

HIGHER TECHNICAL INSTITUTE

ELECTRICAL ENGINEERING COURSE

DIPLOMA PROJECT

DESIGN OF THE ELECTRICAL SERVICES
OF A FACTORY

E/894

NICOS IOANNOU

JUNE 1994

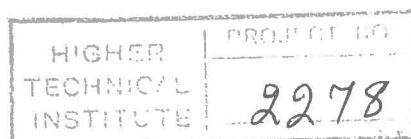
DESIGN OF THE ELECTRICAL SERVICES OF A FACTORY

BY
NICOS IOANNOU

Project report submitted to
the Department
of Electrical Engineering
of the Higher Technical Institute
Nicosia, Cyprus
in partial fulfillment of the requirements
for the Diploma of
Technician Engineer

Project Supervisor : Mr. E. Michael
Lecturer of the Electrical
Engineering Department, H.T.I.

JUNE 1994



Dedicated to

my fiancée

and to my family

ACKNOWLEDGMENTS

I would like to express my personal thanks to my project supervisor Mr. E. Michael, lecturer of the Electrical Engineering Department at H.T.I., to my father for his support and to the general manager of TECON, Mr. Pambos Shamimis and Mr. Nicos Shiamishis for their assistance during the whole process of this project.

Many thanks to Christos Vorkas for his excellent work at typing this project.

TABLE OF CONTENTS

ABSTRACT	vi
INTRODUCTION	vii
ASSUMPTIONS AND ABBREVIATIONS	ix
CHAPTER 1: Illumination.....	1
1.1.Introduction.....	1
1.2.Methods of Illumination Calculations.....	1
1.3.Units and Definitions.....	2
1.4.Illumination Design Procedure.....	5
1.5.Actual Design	7
CHAPTER 2: Lighting Circuits	14
2.1.General	14
2.2.Design Procedure.....	15
2.3.Design Calculations for typical lighting circuits	19
2.3.1. Lighting Circuit 1.....	19
2.3.2. Lighting Circuit 2.....	27
2.3.3. Lighting Circuit 4.....	30
2.4.Table of Results for Lighting Circuits.....	35

CHAPTER 3: Socket Outlet Circuits	41
3.1.General	41
3.2.Single-phase socket outlet circuits.....	41
3.2.1. Design Calculations of a typical ring circuit	41
3.2.2. Design Calculations of a typical radial circuit	50
3.3.Three-phase socket outlet circuits.....	55
3.3.1. Design Calculations of a typical 3-phase socket outlet circuit	55
3.4.Table of Results for Socket Outlet Circuits.....	62
CHAPTER 4: Fixed Appliances Circuits	65
4.1.Cooker Circuit	65
4.1.1. General.....	65
4.1.2. Design Calculations for the cooker circuit.....	66
4.2 Water Heater Circuit 2.....	71
4.2.1. General.....	71
4.2.2. Design Calculations for the water heater	71
4.3.Table of Results for Fixed Appliances Circuits.....	77
CHAPTER 5: Machine Circuits.....	78
5.1.General	78
5.2.Design Calculations for typical machine circuits.....	79
5.2.1. Machine Circuit 1	79

5.2.2. Heating Element of Machine 1.....	86
5.3. Table of Results for Machine Circuits	92
CHAPTER 6: Main Switchgear	96
6.1. General	96
6.2. Isolation and switching	96
6.3. Protection.....	98
6.4. Distribution Boards.....	104
6.4.1. Distribution Boards Circuit Calculations.....	107
6.4.2. Total Results for Distribution Boards.....	122
6.5. Fault Level Calculations.....	123
CHAPTER 7: Earthing.....	136
7.1. General	136
7.2. General requirements for earthing.....	137
7.3. Earthing Definitions	138
7.4. Earthing arrangements for this installation	140
CHAPTER 8: Power Factor Correction	143
CHAPTER 9: Telephone Installation	148
9.1. General	148
9.2. Basic Principles governing the Internal Telecommunications Network	148
9.3. Planning of the telephone distribution system of the factory.....	150

CHAPTER 10: Fire Alarm Installation	155
10.1. General	155
10.2. Equipment used	157
10.3. Planning of the Fire Alarm installation	160
CHAPTER 11: Burglar Alarm Installation.....	162
11.1 General	162
11.2. Equipment used	162
11.3. Planning of the Burglar Alarm System of the factory.....	164
CHAPTER 12: Inspection and Testing	166
12.1. General	166
12.2. Visual Inspection	166
12.3. Testing.....	167
CHAPTER 13: Costing.....	169
13.1. General	169
13.2. Costing of the factory installation	170
CONCLUSION	175
REFERENCES	177
APPENDICES.....	178

ABSTRACT

This project deals with the design of the electrical services of a factory which prepares sesame and tahini.

The main objectives are:

1. To design the complete electrical services for a specified factory which will include the following:
 - a) Fire and Burglar alarm systems
 - b) Telephone installation and internal communication
 - c) Power Factor Correction
2. To study the illumination engineering work involved.
3. To provide all necessary diagrams, schedule of materials and costing including labour.

INTRODUCTION

This project deals with the design of the Electrical Services of a factory located in Nicosia.

The factory consists of the basement, the ground floor and the first floor for which design calculations were avoided. First floor was considered only for telephone installation.

Supply to the factory is given by 500KVA transformer which is located in the basement of the factory.

The level of illumination in the various areas were taken by the CIBS code. For the purpose of illumination design, MOORLITE and SIMPLEX catalogues were used.

The results of the illumination design were tabulated in tables giving the necessary information for the illumination in each area.

The design of the lighting and power circuits was carried out in accordance with the IEE Wiring Regulations as currently amended and the local EAC conditions of supply.

The power circuits are divided into socket outlet circuits, fixed appliances circuits and high power circuits (machine circuits and distribution board circuits).

The lighting, socket outlet and the fixed appliances circuits are supplied from the various distribution boards and are protected by MCBs to BS3871 type 1. The machine circuits are protected by fuses to BS88 part 2. The distribution board circuits are supplied by the main panel and are protected by MCCBs.

The results of the lighting and power circuits are tabulated in tables giving the necessary information for each circuit.

All the switches, lampholders, socket outlets, metal boxes used were taken from GRABTREE catalogues.

All the protective devices such as MCBs, RCDs and MCCBs are manufactured by PROTEUS SWITCHGEAR.

On the ground floor there is one submain distribution board, which is supplied from the main panel located in the EAC room. From the submain distribution board the various distribution boards are supplied.

For the main panel and each distribution board, there is a single line diagram showing the various circuits supplied from them. The main panel and the distribution boards used are taken from PROTEUS SWITCHGEAR.

The main consideration when designing the electrical installation was safety. Therefore, the appropriate measures were taken so that the danger of electric shock, and dangers arising in the case of a fault or short circuit are eliminated.

Also power factor correction was done so that the installation will be more efficient.

In order to ensure that the IEE wiring regulations have been fulfilled, visual inspection and various tests must be carried out. In Chapter 12 the various tests that must be carried out are briefly described.

Then the design of the telephone installation was carried out in accordance with C.Y.T.A. requirements. A 4/8 Key System Unit (HYBREX AX-8) was used for the telecommunication network of the factory.

Finally, the design of the fire and burglar alarm installations are described in chapters 10 and 11 respectively.