



Sheet Metal Worker On-the-Job Training Guide

2022

1-877-363-0536
apprenticeship@gov.sk.ca
saskapprenticeship.ca



Online: www.saskapprenticeship.ca

Recognition:

To promote transparency and consistency, portions of this document has been adapted from the 2018 Sheet Metal Worker Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca

STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Description of the Sheet Metal Worker trade: an overview of the trade's duties and training requirements.

Essential Skills Summary: an overview of how each of the nine essential skills is applied in this trade.

Harmonization: a brief description on the pan-Canadian Harmonization Initiative for the Sheet Metal Worker trade.

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

On-the-Job and In-school Training Content for the Sheet Metal Worker Trade: a chart which outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for topics of technical training.

DESCRIPTION OF THE SHEET METAL WORKER TRADE

Sheet Metal Workers use metal of 10 gauge or lighter to make and repair products and buildings.

Sheet metal workers design, fabricate, assemble, install, and repair sheet metal products and systems. In fabrication work, sheet metal workers lay out and measure pieces to specifications. They use tools such as hand tools, portable power tools and shop equipment to cut and shape material. They assemble and join the pieces with various techniques such as welding and using mechanical fasteners.

They work with black iron, galvanized steel, satin-coated steel, stainless steel, aluminum, copper, brass, nickel, tin plate and other alloys. Some may also work with composites, fibreglass, ceramics, and plastics.

Pieces may be laid out and cut in the shop and assembled on construction or industrial sites. Sheet metal workers may specialize in on-site installation, heating, ventilation, and air conditioning (HVAC) and material handling system design, shop manufacture, and servicing and maintenance of installed equipment and systems. Those who work in installation may specialize in HVAC, boiler lagging / vessel cladding, roofing products, architectural sheet metal, custom metal products, food service products, secondary systems for environmental projects, pneumatic conveyance, or signage.

Employers in this trade include sheet metal fabrication shops, manufacturing companies of sheet metal, installation contractors, and HVAC contractors. Sheet metal workers may be involved in residential, industrial, commercial, institutional and construction sectors.

Key attributes for people entering this trade are mechanical and mathematical aptitude, hand-eye coordination, spatial perception, and manual dexterity. The work often requires considerable standing, climbing, kneeling, lifting, and carrying.

Hazards of the trade include working with sharp metal pieces, at heights, around excessive noise and vibration, as well as exposure to heat and fumes. Sheet metal workers often have to work in adverse weather and environmental conditions.

This standard recognizes some transferable skills between the sheet metal worker trade and other trades such as ironworkers, boilermakers, refrigeration and air conditioning mechanics, plumbers, insulators (heat and frost), gasfitters, oil heat system technicians, electricians, roofers, carpenters and welders.

With experience, sheet metal workers act as mentors and trainers to apprentices in the trade. They may also become specialists in design and layout, and move into other positions such as estimators, supervisors, or business owners.

Training Requirements: 7200 hours and 4 years, including four 8-week training sessions delivered by Saskatchewan Polytechnic in Saskatoon.

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentice's results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journey person's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- demonstrate procedures relevant to the installation of drainage, waste, and vent systems; potable water distribution; fixtures and appliances; hydronic heating and cooling systems; specialty piping; pumps and private sewage disposal systems
- provide the opportunity for apprentices to service the above systems and products
- further the apprentice's ability to interpret technical drawings
- ensure that the apprentice can evaluate the end product.

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

Entrance Requirements for Apprenticeship Training

Your grade twelve transcript (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journey person certification.

Individuals with "modified" or "general" classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or "upgraders" must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	Math Credit at the Indicated Grade Level ❶	Science Credit at Grade Level
Sheet Metal Worker	Grade 11	Grade 10
<p>❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).</p> <p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#</p> <p>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</p>		

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: <https://www.canada.ca/en/employment-social-development/programs/essential-skills/tools.html>.

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

READING

Sheet metal workers require reading skills to gather information from forms and labels. They also need to read to understand more complex texts such as equipment and policy and procedure manuals, specifications, codes and standards. They also refer to project specifications and work orders when planning a job.

DOCUMENT USE

Document use is a significant essential skill for this trade. Sheet metal workers need to be able to locate and interpret information in several types of documents such as labels, signs, forms, lists, tables, technical drawings and schematics. They also need to create documents such as orthographic projections, sketches and work forms.

WRITING

Writing skills are used by sheet metal workers to write short texts, usually less than one paragraph. Some examples of written work include safety documentation, logbook entries, invoices, inventory lists, takeoffs, bids, forms and summaries of work projects.

ORAL COMMUNICATION

Some tasks performed by sheet metal workers require oral communication skills, including discussing project requirements with suppliers, discussing specifications and plans with co-workers, supervisors and general contractors, and supervising and directing the work of apprentices. Sheet metal workers may explain the fabrication, construction, installation and repair procedures to customers as well.

NUMERACY

Numeracy skills are extremely important in the everyday work of sheet metal workers. Substantial mathematical skills are used in taking measurements, doing material layout, using formulas and performing trade calculations such as heat loss/gain, air flows, capacities and air pressures. Numeracy is used significantly in system design. Sheet metal workers may create project timelines, calculating time requirements for tasks in the project. They may also calculate amounts for supplies, estimates and overall costs.

THINKING

Sheet metal workers solve problems in situations where work may be delayed due to equipment breakdowns, shortages in materials and work of other trades. They may perform modifications to project designs to correct flaws. They need the ability to think spatially and visualize in three dimensions. Problem-solving and thinking sequentially are important skills in fabrication and installation activities. Sheet metal workers need to be able to plan their work and organize tasks and materials.

WORKING WITH OTHERS

Sheet metal workers coordinate job tasks and share workspace and equipment with groups of co-workers and colleagues. Those working in fabrication shops may work alone on small projects, and also work as members of a team on larger projects. During installation work, tasks must be coordinated with other tradespersons such as crane operators, carpenters, drywall finishers and plasterers, bricklayers, plumbers and electricians.

DIGITAL TECHNOLOGY

Sheet metal workers may use computers and computer-assisted design (CAD) and building information modelling (BIM) software in their work. They may also use computers to perform word processing and electronic communication devices to communicate with others, record job changes and daily activities, track job progress, order materials and perform Internet research. Increasingly sheet metal workers are required to have digital skills when performing daily tasks which may require the use of numerically-controlled equipment and electronic devices.

CONTINUOUS LEARNING

Sheet metal workers are required to stay current with new technology, trends and product developments as well as changes in fabrication, installation and production processes. They also need to stay updated on codes and trade standards.

ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

1. Trade name

The official Red Seal name for this trade is Sheet Metal Worker.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Sheet Metal Worker trade is four.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Sheet Metal Worker trade is 7200.

4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization was implemented progressively. Level one was implemented in 2018/2019, level two 2019/2020, level three 2020/2021, and level four will be implemented in 2021/2022.

SHEET METAL WORKER TASK MATRIX

This chart outlines the major work activities, tasks and sub-tasks from the 2018 Sheet Metal Worker Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub-tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization will take place progressively. Level one to be implemented in 2018/2019, level two 2019/2020, level three 2020/2021, and level four in 2021/2022.

A – Performs common occupational skills

20%

Task A-1 Performs safety-related functions	A-1.01 Uses personal protective equipment (PPE) and safety equipment 1 (In Context 2, 3, 4)	1.02 Uses personal protective equipment (PPE) and safety equipment 1 (In Context 2, 3, 4)	A-1.03 Performs lock-out and tag-out procedures 1 (In Context 2, 3, 4)		
Task A-2 Uses and maintains tools and equipment	A-2.01 Uses hand and portable power tools 1	A-2.02 Uses shop tools and equipment 1, 2, 3	A-2.03 Uses gas metal arc welding (GMAW) equipment 1, 2, 3, 4	A-2.04 Uses resistance spot welding equipment 1	A-2.05 Uses gas tungsten arc welding (GTAW) equipment 3
	A-2.06 Uses shielded metal arc welding (SMAW) equipment 2	A-2.07 Uses oxy-fuel and plasma arc cutting equipment 1	A-2.08 Uses soldering and brazing equipment 1, 2	A-2.09 Uses measuring and layout equipment 1	A-2.10 Uses testing and inspection devices 2, 3, 4
	A-2.11 Uses stationary and mobile work platforms 1	A-2.12 Uses hoisting, rigging and positioning equipment 1			
A-3 Organizes work	A-3.01 Uses trade-related documentation 1, 2 (In Context 3, 4)	A-3.02 Interprets drawings 1, 2 (In Context 3, 4)	A-3.03 Organizes materials and equipment for project 1	A-3.04 Performs basic design and field modifications 1, 2 (In Context 3, 4)	

Task A-4 Uses communication and mentoring techniques

A-4.01 Uses communication techniques
1
(In Context 2, 3)

A-4.02 Uses mentoring techniques
4
(In Context 2, 3)

B – Performs fabrication

31%

Task B-5 Performs pattern development

B-5.01 Develops patterns using simple and straight line layout
1

B-5.02 Develops patterns using parallel line method
2

B-5.03 Develops patterns using radial line method
2

B-5.04 Develops patterns using triangulation method
2

B-5.05 Uses computer technology for pattern development
4

Task B-6 Fabricates sheet metal components for air and material handling systems

B-6.01 Cuts ductwork, fittings and components
1

B-6.02 Forms ductwork, fittings and components
1, 2, 3

B-6.03 Insulates ductwork, fittings and components
1

B-6.04 Assembles ductwork, fittings and components
1, 2, 3

B-6.05 Fabricates dampers
4

B-6.06 Fabricates hanger systems, supports and bases
1

Task B-7 Fabricates flashing, roofing, sheeting and cladding

B-7.01 Cuts metal for flashing, roofing, sheeting and cladding
2

B-7.02 Forms flashing, roofing, sheeting and cladding
2

Task B-8 Fabricates specialty products

B-8.01 Cuts material for specialty products
(4 In-Context)

B-8.02 Forms specialty products
(4 In-Context)3

B-8.03 Assembles specialty products
(4 In-Context)

B-8.04 Finishes specialty products
3(4 In-Context)

C – Installs air and material handling systems

35%

Task C-9 Prepares installation site	C-9.01 Performs on-site measurements 2 (In Context 3, 4)	C-9.02 Performs demolitions for renovations 2 (In Context 3, 4)	C-9.03 Installs penetrations and sleeves 2 (In Context 3, 4)	C-9.04 Installs supports and bases 2 (In Context 3, 4)	C-9.05 Installs hangers, cables, braces and brackets 2 (In Context 3, 4)
Task C-10 Installs and connects chimneys, breeching and venting to exhaust appliances and mechanical equipment	C-10.01 Installs chimney 2 (In Context 3, 4)	C-10.02 Connects appliances or mechanical equipment to chimney and breeching 2 (In Context 3, 4)	C-10.03 Installs high efficiency appliances and mechanical equipment 2 (In Context 3, 4)		
Task C-11 Installs air handling system components	C-11.01 Installs air handling equipment 1, 2, 3, 4	C-11.02 Installs sheet metal ducts and fittings 1	C-11.03 Installs dampers 1	C-11.04 Installs fire and fire/smoke dampers 2	C-11.05 Installs registers, grilles, diffusers and louvers 1
	C-11.06 Installs terminal boxes 3	C-11.07 Installs coils 3	C-11.08 Installs system component accessories 2, 3, 4	C-11.09 Installs plenums 1, 3	
Task C-12 Installs material handling system components	C-12.01 Installs pneumatic and gravity material handling system components 4	C-12.02 Installs mechanized material handling system components 4			
Task C-13 Applies thermal insulation, lagging, cladding and flashing	C-13.01 Applies thermal insulation to components 4	C-13.02 Applies lagging and cladding to components 4	C-13.03 Applies flashing to components 4		
Task C-14 Performs leak testing, air balancing and commissioning	C-14.01 Performs leak tests 3, 4	C-14.02 Performs testing, adjusting and balancing (TAB) 3, 4	C-14.03 Participates in the commissioning of air and material handling systems 3, 4		

D – Installs roofing and specialty products

8%

Task D-15 Installs metal roofing and cladding/ siding systems	D-15.01 Lays out roof and walls 2	D-15.02 Installs insulation, isolation material and building envelope components 2	D-15.03 Installs roofing and cladding/ siding system components 2	D-15.04 Seals exposed joints 2	D-15.05 Installs decking 2
Task D-16 Installs exterior components	D-16.01 Prepares surface 2	D-16.02 Fastens exterior components 2			
Task D-17 Installs specialty products	D-17.01 Installs stainless steel specialty products 3	D-17.02 Installs non-stainless steel specialty products 3	D-17.03 Installs marine products 3		

E – Performs maintenance and repair

6%

Task E-18 Performs scheduled maintenance	E-18.01 Performs maintenance inspections 3 (In Context 4)	E-18.02 Services components 3 (In Context 4)
Task E-19 Repairs faulty systems and components	E-19.01 Diagnoses system faults 3	E-19.02 Repairs worn or faulty components 3

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One	Transcript Code	Hours
Trade Theory	SHME 100	59
Pattern Drafting	DRFT 100 - Theory	10
	DRFT 101 - Practical	47
Welding and Cutting	WELD 139	12
Bench and Shop Work	BESK 102 - Theory	14
	BESK 103 - Practical	80
Trade Mathematics (Exceeds)	MATH 198	18
		240

Level Two	Transcript Code	Hours
Print Reading	PRNT 204	14
Trade Theory	SHME 200	40
Pattern Drafting	DRFT 203 - Theory	8
	DRFT 204 - Practical	44
Welding	WELD 208	8
Bench and Shop Work	BESK 200 - Theory	8
	BESK 201 – Practical	80
Scheduled Maintenance & Repair	MAIN 204	24
Trade Mathematics (Exceeds)	MATH 293	14
		240

Level Three	Transcript Code	Hours
Welding	WELD 303	12
Pattern Drafting Theory	DRFT 300 - Theory	8
	DRFT 301 – Practical	40
Print Reading	PRNT 303	18
Trade Theory	SHME 381	56
Bench and Shop Work Theory	BESK 300 - Theory	10
	BESK 301 – Practical	68
Scheduled Maintenance & Repair	MAIN 300	14
Trade Mathematics	MATH 381	14
		240

Level Four	Transcript Code	Hours
Scheduled Maintenance & Repair	MAIN 400	18
Communication	COMM 480	8
Pattern Drafting Theory	DRFT 400 – Theory	8
Pattern Drafting Practical	DRFT 401 – Practical	30
Print Reading	PRNT 401	18
Trade Theory	SMHE 481	56
Bench and Shop Work Theory	BESK 400 – Theory	8
Bench and Shop Work Practical	BESK 401 – Practical	80
Trade Mathematics	MATH 481	14
		240

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE SHEET METAL WORKER TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	240 hours
Bench and Shop Work Theory		14 hours
<ul style="list-style-type: none"> • discuss the appropriate sheet metal hand tools and machines for specific shop applications • identify powered metal forming equipment for a specific metal forming function • discuss Gas Metal Arc Welding GMAW operations • discuss hot process metal cutting using plasma and oxy-fuel equipment 		
Bench and Shop Work Practical		80 hours
<ul style="list-style-type: none"> • explain fabrication procedures for various sheet metal seams, locks, and edges • fabricate basic sheet metal items using simple layout procedures • use a spot welder to seam sheet metal objects • assemble a simple duct complete with takeoffs using standard sheet metal tools and equipment • layout degree and ninety degree rectangular elbows using basic layout methods • fabricate regular and “ogee” offsets using basic layout methods • explain safety related functions within a work environment • fabricate sheet metal products using soldering and brazing • use hoisting, rigging and positioning equipment • fabricate insulated ducts and fittings • fabricate hangers, supports, and bases • install air handling equipment • install dampers outlets and louvers • install plenums 		
Mentors can assist the apprentice to prepare for this section of technical training by:		
<ul style="list-style-type: none"> • <i>providing apprentices with opportunities to gain shop experience in a variety of positions</i> • <i>explaining seams, locks and edges</i> • <i>demonstrating simple layouts</i> • <i>assisting to fabricate square to round transitions</i> • <i>promoting safety when welding in the sheet metal shop</i> • <i>providing opportunities to learn theory and practical applications for plasma cutting</i> 		

Pattern Drafting Theory

10 hours

- discuss the various drafting tools used to make drawings for the sheet metal industry
- recognize the types of lines, angles, and lettering used for drawings in the sheet metal industry
- recognize pictorial drawings and orthographic projections
- define terminology associated with drafting
- explain characteristics and measurements of various transverse connections
- identify complex layout methods

Pattern Drafting Practical

47 hours

- discuss geometric principles to construct lines, angles, and common shapes used in layout work
- illustrate orthographic drawings from pictorial drawings
- lay out patterns for sheet metal fittings using basic layout
- lay out patterns for rectangular elbows
- lay out patterns for regular and transitional cheek ogee offsets
- describe three main methods of pattern development
- use scales on drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining proper measurement procedures*
- *explaining layout procedures*
- *explaining the use of blueprints and other trade drawings*
- *always having the apprentice verbally repeat the steps necessary to draft a pattern*
- *letting the apprentice do simple layout and graduate them to more difficult projects*

Trade Theory

59 hours

- demonstrate proper use of safety equipment and safe work practices
- identify common sheet metal hand tools and equipment
- describe the characteristics of shop tools and equipment
- recognize sheet metal seams, locks, and edges
- recognize appropriate fasteners for various sheet metal applications
- describe fabrication procedures used in typical sheet metal shops
- discuss the techniques and materials used to solder various metals
- describe factors affecting building ventilation
- demonstrate the knowledge and procedures required to rig and hoist materials safely
- discuss techniques and equipment for brazing
- discuss measurement and layout of equipment
- discuss organizing materials and equipment
- use effective communication techniques
- discuss installation of air handling equipment
- discuss installation of duct and duct accessories
- discuss installation of plenums

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and explaining general trade practices*
- *explaining the relationships between shop work and field installation*
- *giving apprentices many and varied opportunities to learn different tasks*

- *assisting the apprentice to identify the correct hand tools and shop equipment used for various tasks*
- *having a board displaying the different types of knots and having the apprentice practice tying them*
- *describing and demonstrating the types and application of different knots during on-the-job situations*
- *having the apprentice identify seams by cross-section sketching*
- *describing the components used on a basic ventilation job and how each component works*
- *continuously explaining why, the apprentices are doing what they are doing*

Trade Mathematics

18 hours

- uses basic mathematics
- uses basic algebra
- uses metric units

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing charts and tables covering these aspects of math for the apprentice to study and refer to when needed*
- *demonstrating the use of a sheet metal ruler and provide charts for this also*
- *allowing apprentices to be included in achieving calculations*
- *having the apprentice perform the metric to imperial conversions for the sizing of ducts from blueprints*
- *explaining why, when, where and how specific equations and formulas are required to be used*
- *reviewing trade math concepts and identifying why, when and how to use them*

Welding and Cutting

12 hours

- use Gas Metal Arc Welding (GMAW) equipment
- use welding and cutting protective equipment
- operate oxy- acetylene cutting equipment
- operate plasma arc cutting equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining proper GMAW operating procedures*
- *allowing for hands-on practice with different GMAW equipment*
- *explaining proper oxy-acetylene cutting operating procedures*
- *allowing for hands-on practice with oxy-acetylene cutting equipment*
- *explaining proper plasma arc cutting operating procedures*
- *allowing for hands-on practice with plasma arc cutting equipment*

Level Two

8 weeks

240 hours

Bench and Shop Work Theory

80 hours

- demonstrate safe operation of powered shop equipment
- set up powered machinery to perform basic operations
- examine gas tungsten arc welding (GTAW) operations.

Bench and Shop Work Practical

8 hours

- operate a power press brake to form various types of metal to specific shapes
- operate the notching and punching stations on an iron worker
- tap holes in metal components for the specified machine screw
- use a power rolls machine to roll heavy gage sheet metal to various diameters
- fabricate components from pictorial drawing using the appropriate powered equipment
- fabricate ducts, duct accessories, and fittings using basic layout
- fabricate fittings using parallel line layout
- fabricate fittings using radial line layout
- fabricate fittings using triangulation layout
- use soldering and brazing equipment
- assembles ductwork, fittings, and flexible connectors
- fabricate exterior architectural sheet metal components
- demonstrate on-site measuring.
- install appliances and venting
- install decking, hangers, and supporting components
- install air handling equipment
- install duct accessories
- demonstrate the process for sealing exposed joints and seams on ductwork

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the use of round tees, elbows and offsets*
 - *describing architectural sheet metal*
 - *always having books and other materials available to show examples and procedures*
 - *allowing apprentices to perform hands-on work in a shop environment*
 - *supervising hands-on learning with shop equipment*
-

Pattern Drafting Theory

8 hours

- identify characteristics of basic layout of sheet metal fittings
- identify characteristics of parallel line layout of sheet metal fittings
- identify characteristics of radial line layout of sheet metal fittings
- identify characteristics of triangulation layout of sheet metal fittings
- identify isometric, oblique, and perspective drawings

Pattern Drafting Practical

44 hours

- develop patterns using basic layout methods
- develop patterns using parallel line layout methods
- identify characteristics of triangulation layout methods
- prepare scaled and freehand isometric and oblique drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating how different components are drafted*
- *explaining which methods are used to draft specific fittings*
- *having the apprentice draw and send in shop drawings for fabrication, monitoring for correctness and completeness*
- *demonstrating and then allowing the apprentice to make fittings*

Print Reading

14 hours

- use trade-related documentation
- interpret drawings
- perform basic design and field modifications

Mentors can assist the apprentice to prepare for this section of technical training by:

- *introducing how and why information is gathered from blueprint materials*
- *explaining how different drawings are used on the job for this trade*
- *explaining how information is transferred from one drawing to another and used to coordinate among other trades*
- *identifying scales and how they are used to convert drawings into real measurements*
- *explaining how to determine areas from drawings*
- *having the apprentice study the drawings for current projects that are in progress and having them relate what they see to the actual site*

Scheduled Maintenance & Repair

24 hours

- define terminology associated with the servicing of system components
- use tools and equipment associated with the servicing of system components
- identify hazards and safe work practices pertaining to service work
- perform calculations of system performances
- use tools and equipment associated with airflow in ductwork
- describe the conditions that create airflow in ductwork

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the terminology associated with the servicing of components*
- *explaining the hazards and safe work practices pertaining to service work*
- *having the apprentice select the tools and equipment associated with the servicing of system components*
- *allowing opportunities to have the apprentice perform the preform calculations of system performances*
- *allowing opportunities to have the apprentice perform tests and reading for the repairs*

Trade Mathematics

14 hours

- convert Imperial measurements between fractional and decimal form
- solve basic geometric problems
- Use basic trigonometric functions

Mentors can assist the apprentice to prepare for this section of technical training by:

- *having the apprentice perform many metric to imperial and back again conversions until understanding of the procedures are second nature*
- *continuously explaining when and how math formulas used and applied in this industry*
- *having the apprentice convert drawings from metric to imperial to come up with an order list*
- *allowing opportunities to use this math for all aspects of the trade such as shop fabrication, ordering materials, etc.*

- *relating trade math to hands-on/real-world situations*

Trade Theory

40 hours

- describe HVAC system categories and components including package units, built-up systems and terminal units
- describe the components and subsystems within a material handling systems
- identify the tools, equipment, and labor required to install HVAC and architectural systems and components
- explain how to prepare for ductwork installations
- describe the characteristics of anchors and hangers used to install ductwork
- discuss the characteristics of fire and smoke dampers
- interpret the SMACNA duct fabrication standards to determine gauge, transverse joint spacing and reinforcement for a given section of ductwork
- interpret information related to chimneys and vents
 - discuss appliance venting theories for various types of HVAC appliances
 - discuss types of chimneys and related applications
 - discuss certifications, licenses, and bonding related to appliance installations
 - interpret National Building Codes related to chimneys and venting of appliances
 - interpret Saskatchewan Codes of Practice related to chimneys and venting appliances
 - interpret manufacturer installation methods for a given appliance
 - design a new and retro-fitted chimney installation to meet applicable codes and standards
- explain the process of demolition for renovations
- explain field measuring fundamentals
- discuss installation of insulation and cladding
- discuss different forms of matter
- describe heat energy and heat transfer
- Solve problems involving simple machines

Mentors can assist the apprentice to prepare for this section of technical training by:

- *describing bidding and job costing procedures*
- *demonstrating proper duct installation*
- *explaining the importance of fire and smoke dampers*
- *describing energy recovery ventilators*

Welding

8 hours

- recognize hazards related to welding and cutting processes
- select personal protective equipment
- use gas metal arc welding (GMAW) equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and demanding safe welding practices*
- *demonstrating and demanding safe use of PPE*
- *allowing for hands-on practice with the different cutting and welding processes*

Level Three

7 weeks

240 hours

Bench and Shop Work Theory

10 hours

- recognize hazards related to the use of powered fabrication equipment
- discuss the operational characteristics of powered fabrication equipment
- examine the operational characteristics of a power press brake
- examine Gas Tungsten Arc Welding (GTAW) operation
- examine Shielded Metal Arc Welding (SMAW) operation

Bench and Shop Work Practical

68 hours

- demonstrate safe operation of powered shop equipment.
- fabricate metal parts using heavy gage fabrication equipment.
- fabricate ducts, duct accessories, and fittings using basic layout.
- fabricate fittings using parallel line layout.
- fabricate fittings using radial line layout.
- fabricate fittings using triangulation line layout.
- fabricate fittings using combined layout methods.
- fabricate specialty sheet metal products.
- fabricate specialty sheet metal products using stainless steel.
- install air handling system equipment and accessories.
- install air handling plenums.
- install coils and terminal boxes

Mentors can assist the apprentice to prepare for this section of technical training by:

- *requiring all apprentices to rotate through the performing of all shop work with a competent qualified journeyperson*
- *guiding the apprentice through the various fittings*
- *demonstrating and assisting the apprentice to lay out a square-to-round on a pitch and a “Y” branch*

Pattern Drafting Theory

8 hours

- identify characteristics of basic layout of sheet metal fittings
- identify characteristics of parallel line layout of sheet metal fittings
- identify characteristics of radial line layout of sheet metal fittings
- identify characteristics of triangulation layout of sheet metal fittings
- identify characteristics of a combined layout method for sheet

Pattern Drafting Practical

40 hours

- develop patterns using basic layout methods
- develop patterns using parallel line layout method
- develop patterns using radial line layout method
- develop patterns using triangulation layout method
- develop patterns using combined layout methods

Mentors can assist the apprentice to prepare for this section of technical training by:

- *describing the different ways to develop patterns during drafting*
 - *demonstrating the use of advance pattern drafting in shop production*
 - *allowing the apprentice many opportunities to fabricate all types of fittings*
-

Print Reading**18 hours**

- interpret information from plans and specifications
- interpret information from shop drawings
- examine plans and specifications
- develop shop drawings for given specifications
- perform a take-off from a shop drawing

Mentors can assist the apprentice to prepare for this section of technical training by:

- *supervising the reading and application of prints and shop drawings*
 - *allowing the apprentice to read and interpret all types of drawings*
 - *having the apprentice make fabrication lists from blueprints*
-

Scheduled Maintenance & Repair**14 hours**

- performs maintenance inspections
- service components service
- diagnoses system faults
- repairs worn or faulty system components
- use testing and inspection tools and equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the terminology associated with the servicing of components*
 - *explaining the hazards and safe work practices pertaining to service work*
 - *having the apprentice select the tools and equipment associated with the servicing of system components*
 - *allowing opportunities to have the apprentice perform the preform calculations of system performances*
 - *allowing opportunities to have the apprentice perform tests and reading for the repairs*
-

Trade Mathematics**14 hours**

- basic mathematics and algebra
- complex problems
- application of basic trigonometry to solve problems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing on-site demonstrations of offset calculations, hangar spacing, elevations, etc.*
- *constantly requiring the apprentice to apply different maths to on-the-job practices*
- *assisting apprentices in the shop to learn and apply formulas for wrappers, etc.*
- *assisting the apprentice to measure a duct run containing an offset*
- *having the apprentice calculate supply air volume in a particular room and getting them to compare to square footage*
- *ensuring that the apprentice understands the right triangle formula and can apply it to real-work situations*
- *demanding that the apprentice to review their math notes from previous training and testing them on it*

Trade Theory

56 hours

- compare HVAC systems and components
- examine the properties of air
- examine ventilation
- analyze air flow in ductwork
- categorize fans used in HVAC systems
- analyze HVAC duct systems
- examine the characteristics of heat
- examine the characteristics of cooling systems
- examine duct design characteristics
- compare duct sizing methods
- describe field measuring principles
- analyze hoisting and rigging operations
- examine HVAC equipment and installations
- discuss automatic control systems
- discuss sign work
- discuss properties of various materials
- solve problems involving simple machines
- examine specialty sheet metal products

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing all types of airflow calculations with the apprentice*
- *allowing for practical, hands-on training with HVAC components*
- *demonstrating correct hoisting and rigging operations*
- *ensuring all safety procedures and practices are known and used*
- *consistently reviewing the apprentice's work and offering constructive criticism*

Welding

12 hours

- select protective equipment
- recognize hazards related to welding and cutting processes
- use gas tungsten arc welding (GTAW) operations
- 4) Use Shielded Metal Arc Welding (SMAW) procedures. use Shielded Metal Arc Welding (SMAW) procedures

Mentors can assist the apprentice to prepare for this section of technical training by:

- *if necessary, sending the apprentice to after-hours welding training*
- *allowing for hands-on practice with different welding and processes*

Level Four

8 weeks

240 hours

Bench and Shop Work Theory

8 hours

- discuss shop safety
- calculate bend allowance using empirical formula
- discuss the operational characteristics of powered fabrication equipment

Bench and Shop Work Practical

80 hours

- fabricate complex fittings using the triangulation method
- fabricate complex fittings using the parallel line method
- fabricate complex fittings using the radial line method
- use a combination of drafting methods to fabricate various fittings
- calculate bend allowance using the empirical method and form the part
- fabricate dampers and louvers
- install insulation, lagging, cladding, and flashing
- install material handling components and equipment
- install air handling components and equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *consistently setting the apprentice have shop time in order to improve skills*
 - *supervising from a distance, offering suggestions for improvement*
 - *having the apprentice write out the steps necessary to complete a project before beginning*
 - *assisting with hands-on experience at GTAW welding*
 - *giving a simple exercise to practice GTAW welding such as a stainless steel drain pan*
-

Communication

8 hours

- apply job-related interpersonal and oral communications
- discuss the principles of customer service
- prepare workplace documents
- use mentoring techniques

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring that the expectations for behaviour at the worksite and shop are clearly understood*
 - *ensuring that the employer and supervisors all practice the same objectives that the apprentice is expected to follow*
 - *treating apprentices with the same respect that they are expected to show to others*
 - *having the apprentice perform the ordering of materials*
 - *having the apprentice make out pick lists*
 - *allowing the apprentice to interact with site superintendents, foremen and engineers in order to ask pertinent questions*
-

Pattern Drafting Theory

8 hours

- identify characteristics of sheet metal fitting layout
- examines computer technology for pattern development

Pattern Drafting Practical

30 hours

- draft complex fittings using the triangulation method
- draft complex fittings using the parallel line method
- draft complex fittings using the radial line method
- use a combination of layout methods to fabricate various fittings
- uses computer technology for pattern development

Mentors can assist the apprentice to prepare for this section of technical training by:

- *consistently setting the apprentice have shop time in order to improve skills*
- *reviewing pattern drafting prior to level four intake*

Print Reading

18 hours

- describe the importance of prints and specifications in the construction industry
- interpret information found in prints and specifications
- produce a shop print for a given blow pipe system
- perform a take-off from a shop print

Mentors can assist the apprentice to prepare for this section of technical training by:

- *breaking down detailed drawings into explainable portions*
- *asking specific questions to ensure understanding of the various drawings and specifications*
- *reviewing drawings and specifications for all projects the apprentice is working on to point out special circumstances, notes and details that the apprentice must learn to look for and recognize*

Trade Theory

56 hours

- analyze industrial sheet metal
- compare industrial material handling systems
- examine Blowpipe Systems
- examine industrial specialties related to sheet metal work
- describe duct leakage testing
- examine testing, adjusting, and balancing work
- describe the process of commissioning a building
- examine indoor air quality
- compare filtration and air cleaning equipment
- discuss special ventilation needs
- examine commercial refrigeration systems
- describe how automatic controls function in HVAC systems
- describe fabrication and installation procedures related to boiler breeching
- apply job-related interpersonal and oral communications
- discuss the principles of customer service
- prepare workplace documents
- use mentoring techniques

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice understands how to use measuring instruments such as velometer, anemometer and pitot tube*
- *explaining the importance of ventilation as it relates to air quality*
- *describing and demonstrating the procedures used to work on refrigeration systems such as recharge and recover refrigerant; perform pump down and system purge; and find and repair leaks*
- *describing and demonstrating the procedures used to balance HVAC systems*
- *describing exhaust systems used for the removal of industrial contaminants including recommended fabrication and installation practices for fume and dust removal*
- *discussing alternate applications for sheet metal products*

Scheduled Maintenance & Repair**18 hours**

- review the operation of a standing pilot appliance
- identify electrical components used in modern appliances
- describe the sequence of operation for various appliances
- perform leak tests of a duct system
- perform testing adjusting and balancing of a duct system
- perform commissioning of air and material handling systems
- measure voltage, current, and resistance to confirm the operation of electrical controls found in an appliance

Mentors can assist the apprentice to prepare for this section of technical training by:

- *taking the apprentice on service calls and demonstrating the process of troubleshooting*
 - *ensuring that the sequence of operation is clearly understood*
 - *having the apprentice trouble-shoot heating appliances in the field*
 - *allowing opportunities to perform an installation from start to finish*
 - *allowing the apprentice to further their education by attending supplier training whenever available*
-

Trade Mathematics (exceeds)**14 hours**

- review algebra problems
- use geometry to solve problems
- use trigonometric functions

Mentors can assist the apprentice to prepare for this section of technical training by:

- *continually forcing the apprentice to perform all calculations in the field*
 - *reviewing previous math training to ensure comprehension*
 - *noticing and ensuring that all aspects of the trade's math is now second nature*
-

Trade Theory**56 hours**

- analyzing industrial sheet metal
- comparison of industrial material handling systems
- blowpipe systems
- industrial specialties related to sheet metal work
- duct leakage testing
- testing, adjusting and balancing work
- commissioning a building
- examination of indoor air quality
- comparison of filtration and air cleaning equipment
- special ventilation needs
- commercial refrigeration systems
- how automatic controls function in HVAC systems
- fabrication and installation procedures related to boiler breeching
- planning and running jobs

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice understands how to use measuring instruments such as velometer, anemometer and pitot tube*
- *explaining the importance of ventilation as it relates to air quality*
- *describing and demonstrating the procedures used to work on refrigeration systems such as recharge and recover refrigerant; perform pump down and system purge; and find and repair leaks*
- *describing and demonstrating the procedures used to balance HVAC systems*

- *describing exhaust systems used for the removal of industrial contaminants including recommended fabrication and installation practices for fume and dust removal*
 - *discussing alternate applications for sheet metal products*
-

Welding

6 hours

- preparing a work area for welding operations
- selection of personal protective equipment
- operate gas metal arc welding (GMAW) equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring that a clean safe workstation is maintained, and that appropriate PPE is consistently used*
- *allowing for hands-on practice with different welding processes*
- *describing the importance of cleanliness and the causes of metal contamination*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

Saskatchewan Apprenticeship & Trade Certification Commission

2140 Hamilton St Regina SK S4P 2E3

Tel: (306) 787-2444

Fax: (306) 787-5105

Toll Free: 1-877-363-0536

Website: www.saskapprenticeship.ca

District Offices

Estevan (306) 637-4930

La Ronge (306) 425-4385

Moose Jaw (306) 694-3735

North Battleford (306) 446-7409

Prince Albert (306) 953-2632

Saskatoon (306) 933-8476

Swift Current (306) 778-8945

Yorkton (306) 786-1394