Machinists

NOC 7231

Introduction

Machinists set up and operate a variety of machine tools to cut or grind metal, plastic or other materials to make or modify parts or products with precise dimensions. They are employed by machinery, equipment, motor vehicle, automotive parts, aircraft and other metal products manufacturing companies and by machine shops.

The most important Essential Skills for Machinists are:

- Document Use
- Numeracy
- Critical Thinking

Document Sections

- Reading
- 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
- Digital Technology
- Continuous Learning
- Notes

A. Reading

Reading

Tasks	Complexity Level	Examples
		Machinists:
Typical	1 to 3	• read short notes on drawings and labels, for example, comments on drawings to learn about design changes to specifications, and safety precautions on labels on equipment. (1)
Most Complex	4	• read short notes in logbooks and forms, such as shift notes and entries to learn about the status of various jobs, special machining instructions and changes to customers' orders. (1) • read memos and bulletins, for example memos about staff and safety meetings, and changes to operating procedures. (2) • read health and safety materials, such as Material Safety Data Sheets (MSDS) to learn correct handling procedures and first aid measures for hazardous materials. (2) • read a variety of instructions and procedures, such as step-by-step instructions on work orders to learn the steps required to machine parts. (2) • read directions and instructions from manufacturers and suppliers, for example, how to mount and install sensing equipment on computer numerically controlled (CNC) equipment. (2) • read Standard Operating Procedures (SOPs) to learn procedures for completing tasks in accordance with company standards, industry regulations and provincial laws. For example, procedures for working around radiation or black water, or in confined spaces. (2) • read trade magazines and journals, both paper-based and online, to learn about new equipment, technologies, industry trends and changes in manufacturing processes. (3) • read supplier catalogues to obtain information about new tools or to find tools to suit a particular purpose. They compare tool specifications and descriptions to identify tools that suit their machining needs. (3) • read sections of manuals to learn how to carry out work. For example, they refer to machining manuals to find formulae or procedures for carrying out unfamiliar metal-working tasks. They refer to equipment manuals to

		identify troubleshooting procedures or to learn how to perform routine maintenance. They read computer numerical control (CNC) manuals to learn how to program automated equipment. They often integrate information from multiple sources and use general background knowledge. (4)

Reading Summary

The symbol √ is 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**
		Machinists:
Typical	1 to 3	• scan job tags or labels attached to parts to identify customer information and job number and to verify the job prior to starting work. They may identify job status or priorities by the colours of the tags. (1)
Most Complex	4	• observe symbols and icons, such Workplace Hazardous Materials Information System (WHMIS) hazard symbols. (1)

		• view digital readouts on computer numerically controlled (CNC) equipment to determine settings. (1) • read work schedules to check job assignments. (1) • use colour code charts to locate metal grades and alloys. (2) • locate data in line, bar and scatter graphs, for example, to determine the number of items that were produced outside acceptable tolerances. (2) • read and complete a variety of forms including job cards, work orders and defect reports with information, such as dates, times, costs, quantities and identification numbers. Forms may include multiple sections with colour coding, checklists and abbreviations. (3) • read equipment manuals, both paper-based and online, that include lists and tables, such as part number lists, and assembly and exploded drawings. Information may need to be integrated. (3) • create sketches of parts when planning how to approach a machining job or when discussing ideas with co-workers. They use sketches to verify how different sub-parts will fit together and to illustrate features that are not visible on engineering drawings. (3) • locate data in complex tables, for example, specification tables to determine material requirements, speeds, feed rates, metal classifications, identification numbers and material coefficients. Information may be integrated from multiple tables. (3) • locate and integrate information in multi-page sets of drawings (e.g. multi-views, sectional, assembly, exploded, process) that include machining symbols, abbreviations, SI or imperial dimensions, angles, bore locations and machining tolerances. (4) • view complex three-dimensional representations of parts and machining processes on display panels of computer numerically controlled (CNC) machinery. They review these computer-generated models of finished parts to locate tool paths and other programming data. (4)

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.

- Read tables, schedules or other table-like text.
- Enter information on tables, schedules or other table-like text.
- 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).
- Create assembly drawings.
- Make sketches.
- Obtain information from sketches, pictures or icons (e.g. computer toolbars).

C. Writing

Writing

Tasks	**Complexity Level**	**Examples**
		Machinists:
Typical	1 to 3	• write reminders and short notes, for example, to record equipment setup procedures and to inform other machinists about the status of projects and problems encountered. (1)
Most Complex	3	• write notes on drawings to clarify details or note a correction. (1) • write short notes in logbooks, for example, in maintenance logbooks to record maintenance on equipment such as changing the oil. (1) • complete timecards that include a description of tasks completed or worked on during the shift. (1) • write emails to suppliers to request information about equipment and materials. (2) • write emails to request equipment repairs, tool replacement and missing project specifications. For example, they may email engineers to request corrections to drawings. (2) • write questions and responses on blogs and web forums for troubleshooting and other technical advice. (2) • write comments in forms, for example, in defect and non-conformity report forms to describe defects and corrective actions taken. (2)

		• may write reports describing problems encountered on the job, corrective actions taken and recommendations for improvements. For example, they complete defective materials or damaged tooling reports to document situations that resulted in scrapped or damaged material or equipment. For example, they write requests to engineers to suggest changes to scale drawings that would result in more streamlined work processes. (3) • write lengthy work procedures to record details of machining jobs for other machinists. They describe tools and materials required and each step of complex machining processes. (3) • may write short reports that include details about the job and how it was completed, time spent, materials used and any problems encountered to justify the billing to the customer. (3)

Writing Summary

The symbol √ is 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 symbol √ is explained in the Use of Symbols section.

Numeracy

Tasks	Complexity Level	Examples
√ Scheduling, Budgeting & Accounting	2	Machinists: • may adjust daily work schedules to accommodate rush jobs and jobs that take longer than estimated. (Scheduling, Budgeting, & Accounting), (2) • take length, height, width and weight measurements of raw materials such as metal blocks and bars using tape measures and scales. They measure to determine whether materials are of suitable sizes to produce specified parts and to verify that they will fit on lathes, mills and other equipment. (Measurement and Calculation), (1) • calculate the amount of material to be removed and the number of machine passes required to machine products within tolerances. They calculate the difference between raw and finished dimensions. They divide the excess amount by the depth of cut to calculate the number of passes required. (Measurement and Calculation), (2) • take precise measurements using instruments such as callipers, micrometers and protractors to measure length,diameter, pitch diameter and parallelism, and taper to 1/10,000 of an inch. (Measurement and Calculation), (3) • calculate all finished dimensions before starting a job. For example, they use measurements from drawings as a starting point to calculate lengths, cuts, circumferences and angles that are missing from or not included on drawings. They use formulae to calculate missing values, for example to calculate heights and angles of triangular parts, such as the taper per foot, and circumferences of circular parts. (Measurement and Calculation), (3) • use formulae to calculate cutting speed, depth of cut, chip loads and feed rates for machines. They use the dimensions of parts to be machined and tool sizes to determine appropriate starting positions and settings. For example, they enter the diameter of pipes or bars into formulae to calculate cutting speeds in revolutions per minute. (Measurement and Calculation), (4) • use formulae to calculate the placement of holes, sprocket teeth and shaft threads. For example, to distribute holes
√ Measurement and Calculation	1 to 4	
√ Data Analysis	1 to 3	
√ Numerical Estimation	2	

		around a circular face plate, they enter the radius and the starting angle of the first hole into a formula to get the angle and position of subsequent holes. (Measurement and Calculation), (4) • compare measurements of machined parts to measurements on scale drawings to ensure parts are machined within specified tolerances. (Data Analysis), (1) • verify machine settings by measuring positions, first-run part, and sample work pieces. (Data Analysis) (1) • monitor speed settings and feed rates for drills, lathes and mills. They ensure that machines are operating within specified or acceptable ranges and make adjustments as required. (Data Analysis), (1) • calculate summary measures, such as the average number of product defects per shift. (Data Analysis), (2) • analyze production data, for example, compare finished product dimensions of parts taken at regular intervals over the course of a machining cycle to identify when to replace tools or recalibrate machinery. (Data Analysis), (3) • estimate the duration of machining jobs. They consider the size and complexity of parts to be produced, the type of machining processes required and other work which may take priority. (Numerical Estimation), (2) • estimate the amount of material required to complete a job~~s~~. They consider the number of parts to be produced, the type of material to be used, and the machining processes required. (Numerical Estimation), (2)

Math Skills Summary

a. Mathematical Foundations Used

The symbol √ is 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, reading part, order and customer numbers; counting or adding the numbers of components that comprise finished parts.
√	Integers	Read and write, add or subtract, multiply or divide integers. For example, reading integers when setting up CNC programs; reading electronic displays on machining equipment; measuring

		tolerances on scale drawings; measuring the depth of cuts and holes.
√	Rational Numbers - Fractions	Read and write, add or subtract fractions, multiply or divide by a fraction, multiply or divide fractions. For example, reading tool sizes in fractions of an inch; taking and recording measurements in fractions of an inch; calculating depth of cuts in fractions 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, reading tool sizes marked in hundreds or thousandths of an inch; reading and calculating tolerances in metres and millimetres.
√	Rational Numbers - Percent	Read and write percents, calculate the percent one number is of another, calculate a percent of a number. For example, reading and adjusting machine loads on electronic displays expressed as percentages; calculating percentage wear of parts.
√	Equivalent Rational Numbers	Convert between fractions and decimals or percentages. For example, converting parts and tool measurements between fractions of an inch and decimals.
√	Other Real Numbers	Use powers and roots, scientific notation, significant digits. For example, use pi (π) to calculate circumference, area and volume.
		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. Write, simplify and solve two variable algebraic problems. For example, use trigonometry to calculate missing angles and lengths, and formulae to calculate cutting speeds, depth of cut and feed rates.
√	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. Use a proportion showing comparison between two ratios or rates in order to solve problems. Using scale drawings. For example, speed is measured in revolutions per minute (RPM), and feed rates in inches per minute (IPM) or surface feet per minute (SFM).
		Shape and Spatial Sense
√	Measurement Conversions	Perform measurement conversions. For example, converting between inches and millimetres when interpreting scale drawings and measuring parts.
√	Areas, Perimeters, Volumes	Calculate perimeters. Calculate areas. Calculate volumes.

		For example, calculating the circumference of a cylindrical part and calculating volume of reservoirs in gallons and litres.
√	Geometry	Use geometry. For example, calculating the centre of a circular part; ensuring that machined parts are parallel, concentric and perpendicular as required; and calculating angles in degrees, minutes and seconds.
√	Trigonometry	Use trigonometry. For example, they use trigonometry to calculate angles and lengths, placement of equally spaced holes, and taper per foot. Recognizing common angles. Drawing, sketching and forming common forms and figures.
		Statistics and Probability
√	Summary Calculations	Calculate averages. Calculate rates other than percentages. For example, calculating the average life spans of tools; calculating speed and feed rates. Using tables, schedules or other table-like text. Using graphical presentations.

b. How Calculations are Performed

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

c. Measurement Instruments Used

- Time. For example, using clocks or watches.
- Weight or mass. For example, using scales.
- Distance or dimension. For example, using rulers, tape measures, calipers, verniers, and micrometers.
- Liquid volume. For example, using machine gauges.
- Temperature. For example, using thermometers; temperature probes; thermocouples.
- Angles. For example, using protractors.
- Use the SI (metric) measurement system.
- Using the imperial measurement system.

E. Oral Communication

Oral Communication

Tasks	Complexity Level	Examples
		Machinists:
Typical	1 to 3	• exchange information with co-workers. They provide updates about work performed to other machinists during shift changeovers. (1)
Most Complex	3	• share information and opinions with co-workers and colleagues. For example, they ask other machinists how to approach unfamiliar machining tasks. (2) • discuss work plans, schedules, workloads and coordinate tasks with coworkers to ensure deadlines are met. (2) • clarify instructions and tasks with supervisors, engineers and other staff when scale drawings or work orders are unclear or incomplete. (2) • may interact with customers to clarify specifications and project outcomes. (2) • may discuss features and compare specifications of new tooling products with suppliers. They ask questions and describe work processes to ensure products meet their requirements. (2) • exchange information about a job with other trades people, such as welders. (2) • clarify or confirm information on drawings and specifications with engineers. (2) • attend safety and toolbox meetings to learn changes in safety procedures. May voice safety concerns and safety violations. (2) • may consult one-on-one with customers to discuss design ideas for unique one-off pieces. (3) • mentor apprentices and machinists with less experience. For example, they explain how to set up and operate drill presses, lathes and mills, including computer numerically controlled (CNC) equipment. They also instruct math skills, fitting techniques and safety. (3) • discuss machining jobs during meetings with supervisors and other team members. They may negotiate job timelines and work schedules. (3)

Modes of Communication Used

- In person.
- Using a telephone.
- Using specialized communications signals. For example, using hand signals to signal to other machinists when noisy equipment is operating.

Environmental Factors Affecting Communication

Machinists wear ear protection when operating equipment so communicating with other machinists or supervisors can be difficult. They may use hand signals to communicate or they may shout to be heard over equipment. They may wait to speak with supervisors during breaks or move to enclosed office areas to talk.

Oral Communication Summary

The symbol √ is 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 symbol √ is 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
		Machinists:
Typical	1 to 3	• encounter defective materials. They adjust the machining process to accommodate minor defects and scrap work pieces that are unsalvageable. (1)
Most Complex	3	• find that parts or materials required to perform a machining job are not available. They either substitute materials or order what they need and adjust their work schedules. (1) • figure out how to machine a piece with the least number of machine setups to decrease chances for errors and to save time. They use past experience for similar projects and discuss with coworkers. (2) • discover that finished products do not meet specifications. If possible, they correct the error. They salvage whatever materials they can, adjust equipment settings and re-do the order. (2) • encounter delays due to equipment breakdowns and material shortages. They inform supervisors of the issue, assist with repairs if possible and perform other work until repairs are completed and needed materials arrive. (2) • figure out how to “tweak” the computer program on computer numerically controlled (CNC) equipment so it runs more efficiently to increase productivity and decrease errors, and to troubleshoot the computer program to determine where an error occurred. (2) • may figure out how to repair or rebuild parts for old equipment using the old part, parts manuals and information from the Internet. (3) • are given drawings or instructions that are vague or missing key information. For example, they find that scale drawings are missing instructions or critical dimensions required to plan machining jobs. They make their own calculations to fill in missing numbers. They rely on their experience and knowledge of the parts to determine suitable ways to carry out the machining. When necessary, they ask designers, engineers or supervisory staff to

		provide additional information. (3)

2. Decision Making

Decision Making

Tasks	Complexity Level	Examples
		Machinists:
Typical	1 to 2	• decide when to recalibrate or replace tools and when to perform routine maintenance on equipment. They consider how long the tools or equipment have been in use and the required tolerances of parts being produced. (1)
Most Complex	3	• decide when parts must be scrapped. They consider whether the parts' measurements meet tolerance specifications on engineering drawings and work instructions. (1) • decide which equipment, tools and measuring instruments are most appropriate for individual machining jobs. They consider the size and quantities of parts to be produced, the materials required and the job status or priority. (2) • choose machining methods and materials for a project. They consider project specifications and the availability of equipment and materials. (2) • select the sequence of project tasks. They consider timelines, the availability of equipment, and specifications, such as the size and quantity of parts to be produced, materials and tolerances. (3)

3. Critical Thinking

Critical Thinking

Tasks	Complexity Level	Examples
		Machinists:
Typical	2 to 3	• judge the suitability of tools and equipment for machining jobs. They consider the work process, materials and their own experience with different tools and equipment to determine whether the tools suit the purpose. (2)
Most Complex	3	• assess the quality of cuts and grinding throughout the machining process. They consider whether measurements taken at each stage meet tolerances set out in scale drawings. (2)

		• assess the safety of projects and work sites. They consider the condition of tools, equipment and protective devices, such as safety barriers. They consider electrical, crush and fall hazards, and safety rules outlined in occupational health and safety acts Workplace Hazardous Materials Information System (WHMIS) regulations. (2) • assess the severity of deviations of machined parts from specifications to determine whether they will pass inspection. They consider whether nonconforming measurements are critical or whether corrections can be made in subsequent machining steps. They must understand reasons for nonconformities in order to know whether and how they can be repaired. (3) • judge the most likely interpretation of sketches when information is vague or missing. They use their knowledge of machining processes to interpret sketches with missing information. (3) • may judge the degree to which features illustrated on scale drawings are integral to a part. They use their experience and knowledge of the part's function and form to consider alterations to drawings that will streamline machining processes without compromising the part's quality. (3)

4. Job Task Planning and Organizing

Job Task Planning and Organizing

Complexity Level	Description
2	Own job planning and organizing: • Machinists carry out tasks as assigned to them by supervisors or shop owners, usually on a daily basis. They have scope to determine the task sequence of their work and may establish their own work schedules. The workload of machinists, who perform repairs or who work in smaller shops, may fluctuate more than the workload of those employed by larger shops producing new parts. Machinists' daily routines vary with the type and size of parts machined, with more complex jobs sometimes extending over several days. On larger jobs or when machining large pieces, they may coordinate tasks with coworkers and trades people. Machinists' routines are interrupted by equipment failures, rush jobs and other scheduling problems which may require rescheduling work and assigned tasks. Planning and organizing the work of others: • Machinists may assign routine tasks to apprentices or junior machinists.

5. Significant Use of Memory

Examples

- remember codes and abbreviations associated with materials, tools and CNC programming.
- recall similar machining processes performed in the past when considering how to approach new jobs.
- recall repair histories on different machining equipment.
- remember formulae, for example, for converting measurement units and feed rates, and constants, such as 1.414 for 45 degree angles.

6. Finding Information

Finding Information

Tasks	Complexity Level	Examples
		Machinists:
Typical	1 to 2	• use manuals and handbooks to look up formulae, tolerances and other key information when interpreting job specifications. (1)
Most Complex	3	• use log books to find out what happened with jobs on previous shifts, or problems with equipment. (1) • refer to work orders to find specifications, such as materials required or shipping date. They check scale drawings to find critical dimensions and tolerances. (2) • consult with co-workers, supervisors, engineers and customers, for example, to clarify job details, or to determine information missing from scale drawings. (2) • learn about new products and materials by reading magazines, brochures and information on supplier websites, and speaking with coworkers and suppliers. (2) • may conduct Internet searches to locate parts for old equipment when a new replacement part can no longer be purchased. (3)

G. Working with Others

Working with Others

Complexity Level	Description
2	Machinists work independently and with others. They work independently to interpret, plan and produce or repair parts. They work with other machinists to carry out new or complex tasks or to solve problems. For example, they may

	work with partners or maintenance staff to troubleshoot equipment failures. They may work in pairs or small groups when carrying out work on larger jobs. In larger organizations, they work with engineering staff to ensure documentation is complete and accurate, with computer programming staff to select or write new programs, and with other trades people, such as electricians or welders, to repair or maintain equipment.

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.
- Assign routine tasks to other workers.

H. Digital Technology

Digital Technology

Tasks	Complexity Level	Examples
		Machinists:
Typical	1 to 3	• use calculators, computer software programs and other electronic devices to complete numeracy-related tasks, such as calculating material requirements, and feed rates and speed settings of equipment. (1)
Most Complex	3	• use electronic measuring devices, such as digital micrometers and laser measuring machines, to take precise measurements of length, diameter, pitch diameter, parallelism and taper. (1) • may use databases to access drawings, instructions, internal process documents and work orders. (2) • use communications software to exchange emails and attachments with supervisors, co-workers, customers and suppliers. (2) • use the Internet to access online tooling catalogues and other supplier information about tools and equipment. (2) • program, set up and operate computer numerical controlled (CNC) lathes and mills including operating parameters, such as quantities, times, speeds and depths, and zero and reference points. (2) • may use computer-assisted design (CAD) software to

		produce basic drawings of parts and fixtures. (2) • use Internet browsers and search engines to locate information, such as equipment and supply specifications. (2) • use the Internet to access training courses and seminars offered by suppliers, employers and trade schools. (2) • use the Internet to access blogs and forums where they seek and offer troubleshooting and other technical advice. (2) • use advanced features of manufacturing and machining software to create three-dimensional models and run test programs to ensure programs will meet work specifications. (3)

Computer Use Summary

- Use graphics software.
- Use ~~a~~ databases.
- Use computer-assisted design, manufacture or machining equipment.
- Use communications software.
- Use Internet.

I. Continuous Learning

Continuous Learning

Complexity Level	Description
2	Machinists are required to stay up to date with new technologies, products and trends within the machining industry. They read trade magazines, industry journals, manuals and supplier catalogues to keep up-to-date on changes in technology and new products. They learn on-the-job and from co-workers and supervisors. They participate in training available in the workplace and offered by suppliers, trade schools, technical institutes and community colleges.

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
    - at work.
    - on worker's own time.
    - using materials available through work.

    - using materials obtained through a professional association or union.
    - using materials obtained on worker's own initiative.
- Through off-site training
    - during working hours at no cost to the worker.
    - partially subsidized.

J. Additional Information

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

Physical Aspects

Machinists spend most of their time standing at machines. They use upper-limb coordination to place materials on machines and hand-eye coordination to ensure parts are machined within tolerances. They use multiple-limb coordination and medium strength to lift and carry materials, including blocks and bars of metal and other supplies. They may sit at computer work stations when working on CNC machinery.

Attitudes

Machinists should have a mechanical aptitude, and be detail-oriented, conscientious, confident, and able to work independently as well as with others. They should be positive and flexible when facing problems and willing to work to deadlines. They should have a sincere interest and pride in their craft, and enjoy working with their hands.

Impact of Digital Technology

All essential skills are affected by the introduction of technology in the workplace. Machinists' ability to adapt to new technologies is strongly related to their skill levels across the essential skills, including reading, writing, thinking and communication skills. Technologies are transforming the ways in which workers obtain, process and communicate information, and the types of skills needed to perform in their jobs. In particular, machinists need digital skills to perform day-to-day tasks, such as inputting data into computer numerically controlled (CNC) equipment and using digital micrometers and laser measuring machines to take measurements. Workers can also take precise measurements of length, diameter, pitch diameter, parallelism and taper using digital measuring machines. Other tasks, such as calculating material requirements, conversions, volumes and rates, can be simplified using calculators and software applications.

Technology in the workplace further affects the complexity of tasks related to the essential skills required for this occupation. For example, computer-assisted design (CAD) software has increased the complexity of scale drawings, for example, complex assembly and sectional view diagrams. In contrast, electronic databases and keyword search functions can make it easier to find information, such as specifications. Workers can also complete documents, such as job cards, work orders and defect reports, with speed and accuracy using specialized software applications that input data automatically.

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.