



The Manufacturers Association

TRAINING PLAN – CNC Machinist (YEAR 4)

Total Related Training Instruction (RTI) Hours: 144

Learning Unit	Hrs. of Instruction
Unit 1: Specialized CNC Controls <ul style="list-style-type: none"> ➤ Fanuc ➤ Haas ➤ Mazak 	54
Unit 3: CNC Programming <ul style="list-style-type: none"> ➤ Creating a CNC Program ➤ Calculation for Programming ➤ Canned Cycles 	42
Unit 3: CNC Machine Set Up <ul style="list-style-type: none"> ➤ Set Up Preparation ➤ Entering Offsets ➤ Locating Program Zero ➤ Executing a Program ➤ Storing a Program ➤ Conducting First Part Runs 	48

Unit 1: Specialized CNC Controls

The learning unit further explores the CNC control panel and the differences between the most common CNC manufactured machines. This unit addresses how to enter offsets, locate program zero, execute a program, store a program, and complete a first run on Fanuc, Haas, and Mazak CNC machine controls.

Learning Outcomes and Content

1. Explain how to enter offsets on a Fanuc, Haas, and Mazak CNC mill and lathe.
2. Describe how to locate program zero on a Fanuc, Haas, and Mazak CNC mill and lathe.
3. Explain how to execute a program on a Fanuc, Haas, and Mazak CNC mill and lathe.
4. Describe how to store a program on a Fanuc, Haas, and Mazak CNC mill and lathe.
5. Explain how to conduct a first part run on a Fanuc, Haas, and Mazak CNC mill and lathe.
6. Demonstrate how to enter offsets on a Fanuc, Haas, or Mazak CNC mill.
7. Demonstrate how to enter offsets on a Fanuc, Haas, or Mazak CNC lathe.
8. Demonstrate how to locate program zero on a Fanuc, Haas, or Mazak CNC mill.
9. Demonstrate how to locate program zero on a Fanuc, Haas, or Mazak CNC lathe.
10. Demonstrate how to execute a program on a Fanuc, Haas, or Mazak CNC mill.
11. Demonstrate how to execute a program on a Fanuc, Haas, or Mazak CNC lathe.
12. Demonstrate how to store a program on a Fanuc, Haas, or Mazak CNC mill.
13. Demonstrate how to store a program on a Fanuc, Haas, or Mazak CNC lathe.
14. Demonstrate how to complete a first part run on a Fanuc, Haas, or Mazak CNC mill.
15. Demonstrate how to complete a first part run on a Fanuc, Haas, or Mazak CNC lathe.

Learning Modules





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Module	Hrs. of Instruction	Provider
Fanuc CNC Machines: Entering Offsets - This learning module provides step-by-step instructions for adjusting offsets on the Fanuc mill and lathe controls during a production run.	3	ToolingU-SME
Fanuc CNC Machines: Locating Program Zero – This learning module describes how to determine work offsets and tool geometry offsets on the Fanuc 0-C mill and lathe controls during setup.	3	ToolingU-SME
Fanuc CNC Machines: Program Execution – This learning module describes the steps necessary to activate, execute, and restart programs using the Fanuc 0-C controls for the mill and lathe.	3	ToolingU-SME
Fanuc CNC Machines: Program Storage – This learning module describes common methods for transferring and storing part programs on the Fanuc 0-C controls for the mill and lathe.	3	ToolingU-SME
Fanuc CNC Machines: First Part Runs - This learning module describes how to verify the accuracy of a program and make minor editing changes on the Fanuc 0-C mill and lathe controls.	3	ToolingU-SME
Haas CNC Machines: Entering Offsets - This learning module provides step-by-step instructions for adjusting offsets on the Haas mill and lathe controls during a production run.	3	ToolingU-SME
Haas CNC Machines: Locating Program Zero – This learning module describes how to determine work offsets and tool geometry offsets on the Haas mill and lathe controls during setup.	3	ToolingU-SME
Haas CNC Machines: Program Execution – This learning module describes the steps necessary to activate, execute, and restart programs using the Haas controls for the mill and lathe.	3	ToolingU-SME
Haas CNC Machines: Program Storage – This learning module describes common methods for transferring and storing part programs on the Haas controls for the mill and lathe.	3	ToolingU-SME
Haas CNC Machines: First Part Runs - This learning module describes how to verify the accuracy of a program and make minor editing changes on the Haas mill and lathe controls.	3	ToolingU-SME
Mazak CNC Machines: Entering Offsets - This learning module provides step-by-step instructions for adjusting offsets on the Mazak mill and lathe controls during a production run.	3	ToolingU-SME
Mazak CNC Machines: Locating Program Zero – This learning module describes how to determine work offsets and tool geometry offsets on the Mazak mill and lathe controls during setup.	3	ToolingU-SME



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Mazak CNC Machines: Program Execution – This learning module describes the steps necessary to activate, execute, and restart programs using the Mazak controls for the mill and lathe.	3	ToolingU-SME
Mazak CNC Machines: Program Storage – This learning module describes common methods for transferring and storing part programs on the Mazak controls for the mill and lathe.	3	ToolingU-SME
Mazak CNC Machines: First Part Runs - This learning module describes how to verify the accuracy of a program and make minor editing changes on the Mazak mill and lathe controls.	3	ToolingU-SME
Specialized Controls Practical – This learning module will familiarize a worker with the various types of CNC control panels available at their facility.	9	Facility

Unit 2: CNC Programming

The learning unit instructs the worker in the foundational knowledge required to program CNC machines.

Learning Outcomes and Content

1. Describe how G code programming is used to create a part program.
2. Identify and describe the individual components of a CNC part program.
3. Describe how to write a part program that machines a basic cylindrical part on the CNC lathe.
4. Describe how to write a part program that machines a basic rectangular part on the CNC mill.
5. Describe the various calculations necessary to determine tool position on the lathe or turning center.
6. Describe the various calculations necessary to program toolpaths on a CNC mill or machining center.
7. Describe the standard canned cycles available on common CNC mills and lathes.
8. Demonstrate the ability to develop geometric forms using computer-aided design (CAD) and computer-aided manufacturing (CAM).
9. Demonstrate the ability to develop a plan for CNC machining operations.
10. Demonstrate the ability to perform manual computer numerical control (CNC) programming

Learning Modules

Module	Hrs. of Instruction	Provider
Basics of G Code Programming - This learning module provides a comprehensive introduction to G code programming; which programmers use to direct CNC machines to create a part.	1.5	ToolingU-SME
Creating a CNC Turning Program - This learning module illustrates the process of creating a part program for a CNC lathe.	1.5	ToolingU-SME
Creating a CNC Milling Program - This learning module illustrates the process of creating a part program for a CNC mill.	1.5	ToolingU-SME



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Calculations for Programming the Lathe - This learning module provides an in-depth explanation of various calculations necessary to determine tool positions on the lathe or turning center.	1.5	ToolingU-SME
Calculations for Programming the Mill - This learning module provides an in-depth explanation of the various calculations necessary to program toolpaths on a CNC mill or machining center for a variety of common operations	1.5	ToolingU-SME
Canned Cycles for the Lathe - This learning module provides an overview of standard canned cycles used on CNC lathes.	1.5	ToolingU-SME
Canned Cycles for the Mill - This learning module provides an overview of the standard canned cycles used on CNC mills.	1.5	ToolingU-SME
CNC Machine Programming Practical – This learning module will teach a worker how to develop geometric forms using computer-aided design (CAD) and computer-aided manufacturing (CAM), develop a plan for CNC machining operations, and perform manual computer numerical control (CNC) programming.	31.5	Facility

Unit 3: CNC Machine Set Up

This learning unit will teach a worker the step by step procedures for safe preparation and set up of a CNC machine. This includes preparation of a CNC set up sheet, the input and processing of program data to the machine memory, and determining the tool path and calculation of the proper coordinates. Trainee's will also learn to identify, select, and set up CNC cutting tools and tooling to pre-determined reference points and set machine parameters using speed and feed charts and according to the type, size, grade, and hardness of the material to be cut. Trainees will learn how to position and align a workpiece in a CNC machine to specified datums and required alignments, using chucks, face plates, collets, vises, clamps, stops, and fixtures. Trainees will be instructed on how to input and the steps of verifying the part program at CNC machine controls, as well as how to store and record a verified program on storage media. Trainees will practice verifying tool sequence, tool path, and collision avoidance program, as well as the completion of required set up documentation.

Learning Outcomes and Content

1. Demonstrate the necessary steps to prepare for a CNC machine set up.
2. Demonstrate the steps of entering offsets on a CNC machine.
3. Demonstrate how to locate program zero on a CNC machine.
4. Demonstrate how to execute a program on a CNC machine.
5. Demonstrate how to store a program for a CNC machine.
6. Demonstrate how to complete a first part run on a CNC machine.

Learning Module

Module	Hrs. of Instruction	Provider
CNC Machine Set Up Practical: Set Up Preparation - This learning modules will teach a worker how properly prepare a CNC job. Instruction will introduce the worker to CNC	8	Facility



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set up sheets, the input and processing of program data to the machine memory, and how to determine the tool path and calculation of the proper coordinates.		
<u>CNC Machine Set Up Practical: Entering Offsets</u> – This learning modules will teach a worker how to determine and adjust offsets into a CNC mill and lathe. This module includes practical hands on experience with determining tool length offset, determining cutter compensation, and adjusting cutter compensation offsets for mills and lathes.	8	Facility
<u>CNC Machine Set Up Practical: Locating Program Zero</u> – This learning modules will teach a worker how to determine work offsets and tool geometry offsets during set up on a CNC mill and lathe.	8	Facility
<u>CNC Machine Set Up Practical: Program Execution</u> – This learning module will teach a worker the steps necessary to activate, execute, and restart programs. This module includes practical hands on experience with activating part programs, listing the program displays, and identifying events that signal a normal and abnormal stop. Workers will also be instructed on how to restart a program in the middle of a toolpath, run a program in the graphics display, and delete a specific program.	8	Facility
<u>CNC Machine Set Up Practical: Program Storage</u> – This learning module will teach a worker the steps necessary to demonstrate how to transfer and store part programs. This hands-on experience includes how to input and output from a storage media, change file names, and delete part programs.	8	Facility
<u>CNC Machine Set Up Practical: First Part Runs</u> – This learning module will teach a worker the steps necessary to demonstrate how to verify the accuracy of a program and make minor editing changes. This instruction includes hands on experience with proving out, using machine lock and auxiliary function lock, and conducting a dry run.	8	Facility