

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING COURSE

DIPLOMA PROJECT

**DESIGN OF THE ELECTRICAL SERVICES
OF A BUILDING**

E/1355

BY: FRANGOUDIS PLOUTARCHOS

JUNE 2004

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING COURSE

DIPLOMA PROJECT

**DESIGN OF THE ELECTRICAL SERVICES
OF A BUILDING**

BY: FRANGOUES PLOUTARCHOS

SUPERVISOR: Mr. CHARALAMBOS CHRISAFIADES

JUNE 2004

HIGHER TECHNICAL INSTITUTE	PROJECT NO
	3511

DEDICATED:

*To all the people who
helped me to complete the
Electrical Engineering Course in
Higher Technical Institute*

CONTENTS

	<u>PAGE</u>
Acknowledgements.....	1
Summary.....	2
CHAPTER 1: Introduction.....	3
1.1... Chapter Informations.....	3
1.2... General Informations for the Calculations.....	4
CHAPTER 2: Illumination design	
2.1... Introduction.....	7
2.2... Definitions and units of physical quantities.....	7
2.3... Actual design.....	8
2.3.1... Exact number of Luminaries.....	8
2.4... Illumination Calculations.....	8
2.4.1... Tables showing the luminaries.....	9
CHAPTER 3: Lighting circuit	
3.1... Lighting circuits calculations.....	14
3.2... Single line diagram for lighting circuit 1L1.....	14
3.3... Calculations for lighting circuit 1L1.....	14
3.3.1... Tables showing the cable and conduit sizes for the lighting circuits.....	16
CHAPTER 4: Socket Outlets	
4.1... Introduction.....	18
4.2... Calculations of a ring circuit.....	18
4.2.1... Single line diagram for ring circuit 1R1.....	18
4.2.2... Calculations for ring circuit 1R1.....	18
4.2.3... Tables showing the cables and conduit sizes for the socket outlets.....	21
CHAPTER 5: Fixed Appliances	
5.1... Cooker unit.....	23
5.2... Single line diagram for Cooker unity 1CK1.....	23
5.1.2... Calculations for cooker unit 1CK1.....	23
5.2... Washing Machine unit.....	25
5.2.1... Single line diagram for washing machine unit 1WM1.....	25
5.2.2... Calculations for Washing Machine unit 1WM1.....	26
5.3... Dish Washer unit.....	28
5.3.1... Single line diagram for Dish Washer unit 1DW1.....	28
5.3.2... Calculations for Dish Washer unit 1DW1.....	28
5.4... Refrigerator unit.....	30
5.4.1... Single line diagram for Refrigerator unit 1RF1.....	30
5.4.2... Calculations for Refrigerator unit 1RF1.....	30

5.5... Water Heater unit.....	32
5.5.1... Single line diagram for Water Heater unit 1WH1.....	32
5.5.2... Calculations for Water Heater unit 1WH1.....	33
5.6... Water Pump unit.....	35
5.6.1... Single line diagram for Water Pump unit 1WP1.....	35
5.6.2... Calculations for Water Pump unit 1WP1.....	35
5.7... Lift Motor unit.....	37
5.7.1... Single line diagram for Lift Motor unit LM1.....	37
5.7.2... Calculations for Lift Motor unit LM1.....	38
5.8... Tables showing the cables and conduit sizes of the UNITS.....	40
5.8.1... Single Line diagram for Bell Unit 0BL1.....	40
5.8.2... Calculations for Bell Unit 0BL1.....	40

CHAPTER 6: Air Condition

6.1... Introduction.....	45
6.2... Size selection of the units.....	45
6.2.1... Calculations for size selection of the units.....	45
6.2.2... Tables showing the units sizes.....	45
6.3... Calculations for Air Condition units.....	47
6.3.1... Single line diagram for Air Condition unit 1AC1.....	47
6.3.2... Calculations for Air Condition unit 1AC1.....	47
6.3.3... Tables showing the cables and conduit sizes of the UNITS.....	49

CHAPTER 7: Storage Heaters

7.1... Introduction.....	51
7.2... Size selection of the units.....	51
7.2.1... Calculations for size selection of the units.....	51
7.2.2... Tables showing the units sizes.....	51
7.3... Calculations for Storage Heaters units.....	53
7.3.1... Single line diagram for Storage Heater unit 1SH1.....	53
7.3.2... Calculations for Storage Heater unit 1SH1.....	53
7.3.3... Tables showing the cables and conduit sizes of the units.....	55
7.4... Distribution Boards and Supply Cables.....	57
7.4.1... Distribution board capacity calculations for 1DBSH1.....	57
7.4.2... Table showing the Distribution Board capacity.....	57
7.4.3... Table showing the Distribution boards capacity.....	57
7.5... Calculations for Distribution Board 1DBSH1.....	58
7.5.1... Table showing the Supple Cables and conduit sizes for the Distribution Boards..	60

CHAPTER 8: Fire Alarm

8.1... Introduction.....	61
8.2... Manual Fire Alarm system.....	61
8.3... Automatic Fire Alarm system.....	62
8.4... Detectors.....	63
8.5... General regulations for the installation of Fire Detectors.....	65
8.6... Control units: system 1200 AFA-MINERVA.....	66

CHAPTER 9: Telecommunications

9.1... Introduction.....	67
9.2... Conduit Schematic.....	68
9.3... Wiring Schematic.....	69

CHAPTER 10: Lightning protection

10.1... Definition.....	70
10.2... Creation of lightning	70
10.3... Effects of lightning	70
10.4... Location of lightning.....	71
10.5... Lightning Protection systems.....	71
10.5.1... Way of operation.....	71
10.5.2... Material required.....	71
10.6... Methods to provide protection.....	72
10.7... Need of protection.....	72
10.8... Bonding.....	72
10.9... Earth electrodes.....	73
10.10... Down Conductors.....	73
10.11... Calculation for overall risk factor.....	73
10.12... Protection System necessarily.....	74

CHAPTER 11: Distribution Boards

11.1... Introduction.....	75
11.2... Diversity Application.....	75
11.3... Selection of the supply cables to distribution boards.....	80
11.3.1... Calculations of supply cables to 0DB1.....	80
11.3.2... Table showing the supply cables and conduit sizes for the DBs.....	82
11.4... Distribution board sizes.....	82
11.4.1... Calculations for the size of distribution board 1DB1.....	82
11.5... Single Line diagrams.....	83
11.5.1... Single Line diagram for 0DB1.....	83
11.5.2... Single Line diagram for 1DB1.....	84
11.5.3... Single Line diagram for 2DB1.....	85
11.5.4... Single Line diagram for 3DB1.....	86
11.5.5... Single Line diagram for 4DB1.....	87

CHAPTER 12: Costing

12.1... Methods of Costing.....	88
12.2... General information.....	88
12.3... Material and Labour Costing Calculations.....	90
12.3.1... Material Cost.....	90
12.3.2... Labour Cost.....	94
12.3.3... Costing Evaluation.....	95

CHAPTER 13: Inspection and Testing	
13.1 ... Introduction.....	96
13.2 ... Inspection.....	96
13.3 ... Testing.....	96
APPENDIX 1.....	98
APPENDIX 2.....	121
APPENDIX 3.....	150
APPENDIX 4.....	158
APPENDIX 5.....	162
APPENDIX 6.....	163
APPENDIX 7.....	167
APPENDIX 8.....	178
APPENDIX 9.....	179
APPENDIX 10.....	189
DRAWINGS	

AKNOWLEDGEMENTS

I would like to express my gratitude to my project supervisor, Mr. Charalambos Chrisafiades (senior lecturer of the Electrical Engineering Department of Higher Technical Institute), for his priceless assistance with comments and instructions during the entire period of this project.

Also I would like to express my thanks to:

- My family,
- My uncle Paul,
- All the engineers helped me,
- All the lecturers of H.T.I. ,I had,
- My classmates: Andreas, John, Marios, Lazaros, George S., Charis, George X.,
- My other half.

because their contribution helped me to complete the electrical engineering course and take my Diploma.

SUMMARY

The purpose of the electrical installation project is the design of electrical services in a building that must be carried out with responsibility in order to provide safety to the people.

The electrical design of the building is carried out according to IEE wiring regulations 16th edition. Also C.Y.T.A. and E.A.C. regulations (other than those of IEE), C.I.B.S. code for interior lighting, fire alarm system, storage heater, air-conditioning and lightning protection regulations were considered.

The design of the electrical services of the building is explained in detail in this book. The book has been divided into different chapters. The contents of the book and of each chapter are given at the beginning. At the end of the book there are appendices. In each appendix there are tables and manufacturers data used in the design, for each appendix.