

CNC PROGRAMMER

A DEEP DIVE FOR SKILLS-BASED HIRING

REV: 04/04/16

Occupation Overview: CNC Machine Tool Programmers, Metal and Plastic

Foundational Competencies

- **Programming:** Writing computer programs for various purposes.
- **Monitoring:** Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- **Reading Comprehension:** Understanding written sentences and paragraphs in work-related documents.
- **Active Learning:** Understanding the implications of new information for both current and future problem solving and decision making.
- **Operation Monitoring:** Watching gauges, dials, or other indicators to make sure a machine is working properly.
- **Critical Thinking:** Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- **Mathematics:** Using mathematics to solve problems.
- **Complex Problem Solving:** Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Writing:** Communicating effectively in writing as appropriate for the needs of the audience.
- **Judgment and Decision Making:** Considering the relative costs and benefits of potential actions to choose the most appropriate one.

Occupation-Specific Competencies

- **Computer-Aided Manufacturing:** Proficiency with computer-assisted design programs (e.g., CAD, CAM) and processes/machines (e.g., 5-axis machining, CNC machines, mills, and lathes).
- **Machine Tools:** Certification and/or competency with machine tools such as power grinders, milling cutters, drill presses, lathes, calipers, tool dies, and their dial indicators.
- **Mathematics:** Competency in manipulating numbers, quantities, shapes, and spaces.
- **Industrial Design:** Ability to create and/or use schematic diagrams, blueprints, and sketching when designing industrial products.
- **Engineering Software:** Proficiency with computer software related to modeling (e.g., MATLAB, Wonderware, AnSys) and computer-assisted design (e.g., AutoCAD, Mathcad, SCADA).
- **Microsoft Office:** Ability to create and utilize documents using programs such as Microsoft Word, Excel, PowerPoint, and Outlook.
- **Computer Design (Engineering):** Experience with using software (e.g., CAD Design, CATIA, Unigraphics, etc.) to assist with mechanical drafting, drawing preparation, and tool design.
- **Data Entry:** Ability to take production-related data and input within technical programs.
- **Technical Drawing:** Familiarity reading and adjusting preliminary sketches to then adapt for use with equipment.
- **Manufacturing Standards:** Understanding of ISO 9000 and 9001 Standards, CMM, DOE, FMEA, Minitab, and process control.

Job Description (Example)

Operate computer-controlled machines or robots to perform one or more machine functions on metal or plastic work pieces. Prepare detailed working diagrams of machinery and mechanical devices, including dimensions, fastening methods, and other engineering information.

- Create graphical representations of mechanical equipment.
- Analyze design or requirements information for mechanical equipment or systems.
- Confer with technical personnel to prepare designs or operational plans.
- Discuss designs or plans with clients.
- Verify mathematical calculations.
- Supervise and train other drafters, technologists, and technicians.

Activities (Example List)

- Develop detailed design drawings and specifications for mechanical equipment, dies, tools, and controls, using computer-assisted drafting (CAD) equipment.
- Measure dimensions of finished work pieces to ensure conformance to specifications, using precision measuring instruments, templates, and fixtures.
- Mount, install, align, and secure tools, attachments, fixtures, and work pieces on machines, using hand tools and precision measuring instruments.
- Stop machines to remove finished work pieces or to change tooling, setup, or work piece placement, according to required machining sequences.
- Transfer commands from servers to computer numerical control (CNC) modules, using computer network links.
- Check to ensure that work pieces are properly lubricated and cooled during machine operation.
- Set up and operate computer-controlled machines or robots to perform one or more machine functions on metal or plastic work pieces.
- Insert control instructions into machine control units to start operation.
- Review program specifications or blueprints to determine and set machine operations and sequencing, finished work piece dimensions, or numerical control sequences.
- Listen to machines during operation to detect sounds such as those made by dull cutting tools or excessive vibration and adjust machines to compensate for problems.

Prioritized Foundational Competencies: CNC Machine Tool Programmers, Metal and Plastic

Most Common Required Competencies	
1	Critical Thinking: Using logic and reasoning to identify the best solution to a given problem given the resources available (tools, material) and the cost, time and risk of the options; considering alternative, potentially new, ways of using machines and tools to solve a problem; understanding the capabilities of the machines, tools, and methods available; able to assess the quality and accuracy of output.
2	Operation Monitoring: Deciding what to monitor (setting priorities) and at what frequency; monitoring the full process and lifecycle of key products to ensure adherence to the required specifications (dimensional accuracy); assessing the manufacturability of a given computer program (the code looks good, can the floor use this?); if needed, assess the ongoing process for quality.
3	Reading Comprehension: Reading, understanding, and accurately applying what you learn from blueprints and notes, quality standards, specifications, and other important written materials.

Most Common Break Point Competencies	
1	Judgment and Decision Making: Considering the relative costs and benefits of potential actions to choose the most appropriate one; assiduously following safety rules and quality standards (these are not negotiable); being open to new ideas and input and able to question one's own decisions and preferences; following company protocols and superiors' decisions; communicating changes with others.
2	Operation Monitoring: <i>See previous.</i>
3	Monitoring: Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action; listening to advice and coaching and applying much of what one hears; following set standards and protocols; sharing ideas on how to improve operations with others; not acting independently (lone rangers get things wrong).

Most Preferred Competencies	
1	Critical Thinking: <i>See previous.</i>
2	Active Learning: Understanding the implications of new information for both current and future problem solving and decision making; ideally, interested in learning new things; showing interest in making things better and delivering (helping institute a lean or quality process); thinking about how to apply what one has learned in the current situation.
3	Operation Monitoring: <i>See previous.</i>

Most Hard-to-Find Competencies	
1	Complex Problem Solving: Identifying complex problems, creating and evaluating options and implementing solutions; looking past what's currently happening and developing new solutions; thinking outside the box; developing new solutions to unique or novel problems or opportunities; using machines in unconventional ways; adjusting processes to make things better; work holding.
2	Active Learning: <i>See previous.</i>
3	Critical Thinking: <i>See previous.</i>

Most Evolving Competencies	
1	Complex Problem Solving: Evolution driven by technology (machines, customer needs) and expanded capabilities ("we can making things that were inconceivable five years ago"); changes make it more valuable to understanding new machines and their capabilities, being open to new possibilities and challenging one's own preconceptions to find a better way to do things.
2	Programming: Evolution driven by new programs that offer new capabilities and functions (some programs can model the shop floor); these changes make it more valuable to be proficient with powerful newer programs and understand their advanced functions (if valuable) while also increasing the value of a strong understanding of the fundamentals (G-code).
3	Operation Monitoring: Evolution driven by new programs and machines now offering automated or advanced monitoring capabilities; changes make it more valuable to understand how to use modern monitoring tools, being able to take advantage of automated tool and being able to use and interpret data more so than traditional shop floor indicators (gauges, dials).

Prioritized Occupation-Specific Competencies: CNC Machine Tool Programmers, Metal and Plastic

Most Common Required Competencies	
1	Computer-Aided Manufacturing: Proficiency with computer-assisted design programs (e.g., CAD, CAM) and processes/machines (CNC machines, mills, and lathes).
2	Data Entry: Ability to consistently and accurately take production related data and input within technical programs; basic proficiency with measurement tools (drop gauge, micrometer, caliper, optical comparator); ability to use data to calculate/generate key data fields when necessary.
3	Machine Tools: Competency with machine tools such as power grinders, milling cutters, drill presses, lathes, calipers, tool dies, and their dial indicators.

Most Common Break Point Competencies	
1	Data Entry: <i>See previous.</i>
2	Technical Drawing: Familiarity reading, and adjusting drawings, supporting documents, notes, dimensional standards, and GD&T to make and process parts.
3	Machine Tools: <i>See previous.</i>

Most Preferred Competencies	
1	Computer-Aided Manufacturing: <i>See previous.</i>
2	Machine Tools: <i>See previous.</i>
3	Technical Drawing: <i>See previous.</i>

Most Hard-to-Find Competencies	
1	Technical Drawing: <i>See previous.</i>
2	Machine Tools: <i>See previous.</i>
3	Computer-Aided Manufacturing: <i>See previous.</i>

Most Evolving Competencies	
1	Computer-Aided Manufacturing: Evolution driven by more feature-based coding, tooling advances and more software options; changes make it more valuable to be open and able to adopt new technology to solve problems and capture opportunities and to actively seek out opportunities to make things better (they exist).
2	Technical Drawing: Evolution driven by more sophisticated customer needs (new products) and more capabilities from new machines; the changes make it more valuable to take complicated customer request and make them coherent (customers ask without knowing what makes sense/is possible); increased value in understanding key symbols and measures from other countries.
3	Manufacturing Standards: Evolution driven by high customer standards (better than ISO), unique industry-specifications gaining prominence and globalization (other country's standards now matter); the changes make it more valuable to have a basic understanding of manufacturing standards (e.g., ISO, ASME, SAE, FDA), and one standard in particular, and knowing how to apply them.

Occupation Deep Dive: CNC Machine Tool Programmers, Metal and Plastic

Job Titles Within This Occupation

- CAD CAM Programmer
- Computer Numerical Control (CNC) Programmer
- Process Engineer
- Programmer
- Project Engineer
- Welding Engineer

Certification and Education Preferences (Example)

- Certified Welding Engineer

Tools Used (Example List)

- CAD (Computer-Aided Design) Software
- CAM (Computer-Aided Manufacturing) Software
- CNC Machines
- 5-Axis Machines
- Coordinate Measuring Machines
- Calipers
- Micrometers

Other Relevant Foundational Competencies

1	Programming
2	Monitoring
3	Reading Comprehension
4	Active Learning
5	Operation Monitoring
6	Critical Thinking
7	Mathematics
8	Complex Problem Solving
9	Writing
10	Judgment and Decision Making
11	Active Listening
12	Speaking
13	Operation and Control
14	Systems Analysis
15	Coordination
16	Quality Control Analysis
17	Time Management
18	Systems Evaluation
19	Instructing
20	Equipment Selection
21	Troubleshooting
22	Learning Strategies
23	Social Perceptiveness
24	Management of Personnel Resources
25	Operations Analysis

Other Relevant Occupation-Specific Competencies

1	Computer-Aided Manufacturing
2	Machine Tools
3	Mathematics
4	Industrial Design
5	Engineering Software
6	Microsoft Office
7	Computer Design (Engineering)
8	Data Entry
9	Technical Drawing
10	Manufacturing Standards
11	Electrical/Mechanical Labor
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