COMPUTER-CONTROLLED MACHINE TOOL OPERATORS

A DEEP DIVE FOR SKILLS-BASED HIRING

SKILLFUL
A MARKLE INITIATIVE

Occupation Overview: Computer-Controlled Machine Tool Operators

Foundational Competencies

- **Operation Monitoring:** Watching gauges, dials, or other indicators to make sure a machine is working properly.
- **Monitoring:** Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- **Critical Thinking:** Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- **Quality Control Analysis:** Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- **Operation and Control:** Controlling operations of equipment or systems.
- **Reading Comprehension:** Understanding written sentences and paragraphs in work-related documents.
- **Complex Problem Solving:** Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Active Listening:** Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Troubleshooting:** Determining causes of operating errors and deciding what to do about it.
- **Judgment and Decision Making:** Considering the relative costs and benefits of potential actions to choose the most appropriate one.

Occupation-Specific Competencies

- **Intermediate 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).
- **Basic Machine Tools:** Certification and/or proficiency with machine tools such as power grinders, milling cutters, drill presses, lathes, calipers, tool dies, and their dial indicators.
- **Basic Machinery:** Ability to safely and appropriately operate, demonstrate, clean, and lubricate machines.
- **Basic Industrial Design:** Ability to create and/or use schematic diagrams, blueprints, and sketching when designing industrial products.
- **Intermediate Technical Drawing:** Familiarity reading and adjusting preliminary sketches to then adapt for use with equipment.
- **Basic Manufacturing Standards:** Understanding of ISO 9000 and 9001 Standards, CMM, DOE, FMEA, Minitab, and process control.
- **Basic Data Entry:** Ability to take production-related data and input within technical programs.
- **Basic Electrical/Mechanical Labor:** Familiarity with the base components of manufacturing machinery, including fiber optics, coolant systems, calibration, AC/DC drives and motors, and fuel systems.
- **Basic Equipment Maintenance/Repair:** Proficiency with equipment assembly, maintenance, efficiency, repair, cleaning, installation, and inspection.

Job Description (Example)

Operate computer-controlled machines or robots to perform one or more machine functions on metal or plastic work pieces.

- May set up and operate a variety of computer-controlled machine tools to produce precision parts and instruments.
- May also fabricate and modify parts to make or repair machine tools or maintain industrial machines, applying knowledge of mechanics, mathematics, metal properties, layout, and machining procedures.
- May be required to inspect equipment, structures, or materials to identify the cause of errors or other problems or defects.
- Use machines to measure materials needed to start the process to create the product that the client is ordering

Activities (Example List)

- Measure dimensions of finished workpieces to ensure conformance to specifications, using precision measuring instruments, templates, and fixtures.
- Mount, install, align, and secure tools, attachments, fixtures, and workpieces on machines, using hand tools and precision measuring instruments.
- Stop machines to remove finished workpieces or to change tooling, setup, or workpiece placement, according to required machining sequences.
- Transfer commands from servers to computer numerical control (CNC) modules using computer network links.
- Check to ensure that workpieces 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 workpieces.
- Review program specifications or blueprints to determine and set machine operations and sequencing, finished workpiece 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.
- Remove and replace dull cutting tools.

Prioritized Foundational Competencies: Computer-Controlled Machine Tool Operators

	Most Common Required Competencies
1	**Quality Control Analysis:** Validate pieces meet specifications (e.g., use micrometer); assess machines to verify they work ("are blades sharp?"); be conscientious of machines and tools and follow protocols; provide feedback to programmers and managers on QA problems – ideally identify root cause of problem and offer potential solution(s).
2	**Operation and Control:** Check for end-to-end alignment of all tools and high quality tools (not dull or chipped); position and insert pieces appropriately; exercise diligence monitoring the end-to-end process; read – potentially edit – GCode (command language); manage health of machine (coolant, falls or sleeps, speed and feed rate, chip control, debris); ensure effective and safe material management.
3	**Operation Monitoring:** Watching gauges, dials, coolant levels, chip evacuation, hydraulic oil levels, way oil levels and other indicators to make sure a machine is working properly; listen and look to confirm function ("if it sounds bad, it probably is bad"); follow protocols for safety; check environment for warning signals (hydraulic oil leaking, coolant leaking).

	Most Common Break Point Competencies
1	**Quality Control Analysis:** *See previous.*
2	**Operation and Control:** *See previous.*
3	**Operation Monitoring:** *See previous.*

	Most Preferred Competencies
1	**Critical Thinking:** Identify and discover problems (dull blades, piece tolerance off, blades "cutting air") – come to programmers with problem and – ideally – a proposal solution (change offsets or cutters, improve cutter path); independently identify better ways to produce (use different machine, improve feed rates, different cutters); identify a product feature that can save time or money.
2	**Operation and Control:** *See previous.*
3	**Quality Control Analysis:** *See previous.*

	Most Hard-to-Find Competencies
1	**Quality Control Analysis:** *See previous.*
2	**Critical Thinking:** *See previous.*
3	**Operation Monitoring:** *See previous.*

	Most Evolving Competencies
1	**Critical Thinking:** Evolution driven by emergence of new technology and increasing complexity of potential problems; changes increase value of identifying, anticipating, and preventing problems (dull blades, piece tolerance off, blades "cutting air"); independently identify better ways to produce; identify a product feature that can save time or money.
2	**Judgment and Decision Making:** Evolution due to increased information transparency; changes make it more important to consider cost and equipment maintenance in decision making; able to parallel process and multi-task to increase machine utilization.
3	**Troubleshooting:** Evolution driven by increasingly complex technology and emergence of sophisticated technological problems; changes increase value of understanding new technology, determining causes of operating errors, and deciding how to fix them; tooling (cutters, drills, molds) have all become more sophisticated, and single machines now commonly employ multiple tools.

Prioritized Occupation-Specific Competencies: Computer-Controlled Machine Tool Operators

Most Common Required Competencies

1 **Computer-Aided Manufacturing:** Proficiency with computer-assisted design programs (e.g., CAM) and processes/ machines (e.g., 5-axis machining, CNC machines, mills, and lathes).

2 **Machine Tools:** Certification and/or proficiency with machine tools such as power grinders, milling cutters, drill presses, lathes, calipers, tool dies, dial indicators, micrometers, depth mike or step mike, CNC mills, and CNC lathes.

3 **Machinery:** Ability to safely and appropriately operate, clean, and lubricate machines.

Most Common Break Point Competencies

1 **Computer-Aided Manufacturing:** *See previous.*
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2 **Technical Drawing:** Able to read, interpret and apply blueprints/models/PDFs for production, inspection and quality purposes.

3 **Machinery:** *See previous.*

Most Preferred Competencies

1 **Machine Tools:** *See previous.*

2 **Technical Drawing:** *See previous.*

3 **Mathematics:** Able to think about and apply geometric dimensions and tolerances; able to apply basic geometry (e.g.., triangles, cylinders, circles) for production purposes; able to conduct basic measurements (e.g., angles, diameters inside and outside).

Most Hard-to-Find Competencies

1 **Technical Drawing:** *See previous.*

2 **Computer-Aided Manufacturing:** *See previous.*

3 **Machine Tools:** *See previous.*

Most Evolving Competencies

1 **Computer-Aided Manufacturing:** Evolution due to increasingly complex machinery and changing operational and maintenance practices; changes increase value of being able and willing to learn and adapt to new technologies; willing to communicate well and share information with others.

2 **Manufacturing Standards:** Evolution driven by increasingly numerous and sophisticated customer requirements (traceability, certifications, environmental standards); changes make it more important to understand ISO 9000 and 9001 Standards, 5S, DOE, FMEA, Minitab, and process control.

3 **Industrial Design:** Evolution driven by emergence of more efficient and productive manufacturing technology; changes increase value of assessing floor layouts and offering recommendations for imrpovement.

Occupation Deep Dive: Computer-Controlled Machine Tool Operators

Job Titles Within This Occupation		
• CNC EDM • CNC Mill Operator • CNC Lathe Operator • CNC Wire EDM • CAM Operator • Machinist • CNC Set-Up Operator • CNC Technician • CNC Level III • Turn Machine Programmer/Operator • CNC Set-Up I-II		

Certification and Education Preferences (Example)
•CNC Machining Certificate •Auto CAD •Solid Works •Master CAM •CNC Certified Operator •NIMS/Apprenticeship – CNC Milling Operator

Tools Used (Example List)
•Micrometers and Calipers •Dial Indicators •Gage Blocks and Pins •CNC Mill •Fanuc Controls •Mastercam Software •Measuring Hand Tools •Six-inch Scale

	Other Relevant Foundational Competencies		Other Relevant Occupation-Specific Competencies
1	Operation Monitoring	1	Computer-Aided Manufacturing
2	Monitoring	2	Machine Tools
3	Critical Thinking	3	Machinery
4	Quality Control Analysis	4	Mathematics
5	Operation and Control	5	Industrial Design
6	Reading Comprehension	6	Technical Drawing
7	Complex Problem Solving	7	Manufacturing Standards
8	Active Listening	8	Data Entry
9	Troubleshooting	9	Electrical/Mechanical Labor
10	Judgment and Decision Making	10	Equipment Maintenance/Repair
11	Time Management	11	
12	Speaking	12	
13	Active Learning	13	
14	Coordination	14	
15	Equipment Selection	15	
16	Equipment Maintenance	16	
17	Repairing	17	
18	Mathematics	18	
19	Social Perceptiveness	19	
20	Instructing	20	
21	Systems Analysis	21	
22	Management of Personnel Resources	22	
23	Writing	23	
24	Learning Strategies	24	
25	Operations Analysis	25	