Machining Tool Operators

NOC 9511

Introduction

Machining tool operators set up and operate or tend metal-cutting machines designed for repetitive machining work. They are employed by metal products and other manufacturing companies and in machine shops. This unit group also includes workers who etch or chemically mill metal pieces.

The most important Essential Skills for Machining Tool Operators are:

- Numeracy

Document Sections

- Reading Text
- Document Use
- Writing
- Numeracy
- Oral Communication
- Thinking Skills
    - Problem Solving
    - Decision Making
    - Critical Thinking
    - Job Task Planning and Organizing
    - Significant Use of Memory
    - Finding Information
- Working with Others
- Computer Use
- Continuous Learning
- Notes

A. Reading Text

Reading Text

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • read memos from workers on the previous shift. (1) • read explanatory notes on schematic diagrams and blueprints, providing information about parts to be manufactured. (2)
Most Complex	1 to 3	• read company regulations and notices about company policy. (3) • read detailed instructions on work orders, specifying the work to be done and any special requirements of the customer. (3) • read machinist handbooks and machine operator manuals to learn about machine setup and how to program or fix the machines. (3)

Reading Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

	Purpose for Reading			
Type of Text	**To scan for specific information/To locate information**	**To skim for overall meaning, to get the 'gist'**	**To read the full text to understand or to learn**	**To read the full text to critique or to evaluate**
Forms	>			
Labels	>			
Notes, Letters, Memos	>	>		
Manuals, Specifications, Regulations	>>	>	>>	
Reports, Books, Journals	>	>		

B. Document Use

Document Use

Tasks	Complexity Level	Examples
Typical	1 to 3	Machining Tool Operators: • read identification labels on machinery, computer control buttons and materials. (1) • read lists of jobs to be done. (1) , (daily) • may read and complete job cards or route sheets, showing what parts of the job have been completed. (1) • complete time sheets, punch cards or work production sheets, indicating the jobs worked on and how much time was spent on each job. (1) • complete work order forms which indicate the number and the name of the part. (1)
Most Complex	2 to 3	• read Workplace Hazardous Materials Information System (WHMIS) labels on chemical products. (2) • read lists of codes used to program machines to cut metal and to specify tool movements. (2) • read job specifications contained in order forms. (2) • complete defect reports, indicating the piece and the defect. (2) • refer to tables for cutting speeds and feed rates or for tolerances accepted for different jobs. (3) • interpret blueprints showing where the holes are to be placed in a piece of steel. (3) • read assembly drawings in machine manuals when fixing broken machines. (3) • read computer-generated profile views of a piece being made in order to adjust the tooling appropriately. (3) • interpret scale drawings and sketches, indicating measurements and dimensions, along with the position and angles of the pieces to be built. (3) , (daily)

Examples

- may draw sketches of parts for customers to clarify information needed to make pieces.
- may construct tables or charts, indicating the tools, settings and other procedures needed for jobs.
- write lists to keep track of supplies. (daily)

Document Use Summary

- Read signs, labels or lists.
- Complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported.
- Read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or text of a paragraph or more. The list of specific tasks varies depending on what was reported.
- Read tables, schedules or other table-like text (e.g., read work shift schedules).
- Enter information on tables, schedules or other table-like text.
- Obtain specific information from graphs or charts.
- Interpret information on graphs or charts.
- Recognize common angles such as 15, 30, 45 and 90 degrees.
- Draw, sketch or form common shapes such as circles, triangles, spheres, rectangles, squares, etc.
- Interpret scale drawings (e.g. blueprints or maps).
- Take measurements from scale drawings.
- Draw to scale.
- Read assembly drawings (e.g. those found in service and parts manuals).
- Make sketches.
- Obtain information from sketches, pictures or icons (e.g., computer toolbars).

C. Writing

Writing

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • write notes to themselves or co-workers about job specifications and what work has been done or remains to be done. (1) • write short reminders about materials which have been used and supplies which must be ordered. (1) , (daily)
Most Complex	1 to 2	• complete non-conformity or defect reports which provide a brief description of the defect and what corrective action was taken. (2) • write comments on work orders explaining unusual charges or part substitutions to the billing department. (2)

Writing Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

	Purpose for Writing						
Length	**To organize/ to remember**	**To keep a record/to document**	**To inform/ to request information**	**To persuade/ to justify a request**	**To present an analysis or comparison**	**To present an evaluation or critique**	**To entertain**
Text requiring less than one paragraph of new text	>	>>>	>				
Text rarely requiring more than one paragraph		>	>				
Longer text							

D. Numeracy

The symbols >, >> and >>> are explained in the Use of Symbols section.

Numeracy

Tasks	**Complexity Level**	**Examples**
>>> Measurement and Calculation Math	1 to 5	Machining Tool Operators: • may total the amounts of materials needed or the number of holes to drill, according to the specifications. (Measurement and Calculation Math), (1) • may measure volumes of fluids, such as hydrochloric acid used to take zinc off galvanized steel or caustic solutions used in cleaning. (Measurement and Calculation Math), (1)

>> Numerical Estimation	2	• may measure pieces to verify that the size meets the specifications. (Measurement and Calculation Math), (1) • may measure dimensions of a piece of metal. They add the measurements of the parts to get the total length of a piece. (Measurement and Calculation Math), (2) • may use formulae to calculate cutting speeds taking into account cutting diameter, material being machined and type of tool being used. (Measurement and Calculation Math), (3) • may use geometric figures to lay out pieces to be cut. They work with concepts such as symmetry and parallelism, and use geometric construction methods such as bisecting an angle. (Measurement and Calculation Math), (3) • may use dial callipers, vernier rulers and micrometers to measure dimensions such as inside and outside diameters. Parts may be machined to 1/10,000 of an inch so measurement is extremely precise. Indirect measurements may involve adding and subtracting known dimensions. (Measurement and Calculation Math), (4) • may transpose measurements from scale drawings into machine operating code. They program CNC machine tools, specifying movement along three axes to create the shape specified. (Measurement and Calculation Math), (4) • may use trigonometry and triangle relationships to calculate angles, tapers, and faces when machining complex parts. (Measurement and Calculation Math), (5) • may estimate how much shrinkage a piece will undergo when cooled. (Numerical Estimation), (1) • may estimate the time needed to carry out the sequential machining operations described in customers' specification sheets. They use estimates to project the time needed to complete batch lots. (Numerical Estimation), (2)

Math Skills Summary

a. Mathematical Foundations Used

The symbols >, >> and >>> are explained in the Use of Symbols section.

Mathematical Foundations Used

Code	Tasks	Examples
	Number Concepts	
>>>	Whole Numbers	Read and write, count, round off, add or subtract, multiply or divide whole numbers. For example, using whole numbers to list commands for machines, to read charts or to count holes to drill; adding and multiplying lots in producing an order of, for example, 2000 knife tips.
>>	Integers	Read and write, add or subtract, multiply or divide integers. For example, setting up machines or indicating machine movements using negative numbers to represent one direction and positive numbers to represent the opposite direction.
>>>	Rational Numbers - Fractions	Read and write, add or subtract fractions, multiply or divide by a fraction, multiply or divide fractions. For example, reading imperial measurements such as 1/16th of an inch.
>>>	Rational Numbers - Decimals	Read and write, round off, add or subtract decimals, multiply or divide by a decimal, multiply or divide decimals. For example, adding dimensions measured in the metric system, such as 10.2 centimetres; setting machinery to precise measurements such as 0.001 inches tolerance.
>	Rational Numbers - Percent	Read and write percents, calculate the percent one number is of another, calculate a percent of a number. For example, assessing the percentage completion of a job.
>>	Equivalent Rational Numbers	Convert between fractions and decimals or percentages. For example, converting dimensions of pieces of steel between fractions and decimals; thinking about 0.001 and 1/1000 interchangeably in machine settings.

Code	Tasks	Examples
		Patterns and Relations
>	Equations and Formulae	Solve problems by constructing and solving equations with one unknown. Use formulae by inserting quantities for variables and solving. For example, using a formula to find the volume of a piece of metal.
>	Use of Rate, Ratio and Proportion	Use a rate showing comparison between two quantities with different units. Use a ratio showing comparison between two quantities with the same units. For example, mixing coolant for machines using two cups of water-soluble oil to five gallons of water. Using scale drawings.
		Shape and Spatial Sense
>>	Measurement Conversions	Perform measurement conversions. For example, converting dimensions of a piece of metal from centimetres to inches; converting millimetre measurements from blueprints to inches.
>	Areas, Perimeters, Volumes	Calculate areas. Calculate volumes. For example, calculating the volume of a piece of metal or calculating area when laying out parts to reduce cutting waste.
>>	Geometry	Use geometry. for example, calculating the measurements of simple geometric shapes and angles; using triangulation to plan the layout of holes on a plate before drilling.
>>>	Trigonometry	Use trigonometry. For example, using trigonometry to measure the taper of metal pieces with sloped sides or to determine angles for corner pieces. Recognizing common angles. Drawing, sketching and forming common forms and figures.

b. How Calculations are Performed

- In their heads.
- Using a pen and paper.
- Using a calculator.

c. Measurement Instruments Used

- Time. For example, using a watch or clock.
- Weight or mass. For example, using small weights.
- Distance or dimension. For example, using a ruler, measuring tape, internal and external micrometers, vernier callipers or vernier height gauges, telescoping gauges, bores, thread and screw pitch gauges and gauging blocks.
- Temperature. For example, using a gauge.
- Pressure. For example, using a load meter.
- Angles. For example, using callipers or a protractor.
- Use the SI (metric) measurement system.
- Using the imperial measurement system.

E. Oral Communication

Oral Communication

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • call suppliers to order materials. (1) • may talk to quality control personnel about the suitability of the parts completed. (1) • interact with supervisors to take direction on job assignments, to seek clarification on unclear drawings or job instructions and to seek help when problems arise. (2) , (daily)
Most Complex	1 to 2	• may talk to customers to clarify instructions, to report problems or to request that they pick up their finished products. (2) • participate in group meetings to discuss safety issues. (2) • interact with co-workers, including mechanics, welders and machinists, to exchange tips about methods and procedures, to relay new information and safety precautions, to receive instructions or to instruct others how to perform new jobs. (2)

Modes of Communication Used

- In person.
- Using a telephone.

Environmental Factors Affecting Communication

Noise from loud machines and air compressors at the work site, along with the wearing of ear plugs, makes hearing difficult and forces conversations to be brief and to the point.

Oral Communication Summary

The symbols >, >> and >>> are explained in the Use of Symbols section.

	Purpose for Oral Communication (Part I)					
Type	**To greet**	**To take messages**	**To provide /receive information, explanation, direction**	**To seek, obtain information**	**To co-ordinate work with that of others**	**To reassure, comfort**
Listening (little or no interaction)						
Speaking (little or no interaction)						
Interact with co-workers			>>>	>>>	>>	
Interact with those you supervise or direct						
Interact with supervisor/ manager			>>>	>>>	>	
Interact with peers and colleagues from other organization						
Interact with customers/ clients/ public		>	>	>		
Interact with suppliers, servicers			>			
Participate in group discussion			>	>		
Present information to a small group						
Present information to a large group						

The symbols >, >> and >>> are explained in the Use of Symbols section.

	Purpose for Oral Communication (Part II)					
Type	**To discuss (exchange information, opinions)**	**To persuade**	**To facilitate, animate**	**To instruct, instill understanding, knowledge**	**To negotiate, resolve conflict**	**To entertain**
Listening (little or no interaction)						
Speaking (little or no interaction)						
Interact with co-workers	>>			>		
Interact with those you supervise or direct						
Interact with supervisor/ manager	>					
Interact with peers and colleagues from other organization						
Interact with customers/ clients/ public						
Interact with suppliers, servicers						
Participate in group discussion	>			>		
Present information to a small group						
Present information to a large group						

F. Thinking Skills

1. Problem Solving

Problem Solving

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • may run out of materials. They either wait for them to arrive, use different materials or work on other jobs. (1) • may encounter problems with tools and machinery, such as a part coming loose, a bit overheating or a machine vibrating too much. They make adjustments, if possible, or replace faulty products or parts. (2)
Most Complex	1 to 3	• may be concerned about the quality of some pieces. They consult with the foreperson about whether to redo the pieces. (2) • may lack information which is essential for making a piece or find that instructions do not make sense. They clarify the work with co-workers or make educated guesses before beginning the work. (3) • may find that the procedures they usually use are not efficient for a new order which has very different specifications than most jobs. They brainstorm with co-workers to come up with more effective methods. (3)

2. Decision Making

Decision Making

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • determine the procedure to follow to complete a job. (1) • decide how much material is needed to make parts. (1) • decide what machine is best suited to make a piece, depending on the size and type of piece and the holes needed. (1)
Most Complex	1 to 2	• decide when to reset a machine if it is not cutting within tolerance levels, and how to adjust or to change machine settings to improve the quality of pieces. (2) • decide how to set pieces up when making irregularly shaped pieces. (2) , (weekly or monthly)

3. Critical Thinking

Critical Thinking information was not collected for this profile.

4. Job Task Planning and Organizing

Job Task Planning and Organizing

Complexity Level	Description
2	Own job planning and organizing • Machining tool operators are given job priorities by the foreman or machinists, but they plan the order of tasks to complete the jobs assigned. Much of their planning is short range, focussing on organizing the work station, doing the set up, programming the machine and verifying the hole placement. They may interrupt their schedule to help others or get rush jobs done.

5. Significant Use of Memory

Examples

- remember set-up details and the sequencing of procedures for the present job.
- remember oral instructions and information received from supervisors or co-workers about making particular pieces. (daily)
- remember numerical information, such as readouts on the milling machine, for a brief period of time.
- memorize machine symbols and commands.

6. Finding Information

Finding Information

Tasks	Complexity Level	Examples
Typical	1 to 2	Machining Tool Operators: • receive information from supervisors or colleagues when problems occur or more information is needed about a piece or procedure. (1) • refer to blueprints and purchase orders for job specifications. (1) • refer to machinist handbooks for information on procedures to build pieces or for background on tools, equipment and machinery. (2) , (weekly) • find information on cutting speeds and feed rates from reference tables. (2) • find information in programming manuals to program machines. (2)

G. Working with Others

Participation in Supervisory or Leadership Activities

- Participate in formal discussions about work processes or product improvement.
- Have opportunities to make suggestions on improving work processes.
- Monitor the work performance of others.
- Inform other workers or demonstrate to them how tasks are performed.
- Orient new employees.

H. Computer Use

Computer Use

Tasks	Complexity Level	Examples
Typical	2	Machining Tool Operators: • they may use a computer to confirm measurements or adjust computer control (CNC) machinery, such as the Maho machine, which is used to cut metal to specifications. (2)

Computer Use Summary

• Use computer-assisted design, manufacture or machining.

I. Continuous Learning

How Learning Occurs

Learning may be acquired:

- As part of regular work activity.
- From co-workers.
- Through training offered in the workplace.
- Through reading or other forms of self-study

J. Other Information

In addition to collecting information for this Essential Skills Profile, our interviews with job incumbents also asked about the following topics.

Physical Aspects
Machining tool operators mostly stand while working with machines. They may have to bend to move or lift parts.

Attitudes
The machining tool operators interviewed felt that machining tool operators should be mechanically inclined and dedicated to precision, quality and productivity. They should be willing to learn, have good communication and interpersonal skills and be self-motivated. They should be patient to deal with repetitive tasks and complicated jobs.

Future Trends Affecting Essential Skills
In the future, improvements in technology will affect the tools and machines used by machining tool operators. There is a trend to linking numerical control machines to PCs. The use of more sophisticated computer-controlled machines and the heightened use of robotics will mean more machining tool operators will need to acquire or upgrade their computer skills.

K. Notes

This profile is based on interviews with job incumbents across Canada and validated through consultation with industry experts across the country.
For information on research, definitions, and scaling processes of Essential Skills Profiles, please consult the Readers' Guide to Essential Skills Profiles (http://www.hrsdc.gc.ca/eng/jobs/les/profiles/readersguide.shtml).