

HIGHER TECHNICAL INSTITUTE

MECHANICAL ENGINEERING COURSE

DIPLOMA PROJECT

DESIGN OF A BRAKE DYNAMOMETER

M/1026

BY: ANDREOU IOANNIS

JUNE 2007

DESIGN OF A BRAKE DYNAMOMETER

Project number: 1026

by

Ioannis Andreou

**Project report to the
Department of Mechanical Engineering
Of the Higher Technical Institute
Nicosia Cyprus**

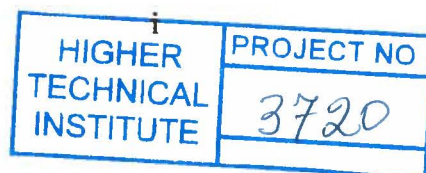
In partial fulfilment of the requirements for diploma of

TECHNICIAN ENGINEER

In

MECHANICAL ENGINEERING

June 2007



ABSTRACT

The objective of this diploma project is the design of a brake dynamometer. Actually is water brake dynamometer because the basic function is the absorption of energy through water. Detailed drawings of the proper design will be presented.

Firstly, the principles and basic ideas of construction of various types dynamometers were research, so as to understand and comprehend the main principles and be able to design something with the similar principles.

Despite of the many type of dynamometers I decided to start from zero and design one with my prototypes but with the similar principles. After the final decision for which idea to select practical problems were found but finally the design finished.

Through this project, I was able to learn and study hard to understand mechanical engineering principles and how are involved.

CONTENTS

	Page
Abstract	i
Contents	ii
List of figures	iii
List of tables	iv
Acknowledgment	v
Abbreviations	vi,vii
Chapter 1: Objectives	1
Chapter 2: Introduction to the related theory	3
2.1 Introduction	3
2.2 Torque	3
2.3 What is the dynamometer	3
2.3.1 Types of the dynamometers	5
2.3.2 Dynamometer comparison	9
2.4 Brake power	11
2.5 indicated power	11
Chapter 3: Methodology adopted	12
Chapter 4: Different designs	14
Chapter 5: Analysis of the problem and synthesis of design	21
Decision of the radius of the impeller	22
Velocity diagrams of the profile impeller blades	28
Construction of velocity diagrams	28
Pump performance	31
Specific speed	32
Power of the fluid / Efficiency of the impeller	33
Calculations for the various specific speeds	31
Inertia optimization of the impeller	37
Volume of disc , blades , mass of disc	39,40
Body diagram of the shaft / Moment diagram	40,41
Torsion on the shaft	45
Forces acting on the coupling	46
Decision of the right key for the impeller	47
Forces on the coupling find the desire diameter	48

Finding the width of the coupling	49
Arm calculations	50
Water brake housing design/Design torque arm	52
Chapter 6: Dynamometer technical drawing	53
Chapter 7: Conclusion	54
Appentices	55
Bibliography	
References	

LIST OF FIGURES

Figures:	Page
2.1: A simple engine dynamometer	4
2.2: Dynamometer or positive pump	5
2.3: A water brake dynamometer	6
2.4: Friction brake dynamometer	7
2.5: A DC generator dynamometer	8
2.6: An Eddy current dynamometer	9
3.1: Research	12
4.1: Design 1	14
4.2: Design 2	14
4.3: Design 3	14
4.4: Design 4	15
4.5: Design 5	15
5.1: Types of impeller blades	29
5.2: Velocity diagram of radial blades	30
5.3: Velocity diagram of backward curved blades	30
5.4: Velocity diagram of forward curved blades	30
5.5: Typical characteristics curves of constant speed	31
5.6: Approximate relative impeller shape vs specific speed	32
6.1: Housing and structure dimensions	
6.2: Impeller dimensions	
6.3: Section of casing	
6.4: Torque arm	

6.5: Pipes and pump diagram

6.6: Part list of dynamometer

6.7: Housing and structure

List of tables

Table	Page
4.1: Cost-Benefit comparisons	16
4.2: Index of performance success	16
4.3: Cost-Benefit comparisons	17
4.4: Benefit analysis table	17
5.1: Power vs Impeller diameter at engine speed of 3600rpm	24
5.2: Power vs Impeller diameter at engine speed of 6500rpm	25
5.3: Power vs Impeller diameter at engine speed of 9500rpm	26
5.4: Torque and horsepower values for different radius at different rpm	27
5.5: Impeller efficiency at 3600rpm	36
5.6: Radius of impeller vs Inertia	39

ACKNOWLEDGMENT

I would like to express my sincere thanks to my project supervisor Mr. Costas Neokleous for his help.

I also would like to thank Mr. Paraskevas Demetriou, John Motis who is automotive engineer, for sharing their vital knowledge that was gained through many years of professional experience, as well as their time, in carrying out this project.