Plumbers

NOC 7251

Introduction

Plumbers install, repair and maintain pipes, fixtures and other plumbing equipment used for water distribution and waste water disposal in residential, commercial and industrial buildings. They are employed in maintenance departments of factories, plants and similar establishments, by plumbing contractors, or they may be self-employed.

The most important Essential Skills for Plumbers are:

- Document Use
- Oral Communication
- Problem Solving

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 3	Plumbers • read brochures from suppliers to obtain information on materials. (1) • read work orders to plan daily activities. (1) • read health and safety notices posted on bulletin boards to comply with related policies and procedures. (2) • read newsletters prepared by the company or the union to stay current on trade and employment issues. (2) • read the minutes of safety meetings to promote safe work practices. (2) • read installation procedures when working with new or unfamiliar products, such as European faucets, to comply with the manufacturers' guidelines. (2) • read Material Safety Data Sheets (MSDS) to obtain information about hazardous products and their properties. (2)
Most Complex	3	• read labour standards to apply regulatory information on working in confined spaces to specific situations on the job. (3) • read manuals to install, repair and maintain plumbing fixtures and systems. (3) • read trade text books to understand the science related to plumbing such as the properties of water, metals and alloys. (3) • read the Canadian Plumbing Code to comply with the requirements for the design, construction, extension, alteration, renewal or repair of plumbing systems. Locating the required information may involve cross-referencing information from various sections. (3) • may read project specifications at the outset of a job to plan work and to identify potential problems and risks. (3)

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
Typical	1 to 4	Plumbers • read point-form notes that they have made in daily log books to track work in progress. (1) • read assembly drawings to install fixtures and appliances. (2) • use conversion tables provided in trade-related training materials to convert Metric measures to Imperial measures. (2) • use tables on pipe thread information to locate information such as nominal pipe size, overall length of pipe thread, number of threads per inch and drill size to tap. (2)
Most Complex	3 to 4	• interpret diagrams in the Canadian Plumbing Code to ensure that the capacity of building venting systems complies with regulatory requirements. (2) • interpret schematics to trace the circuit along which gas can flow when planning for the installation of piping. This involves interpreting symbols for pipe fitting and valves. (3) • interpret working drawings to locate municipal connections or water sources and to plan the routing of pipe when installing water services. (4) • interpret blueprints to check locations of piping and catch basins for drainage systems. (4) • may cross-reference several pages on a blueprint to establish how plumbing and carpentry tasks relate in order to coordinate with other trades when installing, for example, hydronic heating/cooling systems. (4)

Examples

- make sketches and drawings to supplement the information on work orders and to provide instructions to apprentices.
- prepare isometric drawings to plan for commercial jobs.
- make simple drawings of toilets, sinks, vents, tanks, valves, etc. to provide inspectors with information on the method of venting and sizes of piping used.
- prepare sleeving and rough-in drawing.

Document Use Summary

- Read signs, labels or lists.
- 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).
- Read schematic drawings (e.g. electrical schematics).
- Make sketches.
- Obtain information from sketches, pictures or icons (e.g., computer toolbars).

C. Writing

Writing

Tasks	Complexity Level	Examples
Typical	1 to 2	Plumbers • write short notes to inform supervisors about repairs in progress and tasks to be completed. (1) • write lists of materials required for a particular job. (1) • complete order forms to purchase materials and supplies, request information or explain why a product is being returned. (1)
Most Complex	2	• maintain a daily log book using point-form notations to record information such as hours worked, tasks completed, problems encountered, observations and concerns. (1) • may prepare invoices for clients with brief descriptions of work and materials used. (1) • may complete incident reports to record the details of an occurrence that resulted in injury. This involves writing a few paragraphs using a pre-set format and guidance is available from the foreperson upon request. (2)

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
√ Money Math	1 to 3	Plumbers • may collect payment and give change. (Money Math), (1) • may total receipts for petty cash. (Money Math), (1)
√ Data Analysis Math	1 to 2	• schedule their daily activities to complete assigned tasks. (Money Math), (1) • may approve payment for invoices submitted by suppliers, verifying the accuracy of the charges for parts ordered and received. (Money Math), (2)
√ Numerical Estimation	1 to 2	• adjust schedule to co-ordinate work with other trades when the overall timetable for construction changes or when unforeseen problems slow things down. This may be done in consultation with the foreperson. (Money Math), (2) • determine materials and supplies needed to complete a project. (Money Math), (2) • may prepare quotations and invoices based on costs for labour at an hourly rate, cost of parts and applicable taxes. These invoices are presented to customers when an installation or repair has been completed. (Money Math), (3) • may compare the costs of equipment and materials available from different vendors to make cost-effective purchasing decisions. (Money Math), (3) • measure to locate and mark positions for pipe connections when preparing rough-in to accept fixtures. (Measurement and Calculation Math), (1) • convert imperial and metric measures involving weight (e.g., kilograms to pounds) and linear measures (e.g., inches to millimetres). (Measurement and Calculation Math), (2) • calculate the total fall on a drain line by using a formula (i.e., total fall = grade x length) to install potable water distribution piping systems. (Measurement and Calculation Math), (2)

		• determine the total hydraulic load on a sanitary drainage system using a conversion factor given in the Canadian Plumbing Code (i.e., 26.4 fixture units per litre per second). The discharge from a continuous flow fixture in litres per second when multiplied by 26.4 gives the hydraulic load in fixture units, and that load is added to the fixture unit load from other fixtures to give the total load that the sanitary drainage pipe must carry. (Measurement and Calculation Math), (3) • calculate rolling offset to design, fabricate and install pipe around an obstacle in its path such as a circular vessel. This involves multiple steps of calculation using trigonometric constants based on angle of elbows. (Measurement and Calculation Math), (4) • compare pressure gauge readings and manufacturers' standards to install underground gas piping systems. (Data Analysis Math), (1) • calculate averages from sets of readings to determine humidity, temperature and water pressure within levels recommended by manufacturer. (Data Analysis Math), (2) • estimate the material requirements for a job, such as length of pipe and number of fixtures, to ensure that sufficient materials are on hand to complete tasks. (Numerical Estimation), (1) • estimate the length of time that it will take to complete a job considering such factors as the need to coordinate with other trades and availability of materials. (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, counting the number of pipes and fittings.
√	Integers	Read and write, add or subtract, multiply or divide integers. For example, recording distances from centre line.
√	Rational Numbers - Fractions	Read and write, add or subtract fractions, multiply or divide by a fraction, multiply or divide fractions. For example, adding measurements in fractions of inches.
√	Rational Numbers - Decimals	Read and write, round off, add or subtract decimals, multiply or divide by a decimal, multiply or divide decimals. Use decimals mainly to refer to dollars and cents. For example, preparing invoices and rounding off decimal inches to a whole number.
	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. Write, simplify and solve quadratic equations. For example, calculating travel using a formula (travel = offset x constant based on elbow fitting angles).
√	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, showing the flow of liquid in litres/second and showing the ratio of pipe cross-sectional areas. Using scale drawings.

Code	Tasks	Examples
		Shape and Spatial Sense
√	Measurement Conversions	Perform measurement conversions. For example, converting decimal inches to fractions of an inch.
√	Areas, Perimeters, Volumes	Calculate areas. Calculate perimeters. Calculate volumes. For example, calculating the volume of liquid in a vessel.
√	Trigonometry	Use trigonometry. For example, calculating offset using the Pythagorean Theorem. Recognizing common angles. Drawing, sketching and forming common forms and figures.
		Statistics and Probability
√	Summary Calculations	Calculate averages. For example, calculating average time required to perform job tasks when planning jobs. Using tables, schedules or other table-like text.

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 clock or watch.
- Distance or dimension. For example, using a tape measure, rule, transit, builder's level, calliper, micrometer.
- Pressure. For example, using system dials and gauges.
- Angles. For example, using slide angle rules.
- Use the SI (metric) measurement system.
- Using the imperial measurement system.

E. Oral Communication

Oral Communication

Tasks	Complexity Level	Examples
Typical	1 to 2	Plumbers • talk to suppliers about the availability of parts. (1) • communicate with carpenters or other tradespersons to co-ordinate the time scheduling for the plumbing work at a construction or renovation site and to discuss any problems that have arisen (e.g., premature closing of a wall barring access to pipes). (1) • interact with forepersons to receive job assignments and to consult as necessary. (1)
Most Complex	1 to 2	• mentor apprentices to assist them in building skill and trade knowledge on the job. (2) • interact with suppliers by telephone and in person to gather information needed to troubleshoot system problems. (2) • interact with agitated customers who are concerned about water damage to identify problems (e.g., pipe is leaking) and to obtain information on events leading up to the problem. (2) • negotiate with other tradespeople on a job site regarding time schedules, system failures, alterations needed to installations. (2)

Modes of Communication Used

- In person.
- Using a telephone.
- Using a two-way radio or other such means.
- Using specialized communications signals. For example, hand signals to signal safety concerns on a construction site.

Environmental Factors Affecting Communication

Noise from plumbing and heating systems, equipment and other trades people may hinder communication at times. For plumbers involved in larger construction projects additional noise from cranes and large equipment may further hinder communication.

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
Typical	1 to 3	Plumbers • encounter time-management problems when completion of tasks for repairs extend beyond time estimates for completion. They may consult with their supervisor or customer to reschedule work. (1) • may find that a toilet can not be repaired without removing the surrounding tile. They look to see if there is another way of accessing the area, such as coming through a closet or coming through a wall. (2)
Most Complex	3	• may have to diagnose and solve problems such as inefficient water flow caused by do-it-yourself homeowners who have performed the work without understanding basic plumbing principles. They redo the work to industry standards. (2) • are assigned to resolve a backflow problem that has caused a sewer to back up. Identifying the root cause of the problem is difficult because pipes are concealed in walls and floors and a variety of pumps are used. This may involve extensive analysis before the problem can be resolved. (3)

2. Decision Making

Decision Making

Tasks	Complexity Level	Examples
Typical	1 to 3	Plumbers • decide on priorities for service calls, repair work and scheduled work based on information they are given. (1) • decide on the most cost-effective way to use materials and supplies when installing plumbing and heating systems. (2)
Most Complex	3	• make decisions on how to install a large and heavy pumping system with the available personnel and equipment in confined spaces or less than ideal conditions. (3) • decide whether to refuse a job that they consider potentially dangerous. (3)

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
3	Own job planning and organizing • Job task planning and organizing differs according to the work context. In the case of residential service appointments, there may be ten to fifteen service calls in one shift. Planning and organizing must take into account the distances between customer locations and the urgency of specific calls. When working on new construction projects, job task planning and organizing is geared toward fitting smoothly into a schedule which involves other trades coming before and after them. Plumbers plan their work in conjunction with forepersons, supervisors and other tradespeople on the job. Time pressures may become intense and interruptions from others result in frequent stops and starts. Plumbers reprioritize their tasks in case of emergency and if work in progress needs to be adjusted or altered. Plumbers work both independently and in co-operation with other tradespeople on job sites. Planning and organizing for others • Journeypersons may plan the work of apprentices under their supervision.

5. Significant Use of Memory

Examples

- remember priorities and directives for the day to maximize efficiency.
- remember locations of pipes, pumps and heating systems to save time by not having to review related documents.
- memorize parameters, such as tolerances, and emergency evacuation procedures to maximize efficiency.
- remember item numbers for frequently ordered products, such as taps and sinks, to expedite the ordering process.

6. Finding Information

Finding Information

Tasks	Complexity Level	Examples
Typical	1 to 2	Plumbers • contact mechanical engineers, suppliers and manufacturers to clarify installation procedures or system specifications to ensure that the Canadian Plumbing Code is met. (1) • locate information on plumbing products and fixtures in catalogues issued by suppliers. (1)
More Complex	2	• refer to schematics to locate the shut-off valve for natural gas when performing maintenance. (2) • refer to trade, provincial and national code books to ensure installations and repairs are compliant with industry standards for plumbing and heating systems. (2) • may locate specific clauses in construction contracts, or service agreements in the case of owner/operators of plumbing and heating businesses, and interpret their application to specific situations. (2)

G. Working with Others

Working with Others

Complexity Level	Description
2	The degree to which plumbers work with others depends on the specific setting in which they are working. On construction sites, plumbers must co-ordinate with other trades on site as there is a sequence in which the work should be performed and safety is always a concern. For example, during installation they complete the rough in and then return to complete the finishing after other trades (e.g., plasterers, tilesetters) have completed their work. Plumbers frequently work with an apprentice. Plumbers servicing residential clients typically work with others to a lesser extent. They often work alone on small residential jobs.

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.
- Select contractors and suppliers.
- Assign routine tasks to other workers.
- Identify training that is required by, or would be useful for, other workers.
- Deal with other workers' grievances or complaints.

H. Computer Use

Computer Use

Tasks	Complexity Level	Examples
Typical	2	Plumbers • may use word processing software For example, they prepare letters to customers. (2)
Most Complex	2	• may use computer-assisted design, manufacturing and machining equipment. For example, they use CAD to review construction drawings. (2)

Computer Use Summary

- Use word processing.
- 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
    - 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
    - partially subsidized.
    - with costs paid by the worker.

J. Other Information

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

Attitudes
The plumbers interviewed stressed the importance of being physically fit, since much of their work involves climbing, crawling and lifting. Plumbers should not be afraid of heights or enclosed spaces. They should be alert at all times and aware of their surroundings for safety. Much of the work done by plumbers requires the ability to work alone as well as with a helper or apprentice and others trades. Important characteristics for individuals working in the industry are a strong work ethic, an open mind and an ability to co-operate with others.

Future Trends Affecting Essential Skills
Future skills shortages are expected because fewer young people are entering the plumbing trade. With changes and improvements to plumbing and heating systems, plumbers are increasingly required to stay current and in some cases specialize. Increasingly, computer assisted design (CAD) software is being utilized for system design, layout and project management. Technological advances are having an impact on the design of water supply, drainage, waste and venting gas fitting and hot liquid heating. This is triggering changes to the applications and materials used by plumbers.

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).