of this project are to measure the fuel consumption and the operating temperature, of water and oil of a water cooled engine at different revolutions.

Then the belt drives must be removed from the water pump and fun. The engine must be modified such that cold air can be forced into the normal water passages to cool the engine.

The fuel consumption, the oil temperature and the inlet and outlet temperature of the air must be measured at different revolutions.

After that the effectiveness of this air cooling system should be discussed and suggestions for further work should be made.

This book is going to examine the main types of cooling systems that already exist in chapter 2.

In chapter 3 the engine specifications the mechanical losses and fan outputs are examined. In that chapter the engine characteristics of the project are shown and various losses related to the energy produced from the fuels are determined.

In chapter 4 the method of cooling that was chosen is analysed. The sequence of events, the procedure of manufacturing and preparing the engine to accept the system and the methods used is described.

Results presentation and discussing takes place in chapter 5. Also the calculations needed in order to support the practical approach are stated. Alternative solutions and suggestions for improvements are stated.

Chapter 6 deals with the conclusions and recommendations. The benefits of the project to the society and the author are mentioned.

The method chosed for the cooling of an engine-which is normally water cooled and was designed in 1959 from Alex Isigones (Morris Mini 850 cc) which is an engine that tend to have high temperature indications – is an internal air cooled system that is going to be examined if there will be decrease in fuel consumption, increase in mechanical efficiency and also the engine temperature cylinder head temperature, oil temperature.

This project also includes a practical determination of these objectives (actually is based on the practical measurement).

The steps proceeded are shown in detail as well as the machinery used to produce various components such as air inlet manifold and exhaust manifolds to suit a Toyota Glanza turbocharger Kit.

## LIST OF CONTENTS

,

# ACKNOWLEDGEMENTS

## **SUMMARY**

## LIST OF CONTENTS

## **LIST OF FIGURES**

## LIST OF TABLES

# LIST OF PHOTOS

## **LIST OF GRAPHS**

# Chapter 1

1.1. Introduction to the project.

# Chapter 2 RELATIVE THEORY

- 2.1. Main types of cooling systems
- 2.2. Water Cooled engine
  - 2.2.1 Mechanical / Forced Circulation
  - 2.2.2 The radiator / Heat exchanger
  - 2.2.3 The Thermostat
  - 2.2.4 The Impeller
  - 2.2.5 Closed System
  - 2.2.6 Expansion Tank
  - 2.2.7 The Heater
- 2.3. Air cooled system
  - 2.3.1 Forced Circulation of Air
  - 2.3.2 The Cooling
- 2.4. Advantages and Disadvantages

- 2.4.1 Advantages of air cooled system
- 2.4.2 Disadvantages of air cooled system
- 2.4. The oil radiator / cooler

# Chapter 3 ENGINE SPECIFICATIONS

- 3.1. Engine Specifications
- 3.2. Oil temperature
- 3.3. Mechanical losses and fan outputs
- 3.4. Fan output
  - 3.4.1 The electric fan

## Chapter 4 METHODOLOGY ADOPTED

- 4.1. Introduction to Procedure
- 4.2. Method used
  - 4.2.1 Description of the idea
- 4.3. The sequence of events

### Chapter 5 PRESENTATION OF RESULTS AND DISCUSSION

5.1. Calculation of cooling load

#### 5.2. Fuel consumption

- 5.2.1 Fuel consumption characteristics
- 5.2.2 Thermal efficiency
- 5.2.3 Relative efficiency
- 5.2.4 The energy balance or energy audit
- 5.2.5 Cooling load determination
- 5.2.6 Mass flow Rate of cooling air
- 5.2.7 Performance of Air compressor
- 5.3. Calculation of air-compressor's mass flow rate
- 5.4. Engine trial
- 5.5. Effectiveness of Air cooling system

- 5.6. Engine test using air-blower
- 5.7. Discussion on performance

## Chapter 6 DECISION OF THE MOST EFFECTIVE SOLUTION

,

6.1. Suggestion

## **APPENDICES**

## **REFERENCES**