

HIGHER TECHNICAL INSTITUTE
MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

**PART PROGRAMMING ON A
C.N.C VERTICAL MILLING MACHINE**

By
IOANNOU CHRISTODOULOS
(M/747)

JUNE 1996

HIGHER TECHNICAL INSTITUTE

MECHANICAL ENGINEERING COURSE

DIPLOMA PROJECT

**PART PROGRAMMING ON A
C . N . C VERTICAL MILLING MACHINE**

M / 747

IOANNOU CHRISTODOULOS
1996

HIGHER TECHNICAL INSTITUTE	PROJECT NO 2589
----------------------------------	--------------------

PART PROGRAMMING ON A
C.N.C VERTICAL MILLING MACHINE

BY
IOANNOU CHRISTODOULOS

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 TECHNICAL ENGINEER IN MECHANICAL
ENGINEERING

JUNE 1996

HIGHER TECHNICAL INSTITUTE	PROJECT NO 2589
----------------------------------	--------------------

**HIGHER TECHNICAL INSTITUTE
NICOSIA - CYPRUS
MECHANICAL ENGINEERING DEPARTMENT**

DIPLOMA PROJECT 1995/96

Project Number : M / 747

Title : " Part programming on a C.N.C vertical milling machine and design of a milling fixture "

Objectives:

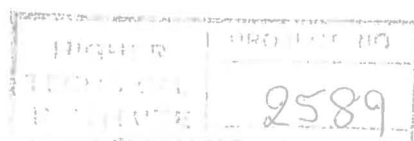
1. Study the programming characteristics of the Bridgeport IMII (with TNC 155 Heidenhein control) C.N.C vertical milling machine.
2. Write a part program for the manufacture of a component (to be decided with the student).
3. Make use of linear interpolation, circular interpolation and canned cycles.
4. Design a milling fixture to ensure location, support and clamping of the component to be manufactured.
5. Test of the above programmed component and fixture.
6. Produce detailed drawing of the manufactured component and fixture.

Terms and conditions:

1. All recommendations should be according to ISO.
2. Selection of components for the milling fixture should be according to standard components.
3. Professional guidance will be provided.

Student: Ioannou Christodoulos (3M1)

Project Supervisor: Vasilios Messaritis



THIS PROJECT IS DEDICATED,
TO MY FAMILY
AND SOMEONE VERY " SPECIAL "

ACKNOWLEDGMENTS

I would like to express my sincere thanks and appreciation to my supervisor Dr. V. Mesaritis lecturer in Mechanical Engineering Department at the Higher Technical Institute for his valuable assistance and guidance the project period.

Ioannou Christodoulos
3rd year student in
Mechanical Engineering
Higher Technical Institute
JUNE 1996

ABSTRACT

The main objective of the manufacture of a component using the C. N. C vertical milling machine and to location, support and clamping of the component to be manufactured.

To achieve this programming characteristics of the Bridgeport IMII (with TNC 155 Heidenhein) C. N. C vertical milling machine were studied and a manufacture for practice reasons.

Finally part programs were written by making use of linear interpolation, circular interpolation and canned cycles having as a result the manufacture of the component to be required.

Detailed drawings of the manufactured component and fixture , are produced.

CONTENTS

Acknowledgments	-5-
Abstract	-6-
Contents	-7-

CHAPTER 1

1. Introduction	-11-
1.1 Definitions of numerical control	-11-
1.2 N.C applications	-11-
1.3 Capabilities of numerical control	-12-
1.4 Advantages of numerical control	-12-

CHAPTER 2

2. N.C/C.N.C machining	-15-
2.1 Input data	-15-
2.2 Rectangular or cartesian coordinate data system	-16-
2.3 Preparatory functions	-17-
2.4 Positioning control	-17-
2.5 Miscellaneous functions	-18-
2.6 Point to point positioning control	-18-
2.7 Continuons path control	-19-
2.8 Types of interpolation	-20-
2.9 Linear interpolation	-20-
2.10 Circular interpolation	-21-

CHAPTER 3

3.1 Method of dimensions	-23-
3.2 Absolute dimensions	-23-
3.3 Incremental dimensions	-23-
3.4 Advantages of absolute and incremental dimensions	-24-
3.5 Canned cycles	-24-
3.6 Tool offsets	-25-
3.7 Tool length offsets	-25-
3.8 Tool radius offsets	-26-
3.9 Workpiece and program zero point	-26-

CHAPTER 4

4. Speeds and feeds	-29-
4.1 Introduction	-29-
4.2 Importance of cutting conditions	-29-
4.3 Steps in selective the cutting conditions	-29-
4.4 Feed rate for milling	-30-
4.5 Feed rate for drilling	-31-

CHAPTER 5

5. Bridgeport vertical milling machine series I	-33-
INTERACT MK II	
5.1 Bridgeport series I MK II	-33-
5.2 Additional features	-34-
5.3 Current programming	-34-
5.4 TNC 155 Heidenhain control features	-35-

CHAPTER 6

6 Fundamentals of CAD/CAM	-37-
6.1 Introduction	-37-
6.2 Computer - aided desing	-37-
6.3 Computer - aided manufacturing	-37-
6.4 Manufacturing planning	-38-
6.5 CAD/CAM	-38-

CHAPTER 7

7 Fixture desing	-41-
7.1 Definition and purpose	-41-
7.2 Materials used in jibs and fixtures	-41-
7.3 Presentation of workpiece	-42-
7.4 Constraints	-43-
7.5 Principles of location	-43-
7.6 Types of location	-44-

CHAPTER 8

8.1 Clamping and supporting	-46-
8.2 Procedure for the manufacturing	-47-

CHAPTER 9

9.1 Familiarization with the component No.1	-50-
9.2 Familiarization with the component No.2	-56-

9.3 Familiarization with the component No.3-63-
9.3.1 Familiarization with the component No.3-72-
 (using CAD/CAM system)

CHAPTER 10

10 Conclusions-79-

APPENDICES-84-

REFERENCES-85-