Sheet Metal Workers

NOC 7261

Introduction

Sheet metal workers fabricate, assemble, install and repair sheet metal products. They are employed by sheet metal fabrication shops, sheet metal products manufacturing companies, sheet metal work contractors and various industrial sectors.

The most important Essential Skills for Sheet Metal Workers are:

- Document Use
- Numeracy
- 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	Sheet Metal Workers • read instructions and warnings on equipment labels. For example, sheet metal workers employed by metal fabrication shops may read labels affixed to equipment to learn about the safe operation of equipment such as saws, shears and metal brake presses. (1) , (daily) • read short text entries in forms and comments on drawings. For example, they may read short text entries in change orders to learn about changes to material specifications. They may read comments on scale drawings to learn about design modifications. (1) , (daily) • read memos and bulletins. For example, they may read memos to learn about changes to work processes. They may read safety bulletins to learn about hazards and accident avoidance. (2)
Most Complex	3	• read product brochures and articles in trade magazines for information about industry practices and new equipment and tools. For example, sheet metal workers employed by sheet metal work contractors may read newsletters to learn how to protect themselves in cold weather. Those employed by sheet metal fabrication shops may read brochures to learn about the features and benefits of new products such as shears and band saws. (3) • read equipment and policy and procedure manuals. For example, sheet metal workers employed by sheet metal fabrication shops may read equipment manuals to learn how to operate and maintain equipment such as forklifts, welders and punch machines. Those employed by sheet metal work contractors may read procedure manuals published by organizations such as the Sheet Metal and Air Conditioning Contractors' National Association to learn about evaluating and reporting worksite hazards. (3) • may read specifications, codes and standards for the installation and modification of products such as air conditioning, heating and ventilation systems. For example, sheet metal workers employed by sheet metal work contractors read provincial building codes to learn about clearances, metal gauges and ventilation configurations for new construction. (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 3	Sheet Metal Workers • locate data on labels and signs. For example, they may locate part numbers and air velocities on labels affixed to furnaces and air make-up units. They may identify symbols for hazardous materials on labels affixed to containers of solvents and caulking products. They may observe symbols on signs to learn about the requirements for personal protective equipment and the hazards that may result from the improper use of machinery. (1) , (daily) • complete entry forms such as work orders, permits, time sheets, job estimates, parts requisitions and inspection checklists. For example, they may enter parts numbers, dates, identification numbers, job codes, dimensions, quantities, unit prices and instrument readings into job estimate forms. (2) • locate data in lists and tables. For example, they may locate part numbers, descriptions, dimensions, specifications, times, clearances and inventory levels in lists and specification tables. (2)
Most Complex	3	• study technical drawings to locate data and identify the placements of parts. For example, sheet metal workers employed by sheet metal fabrication shops may review technical drawings to identify fabrication sequences and locate dimensions. Those employed by sheet metal work contractors may scan drawings of mechanical and plumbing systems to locate thermostats, ductwork, grills and plumbing fixtures. (3) • interpret process schematics. For example, sheet metal workers employed by sheet metal contractors review wiring schematics for furnace systems to locate circuits, solenoids, transformers and fan motors. They may study loop circuit diagrams to understand how heating systems work and to locate system components. (3)

Examples

- create sketches to illustrate the placements of fittings and ductwork.
- may create tables to record data such as hours worked and parts used.

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).
- Create tables, schedules or other table-like text.
- Enter information on tables, schedules or other table-like text.
- Obtain specific information from 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.
- Read assembly drawings (e.g. those found in service and parts manuals).
- Create assembly drawings.
- 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	Sheet Metal Workers • write logbook entries and short notes to co-workers and colleagues. For example, they may write short notes about design changes on work orders and drawings. They may write comments about design errors on fabrication sheets. They may write logbook entries to record tasks performed and equipment settings changed. (1) , (daily)
Most Complex	2	• may write text entries in forms. For example, they may outline the sequences of events leading to workplace accidents and the steps taken afterwards in accident report forms. They may describe potential worksite hazards in hazard assessment forms. (2) • may write short reports on projects such as installations and production runs. For example, sheet metal workers may write short reports to inform contractors and customers about the progress being made and difficulties encountered on heating system installation projects. (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	2 to 3	Sheet Metal Workers • may calculate expense claim amounts for travel and supplies. For example, sheet metal workers employed by sheet metal work contractors may calculate reimbursements for the use of personal vehicles for out-of-town travel. They may calculate reimbursement amounts for supplies purchased using cash. (Money Math), (2)
√ Scheduling, Budgeting & Accounting Math	2	• may calculate amounts for estimates and invoices. They multiply hours worked by labour rates and add amounts for parts, materials and supplies. They calculate applicable taxes and subtract pre-paid payments. (Money Math), (3)
√ Measurement and Calculation Math	1 to 4	• may create project timelines. For example, sheet metal workers may create timelines to record significant events such as start and completion dates for large installation projects. (Scheduling, Budgeting & Accounting Math), (2) , (daily)
√ Data Analysis Math	1 to 2	• measure distances, temperatures and angles using basic measuring tools such as tape measures, thermometers and protractors. (Measurement and Calculation Math), (1) , (daily)
√ Numerical Estimation	1 to 2	• take measurements using specialized measuring tools. For example, sheet metal workers employed by sheet metal fabrication shops may take precise measurements using micrometers. (Measurement and Calculation Math), (3) , (daily)
		• calculate capacities, air flows, temperature differentials and other factors important to the operation of heating and ventilation systems. For example, sheet metal workers employed by sheet metal work contractors may calculate the movements of air through ducts using measurements of air pressures taken with manometers. (Measurement and Calculation Math), (3) , (daily)

		• calculate quantities of materials needed for fabrication, construction and installation projects. For example, sheet metal workers employed by sheet metal work contractors calculate numbers of sheets of metal needed for ventilation systems. They calculate areas of panels specified in construction plans and then add percentages for wastage. Those employed by metal fabrication shops ascertain the material requirements for complex structures by analyzing surfaces into constituent geometric shapes and using formulae to calculate areas. (Measurement and Calculation Math), (4) , (daily) • may lay out materials for cutting, bending, folding and welding. For example, they may use geometric construction methods to scribe flat metal pieces for cutting and bending into three dimensional structures. They may calculate dimensions for curves, tapers and offsets. (Measurement and Calculation Math), (4) , (daily) • compare measurements of angles, airflows, dimensions, clearances, humidity and temperatures to specifications. For example, sheet metal workers employed by sheet metal contractors compare measurements of humidity and temperature to specifications to determine the operating condition of furnace components such as dehumidifiers, humidifiers, heaters and air conditioners. (Data Analysis Math), (1) , (daily) • may manage small material and supply inventories. Sheet metal workers employed by sheet metal fabrication shops may reduce inventory counts when repair parts such as fans and materials such as sheet metals are used for projects. They may order and restock items to replace those that have been used. (Data Analysis Math), (2) , (daily) • estimate cut lengths and seam allowances when exact measurements are not required. (Numerical Estimation), (1) , (daily) • estimate times required to complete projects. They consider the characteristics of new fabrication and installation projects and the recall times taken to complete similar projects in the past. (Numerical Estimation), (2) , (daily)

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 panels installed and fittings fabricated; calculating numbers of parts used.
√	Integers	Read and write, add or subtract, multiply or divide integers. For example, calculating production variances; reading tolerances in manuals and specification tables; measuring positive and negative air pressures.
√	Rational Numbers - Fractions	Read and write, add or subtract fractions, multiply or divide by a fraction, multiply or divide fractions. For example, reading and writing measurements and product specifications in fractions of inches; adding and subtracting fractions of inches to determine dimensions and clearances.
√	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 decimals to identify sheet metal gauges; writing decimals to record measurements; adding and multiplying metres and millimetres to determine lengths, raw material requirements and hours worked; measuring dimensions and tolerances to two significant digits.
√	Rational Numbers - Percent	Read and write percents, calculate the percent one number is of another, calculate a percent of a number. For example, reading percentages in specification tables; calculating waste as percentages; identifying work completed as percentages of total.
√	Equivalent Rational Numbers	Convert between fractions and decimals or percentages. For example, converting measurements expressed as fractions of inches into decimal notation to select tools and bit sizes.
√	Other Real Numbers	Use powers and roots, scientific notation, significant digits. For example, using powers in measurement units such as square meters and cubic feet.

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, constructing and solving equations to determine the areas complex shapes; using formulae to calculate the lengths of the sides of triangles; inserting quantities such as air velocities, vent sizes and vent shapes into equations to calculate air flow 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. For example, calculating airflow rates in cubic feet and cubic litres per second; using ratios to calculate the airflow capacities of different sizes of ducts, vents and diffusers; using proportions to convert scale measurements to actual sizes. Using scale drawings.
		Shape and Spatial Sense
√	Measurement Conversions	Perform measurement conversions. For example, converting product specifications and measurements from inches to centimetres and millimetres; converting square feet to square metres and pounds to kilograms; converting airflows from cubic feet to litres.
√	Areas, Perimeters, Volumes	Calculate areas. Calculate perimeters. Calculate volumes. For example, calculating the areas and perimeters of rooms; calculating the interior volumes of piping, tanks and ductwork.
√	Geometry	Use geometry. For example, using geometric construction methods to lay out patterns; using geometry to analyze complex shapes; using geometry to align vents and pipes.
√	Trigonometry	Use trigonometry. For example, using trigonometric tables and calculations to locate arc lengths and angles; using trigonometry to calculate the dimensions of offsets. Recognizing common angles. Drawing, sketching and forming common forms and figures.

Code	Tasks	Examples
		Statistics and Probability
√	Summary Calculations	Calculate averages. Calculate rates other than percentages. For example, calculating average times required to fabricate products and to complete installations; calculating rates such as units produced per shift.
√	Statistics and Probability	Use descriptive statistics (e.g. collecting, classifying, analyzing and interpreting data). For example, collect data and generate statistics to describe the progress of fabrication and installation jobs. 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.
- Using other devices, such as ductulators to calculate airflow in vents and ducts.

c. Measurement Instruments Used

- Time. For example, using timers, clocks and watches.
- Weight or mass. For example, using scales.
- Distance or dimension. For example, using measuring tapes, trammel points, vernier callipers, micrometers and rulers.
- Temperature. For example, using thermometers and gauges.
- Pressure. For example, using pressure gauges and manometers.
- Angles. For example, using squares and protractors.
- Air flow velocity. For example, using anemometers.
- Use the SI (metric) measurement system.
- Using the imperial measurement system.

E. Oral Communication

Oral Communication

Tasks	Complexity Level	Examples
Typical	1 to 2	Sheet Metal Workers • discuss sheet metal work products with suppliers. For example, sheet metal workers employed by sheet metal fabrication shops may call suppliers to order additional fasteners and to request delivery information. (1) , (daily) • discuss specifications, timelines, procedures and other work-related matters with co-workers, general contractors and other tradespeople. For example, sheet metal workers employed by sheet metal fabrication shops may speak to co-workers about the technical details of complicated fabrication projects. They may talk to supervisors about project specifications and job tasks. Those employed by sheet metal work contractors may talk to general contractors to learn about changes to specifications, to establish timelines and to discuss unsafe work conditions. They may discuss job task coordination with tradespeople such as plumbers and electricians. (2) , (daily)
Most Complex	3	• may supervise and train apprentices and helpers. For example, they may provide apprentices with detailed directions and explanations of work procedures. They may teach apprentices and helpers how to identify and avoid safety hazards. (3) , (daily) • may explain fabrication, construction and installation procedures to customers and address their concerns. For example, workers employed by sheet metal work contractors may explain furnace installation procedures to customers and respond to complaints about matters such as missed deadlines, cost overruns and ill-fitting components. (3) , (daily)

Modes of Communication Used

- In person.
- Using a telephone.

Environmental Factors Affecting Communication

Sheet metal workers may have difficulty communicating with co-workers when working in close proximity to noisy machinery such as band saws.

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	2 to 3	Sheet Metal Workers • encounter delays due to equipment breakdowns and shortages of materials. They inform supervisors and general contractors about equipment breakdowns and shortages of materials. They perform other work until repairs are completed and needed materials arrive. (2) • are unable to complete installations because specifications and instructions are unavailable. They locate the required specifications by talking to suppliers, engineers, general contractors and supervisors. They may visit manufacturers' websites to locate missing information such as instructions for connecting air make-up units. (2)
Most Complex	3	• face disruptions of work schedules, timelines and budgets when project designs are found to be faulty and when specifications are changed after projects have already started. They inform supervisors, general contractors and colleagues such as engineers about design flaws and suggest modifications. They meet supervisors, customers, general contractors and engineers to clarify the changes, review change notices and establish new timelines and budgets. (3)

2. Decision Making

Decision Making

Tasks	Complexity Level	Examples
Typical	2 to 3	Sheet Metal Workers • assign task to apprentices and helpers. They consider apprentices' skills and the safety hazards, timelines and the complexities of job tasks. (2) , (daily)
Most Complex	3	• choose methods and materials for sheet metal fabrication and installation jobs. They select workplace processes that meet safety, quality and production requirements. They select the materials and components that meet specifications. (3) , (daily)

3. Critical Thinking

Critical Thinking

Tasks	Complexity Level	Examples
Typical	2 to 3	Sheet Metal Workers • evaluate the feasibility of proposed designs and installations. They check to see that their organizations have the skills and equipment to undertake fabrication and installation jobs. They confirm that fabricated products and installations conform to building and safety codes. (2) , (daily) • evaluate the safety of workplaces and work procedures. For example, sheet metal workers employed by sheet metal fabrication shops evaluate risks posed by machines such as shears. They check the operation of safety systems such as guards and automatic switches. Sheet metal workers employed by sheet metal work contractors assess the safety of ladders and hoists. They walk around construction sites to look for unsafe conditions such as slippery work surfaces caused by ice and standing water. (2) , (daily)
Most Complex	3	• may evaluate the performance of apprentices. They consider apprentices' abilities to fabricate products, install sheet metal and locate information such as specifications. (2) • judge the performance of equipment and the quality of parts and installations. For example, sheet metal workers employed by sheet metal fabrication shops evaluate the performance of equipment such as presses and shears. They inspect the straightness of folds and the accuracy of cuts. Those employed by sheet metal work contractors measure and inspect components such as exhaust hood fittings to ensure they meet specifications and are in good condition. They judge the quality of installations by taking instrument readings and by visually inspecting the fit and alignment of seals, seams and joints. (3) , (daily)

4. Job Task Planning and Organizing

Job Task Planning and Organizing

Complexity Level	Description
3	Own job planning and organizing • Sheet metal workers organize their daily activities to meet targets established by their supervisors. They may be required to adjust their work schedules to accommodate equipment failures, temperature extremes and shortages of materials and supplies. Planning and organizing for others • Sheet metal workers may schedule the activities of apprentices and helpers.

5. Significant Use of Memory

Examples

- remember details about past installations. For example, they may remember regulatory requirements of completed jobs to gain insight into upcoming jobs.
- remember specifications such as product dimensions and equipment capacities, operating speeds and settings.

6. Finding Information

Finding Information

Tasks	Complexity Level	Examples
Typical	2	Sheet Metal Workers • find information about products and materials. For example, sheet metal workers may find information about sheet metal supplies and equipment by reviewing manufacturers' web sites, catalogues and pricelists and by talking to suppliers, co-workers, other tradespeople and general contractors. (2)
More Complex	2	• locate information on fabrication, construction and installation projects. For example, sheet metal workers employed by sheet metal work contractors locate specifications such as the sizes and locations of sheet metal components on scale drawings. They read change notices, building codes and standards issued by organizations such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers. They locate data in work orders. They discuss designs and design changes with co-workers, engineers, other tradespeople and colleagues. (2)

G. Working with Others

Working with Others

Complexity Level	Description
2	Sheet metal workers coordinate job tasks and share tools, workspace and equipment with small groups of co-workers and colleagues. Those employed by sheet metal fabrication shops may work alone on small sheet metal projects, share equipment and workspace with other machine operators and work as members of teams on larger projects. Sheet metal workers employed by sheet metal work contractors coordinate activities with co-workers and tradespeople such as plumbers and electricians to ensure the efficient uses of workspaces, materials and time.

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.
- Inform other workers or demonstrate to them how tasks are performed.

H. Computer Use

Computer Use

Tasks	Complexity Level	Examples
Typical	2	Sheet Metal Workers • may use word processing. For example, they may use basic editing and text formatting features of word processing applications such as Word and WordPerfect to write change notices and describe the work they have performed. (2) , (weekly) • use the Internet. For example, sheet metal workers employed by sheet metal fabrication shops may use Internet browsers to access suppliers' websites and to find information about new products and equipment. (2)
Most Complex	2	• use computer-assisted design, manufacturing and machining. For example, sheet metal workers employed by sheet metal fabrication shops may use computer-assisted design programs such as AutoCAD to create elevation, plan and sectional views of sheet metal fabrications. They may generate three-dimensional views. They may operate computer numerically-controlled equipment by programming specifications for cutting speeds and depths, cut lengths and bend angles. (3)

Computer Use Summary

- Use word processing.
- Use computer-assisted design, manufacture or machining.
- Use Internet

I. Continuous Learning

Continuous Learning

Complexity Level	Description
2	Sheet metal workers learn continuously to stay abreast of new products and changes in installation and production processes. They maintain current product knowledge by reading trade magazines, brochures and bulletins and by talking to suppliers. They learn about changes to building codes, safety standards and new installation and manufacturing techniques by reading building codes and regulations. They may take training provided by employers, unions, suppliers and organizations such as the Sheet Metal and Air Conditioning Contractors' National Association.

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. 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
Sheet metal workers require good hand-eye, upper limb and multiple limb coordination. They bend, balance, stretch, kneel and crouch when operating equipment and installing sheet metal components such as ductwork. They are often required to lift heavy objects such as ducts and sheet metal panels and components that weigh in excess of twenty kilograms. They use their senses of sight and touch to determine the fit of components and the quality of their workmanship. Sheet metal workers employed by sheet metal work contractors may be required to tolerate heights and extreme weather conditions.

Attitudes
Sheet metal workers must work well with people and have positive attitudes. They should also be patient and take pride in quality.

Future Trends Affecting Essential Skills
Sheet metal workers will require enhanced essential skills to benefit from new products and to cope with changes to installation and production processes. Sheet metal workers employed by sheet metal fabrication shops will require enhanced computer use skills to benefit from the increasing use of technology such as computer numeric controlled equipment. They will need strong continuous learning skills to adapt to production system changes resulting from new environmental protection and manufacturing processes. Sheet metal workers employed by sheet metal work contractors will require stronger document use and continuous learning skills to interpret increasingly complex technical drawings and to install equipment which incorporates new technologies.

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).