

Red Seal Occupational Standard

Sheet Metal Worker



red-seal.ca
sceau-rouge.ca



Employment and
Social Development Canada

Emploi et
Développement social Canada

Canada 

Red Seal Occupational Standard

Sheet Metal Worker



Title: Sheet Metal Worker

This publication is available for download at canada.ca/publiccentre-ESDC. It is also available upon request in multiple formats (large print, Braille, MP3, audio CD, e-text CD, DAISY, or Accessible PDF), by contacting 1 800 O-Canada (1-800-622-6232). By teletypewriter (TTY), call 1-800-926-9105.

© His Majesty the King in Right of Canada, 2026

For information regarding reproduction rights:

droitdauteur.copyright@HRSDC-RHDCC.gc.ca.

Em15-3/15-2026E-PDF

ISBN 978-0-660-98829-0

Foreword

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this Red Seal Occupational Standard (RSOS) as the national standard for the Sheet Metal Worker trade.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. Employment and Social Development Canada (ESDC) funds the Red Seal Program, which, under the guidance of the CCDA, develops a national occupational standard for each of the Red Seal trades.

Standards have the following objectives:

- to describe and group the tasks performed by skilled workers
- to identify which tasks are performed in every province and territory
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and assessment tools for apprenticeship and certification authorities
- to develop common tools for apprenticeship on-the-job and technical training in Canada
- to facilitate the mobility of apprentices and skilled workers in Canada
- to supply employers, employees, associations, industries, training institutions and governments with occupational standards

Any questions, comments, or suggestions for changes, corrections, or revisions to this standard or any of its related products may be forwarded to:

Trades and Apprenticeship Division
Skilled Trades and Mobility Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV
Gatineau, Quebec K1A 0J9

Acknowledgements

The CCDA and ESDC wish to express sincere appreciation for the contribution of the many tradespersons, industrial establishments, professional associations, labour organizations, provincial and territorial government departments and agencies, and all others who contributed to this publication.

Special thanks are offered to the following representatives who contributed greatly to the original draft of the standard and provided expert advice throughout its development.

The following lists these participants and the province/territory or organization that nominated them to attend the national development workshop.

- Sean Baldwin – Manitoba
- Willie DeBay – Nova Scotia
- Alain Dufresne – Québec
- Jeremy Hamm – New Brunswick
- Joe Hawley – Ontario
- Molly Keizer – Yukon
- TJ King – Saskatchewan
- Paul Lavigne – New Brunswick
- Jake LeBlanc – British Columbia
- Mark MacDonald – Nova Scotia
- Brent Rogoski – Alberta
- Samara Sampson – International Association of Sheet Metal, Air, Rail and Transportation Workers (SMART Union)
- Barry Simon – Newfoundland and Labrador
- Stéphane St-Laurent – Québec
- Chris Taylor – Alberta
- Jeff Young – Manitoba
- Jake Watters – British Columbia
- Scott A. Wood – Ontario

This standard was prepared by the Skilled Trades and Workforce Mobility Directorate of ESDC. The coordinating, facilitating and processing of this standard were undertaken by employees of the standards development team of the Trades and Apprenticeship Division and of Nova Scotia, the host jurisdiction for this trade.

Structure of the Occupational Standard

This standard contains the following sections:

Methodology: an overview of the process for development, review, validation and weighting of the standard

Description of the Sheet Metal Worker Trade: an overview of the trade's duties, work environment, job requirements, similar occupations and career progression

Trends in the Sheet Metal Worker Trade: some of the trends identified by industry as being the most important for workers in this trade

Skills for Success Summary: an overview of how each of the skills for success (formerly called essential skills) is applied in this trade

Roles and Opportunities for Skilled Trades in a Sustainable Future: an overarching description of how in the context of climate change, skilled trades play a large role in implementing solutions and adjusting to changes in the world. In addition to highlighting the importance of this awareness, the standard may also contain more details on activities, skills and knowledge elements that are specific to the trade

Industry Expected Performance: description of the expectations regarding the level of performance of the tasks, including information related to specific codes, regulations and standards that must be observed

Language Requirements: description of the language requirements for working and studying in this trade in Canada

Pie Chart of Red Seal Examination Weightings: a graph which depicts the national percentages of exam questions assigned to the major work activities

Task Matrix and Weightings: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard and the national percentages of exam questions assigned to the major work activities and tasks

Harmonization of Apprenticeship Training: the aspects of apprenticeship training that participating provinces and territories have agreed upon to substantively align apprenticeship systems across Canada

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
- **Task Descriptor:** a general description of the task
 - **Sub-task:** distinct actions that describe the activities within a task

- **Skills:**
 - **Performance Criteria:** description of the activities that are done as the sub-task is performed
 - **Evidence of Attainment:** proof that the activities of the sub-task meet the expected performance of a tradesperson who has reached journey person level
 - **Range of Variables:** elements and examples (not all-inclusive) that provide a more in-depth description of a term used in the performance criteria and evidence of attainment

- **Knowledge:**
 - **Learning Outcomes:** describes what should be learned relating to a sub-task while participating in technical or in-school training
 - **Learning Objectives:** topics to be covered during technical or in-school training in order to meet the learning outcomes for the sub-task
 - **Range of Variables:** elements and examples (not all-inclusive) that provide a more in-depth description of a term used in the learning outcomes and learning objectives

- **Appendix A – Acronyms:** a list of acronyms used in the standard with their full name
- **Appendix B – Tools and Equipment / Outils et Équipement:** a bilingual non-exhaustive list of tools and equipment used in this trade
- **Appendix C – Glossary / Glossaire:** bilingual definitions or explanations of selected technical terms used in the standard

Methodology

Development of the Standard

A draft standard is developed by a broad group of trade representatives, including tradespeople, instructors and employers at a National Workshop led by a team of facilitators. This draft standard breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Harmonization of Apprenticeship Training

An analysis of all provinces' and territories' apprenticeship programs is performed and recommendations are made on harmonizing the name of the trade, the hours of training required and the number of levels of training. Provinces and territories consult with their respective industry stakeholders on these elements and revisions are discussed until consensus is reached. Following the development of the workshop draft of the RSOS, participants discuss and come to consensus on the sequence of training topics, as expressed in the new standard. Their sequencing recommendations are reviewed by stakeholders in participating provinces and territories and further discussions are convened to reach consensus and to identify any exceptions.

Online Survey

Stakeholders are asked to review and validate the activities described in the new standard via an online survey. These stakeholders are invited to participate in this consultation through apprenticeship authorities, as well as national stakeholder groups.

Draft Review

The RSOS development team forwards a copy of the standard to provincial and territorial authorities who consult with industry representatives to review it. Their recommendations are assessed and incorporated into the standard.

Validation and Weighting

Participating provinces and territories also consult with industry to validate and weight the document for the purpose of planning the makeup of the Red Seal Interprovincial Examination for the trade. They validate and weight the major work activities (MWA), tasks and sub-tasks of the standard, as follows:

- MWA - Each jurisdiction assigns a percentage of questions to each MWA for an examination that would cover the entire trade.
- Tasks - Each jurisdiction assigns a percentage of exam questions to each task within a MWA.
- Sub-tasks - Each jurisdiction indicates, with a “yes” or “no”, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the RSOS development team who then analyzes the data and incorporates it into the document. The RSOS provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for MWA and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

The validation of the RSOS is used to identify common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions' industry performs a sub-task, it shall be considered common core. Interprovincial Red Seal Examination questions are limited to the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

yes	sub-task performed by qualified workers in the occupation in that province or territory
no	sub-task not performed by qualified workers in the occupation in that province or territory
NV	standard Not Validated by that province or territory
ND	trade Not Designated in a province or territory
Not Common Core (NCC)	sub-task, task or MWA performed less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
National Average %	average percentage of questions assigned to each MWA and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

Description of the Sheet Metal Worker Trade

“Sheet Metal Worker” is this trade’s official Red Seal occupational title approved by the CCDA. This standard covers tasks performed by sheet metal workers.

Sheet metal workers design, fabricate, assemble, install and repair sheet metal products and systems. In fabrication work, sheet metal workers design, lay out and manufacture pieces to project 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, soldering, seaming and using mechanical fasteners.

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

Pieces may be designed, 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), material handling system design, shop manufacture, using computer aided design (CAD), 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. In some jurisdictions, they may also specialize in testing, adjusting and balancing (TAB).

Employers in this trade include sheet metal fabrication shops, manufacturing companies of sheet metal, installation contractors, HVAC contractors, and architectural sheet metal contractors. Sheet metal workers may be involved in residential, industrial, commercial, institutional, construction, and civil infrastructure 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, carrying and working at heights.

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 must 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.

Trends in the Sheet Metal Worker Trade

Technology

There is an increase in the use of 3D modeling and CAD software to help with the visualization of blueprints and the manufacturing process. Building Information Modeling (BIM) is being used in many jurisdictions and is becoming increasingly important for sheet metal workers. It enables them to create and manage digital models of sheet metal projects throughout their lifecycle, from planning and design to fabrication and installation. Greater awareness of this new technology is needed for apprentices entering the trade.

There is an ongoing increase in technology such as digitization and automation which are transforming the industry's efficiency, productivity and workforce management. These new technologies make measuring, layout and pattern development more efficient, and in some cases, may reduce the frequency of some manual layout practices.

Health and Safety

There is a growing need to improve health and safety for workers on jobsites. Ensuring that workers have a solid understanding of their rights, including general workers' rights and union policies, is essential. There is a growing appreciation and awareness of the importance of mental health and respectful workplaces.

Workers need to continually stay aware of health and safety legislative and regulatory changes that are intended to protect their health and safety and outline worker, supervisory and employer responsibilities.

Tools and Equipment

Tools and equipment continue to improve in the trade. Equipment such as laser welders, laser cutting tables, laser levelling and 3D scanners enhance productivity, safety, precision and efficiency. A robotic total station may enable faster and more precise layout, placement and installation of sheet metal components.

Virtual reality (VR) and augmented reality (AR) is transforming the sheet metal worker trade in several innovative ways such as training and skills development, enhancing precision and improving the quality of the finished product. It also improves safety by providing real time safety instructions and alerts, ensuring workers follow proper procedures and avoid hazards.

There is an increasing use of tablets on the worksite for communications and accessing work documents such as blueprints and specifications.

The robotization of suspension anchor drilling in the sheet metal worker trade involves integrating advanced robotic systems to automate the drilling process. This technology enhances precision, efficiency and safety in the manufacturing and installation activities of the trade.

Battery-operated tools and equipment have become increasingly popular in the sheet metal worker trade due to their convenience, portability, efficiency, safety, and environmental benefits.

Products/Materials

Pre-fabricated products are becoming more popular. Suppliers are opting for these pre-fabricated components as they can reduce costs and streamline operations.

Composite materials, such as fibre-reinforced polyethylene (FRP), solid polyvinyl chloride (PVC) and PVC-coated components, are increasingly being used in the trade in applications such as underground ductwork, for transporting hazardous or corrosive materials, roofing, flashing and cladding as they provide a durable and weather-resistant surface which may protect against corrosion and wear.

There are many new products such as high induction diffusers, mechanical joint systems, fabric ducts and phenolic ducts, slab ducts, and cable suspension systems that are now commonplace in the trade.

Environmental

Recycling ferrous and non-ferrous materials is essential for both environmental sustainability and economic efficiency. To maximize these benefits, it is important to educate workers on effective recycling practices.

Sheet metal workers play a significant role in various green energy projects such as solar-heat, wind-power, nuclear energy, renewable fuel sources and geothermal energy. These projects contribute to a sustainable future and sheet metal workers are critical to their development.

Legislative and Regulatory

There has been an increase in the number of provinces and territories that have designated this trade as compulsory. For those jurisdictions, it is important that workers are well-qualified to be working on HVAC systems.

Other

Multi-trade racks are being introduced to many large-scale workplaces. These racks are organized to transport and contain all mechanical parts that are required for multiple trades' mechanical systems because they can improve the efficiency and provide a coordinated workflow.

Skills for Success Summary

Skills for Success are needed in a quickly changing world for work, learning and life. They are foundational for building other skills and important for effective social interaction. Everyone benefits from having these skills as they help individuals get a job, progress at their current job and change jobs. They also help individuals become active members of their community and succeed in learning.

Through extensive research and consultations, the Government of Canada launched the new Skills for Success model renewing the previous Essential Skills framework to better reflect the needs of the current and future labour market.

The summary presented here is based on existing Essential Skills profiles and will be updated to align with the new [Skills for Success model](#) over time.

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 co-workers and colleagues. Those working in fabrication shops may work alone on small projects, and 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, plasterers, bricklayers, plumbers and electricians. They actively participate with apprentice training and progression on the job.

Digital Technology

Sheet metal workers may use computers, CAD and 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, trade standards and regulations.

Roles and Opportunities for Skilled Trades in a Sustainable Future

Climate change and the environment is an important issue for many Canadians, and the skilled trades play a large role in implementing solutions.

Throughout this standard, references to tasks, skills and knowledge that clearly show the trade's role in building a more sustainable future. Each trade has different roles to play and contributions to make in their own way.

Here are a few examples:

- **Construction** tradespeople need to consider the materials they are using, building methods, and technological improvements to mechanical and electrical installations. Efficiency upgrades and advanced materials are changing the construction industry in Canada. Improvements to energy-efficiency in building structures and systems are continual, and codes, specifications and designs such as Leadership in Energy and Environmental Design (LEED) and the Zero Carbon Building (ZCB) standards outline how the construction trades can improve the efficiency and sustainability of the industry.
- **Automotive and mechanical** trades are seeing shifts to more efficient vehicles and advanced materials, including alternate fuels and electric vehicles. With the continual and rapid evolution of technology in this sector, there is a need for skilled workers to always be learning.
- **Manufacturing** sectors face global competition resulting in a move towards increased efficiency and automation. Many industrial and commercial facilities are being upgraded to improve efficiency in areas such as lighting systems, building envelope air tightness, mechanical insulation, heat pumps and new production processes and technologies. New control technologies allow better monitoring of processes resulting in less waste and higher-quality products.
- **Industrial** trades are being encouraged to reduce greenhouse gas and carbon emissions by supporting development of carbon capture, utilization and storage (CCUS) and renewable energy generation such as solar, wind, hydro, geothermal and nuclear generation, as well as upgrades to transmission and distribution infrastructure. Systems designed to recover renewable natural gas (RNG) produced by landfill, digester, and biogas facilities, and hydrogen production and utilization provide many opportunities for future projects.
- **Landscape horticulturists** will have opportunities to design and develop biodiverse ecosystems to mitigate the effects of climate change. Concerns such as erosion, species diversity and ecosystem health can be addressed through the use of green infrastructure systems.
- **Service sector trades** may also need to be aware of responsible sourcing, as well as the efficient use of products and materials. The increasing popularity of eco-tourism will provide opportunities in new areas.

There are fast-moving changes in guidelines, codes, regulations, international agreements, and manufacturers' specifications implemented for the purpose of energy efficiency and mitigating climate change. Tradespeople need to continually stay on top of new and changing requirements to stay competitive.

Apprentices and tradespeople need to increase their climate literacy and reinforce their own understanding of current climate change, energy conservation and environmental practices. Most trades are encouraged to use ecologically friendly products and follow requirements related to the reuse, recycling or disposal of materials. While individual tradespeople and apprentices may not be able to choose certain elements (like the architectural design of buildings, building material selection, regulatory requirements, or use of electric vehicles and technologies), understanding the impact of using these elements and how to apply them in their work is still important. This helps ensure that energy and environmental specifications are fully met.

In apprenticeship training, as well as in ongoing professional development, employers and instructors should encourage learning about these concepts, why they are important, how they are implemented, and the overarching targets they are aiming to achieve.

Industry Expected Performance

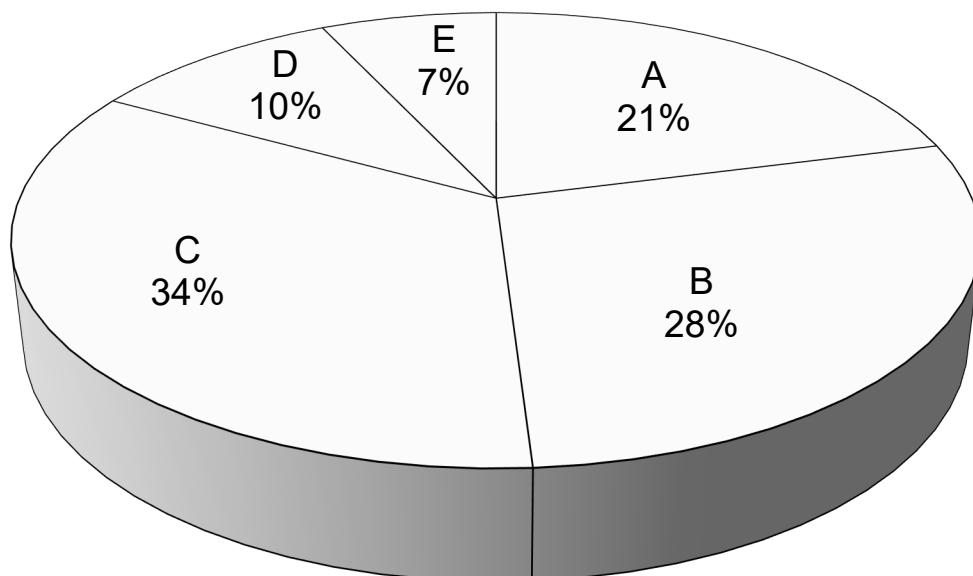
All tasks must be performed according to the applicable jurisdictional codes and standards. All health and safety standards must be respected and observed. Work should be performed efficiently and to a high quality without material waste or environmental damage. All requirements of the manufacturer, client project specifications, the National Building Code (NBC), Authority Having Jurisdiction (AHJ) and trade standards (such as Sheet Metal and Air Conditioning National Association [SMACNA]; American Society of Heating, Refrigeration and Air Conditioning Engineers [ASHRAE]; American National Standards Institute [ANSI]; Canadian Standards Association [CSA]; National Fire Protection Association [NFPA]; Underwriters Laboratories of Canada [ULC]; Health Canada; Wood Energy Transfer Technology (WETT); Testing, Adjusting and Balancing Bureau [TABB]; Transportation Safety Board [TSB]; and American Society for Testing and Materials [ASTM]) must be met.

At a journeyman level of performance, all tasks must be done with minimal direction and supervision. As a journeyman progresses in their career there is an expectation they continue to upgrade their skills and knowledge to keep pace with industry and promote continuous learning in their trade through mentoring of apprentices.

Language Requirements

It is expected that journeypersons are able to understand and communicate in either English or French, which are Canada's official languages. English or French are the common languages of business as well as languages of instruction in apprenticeship programs.

Pie Chart of Red Seal Examination and Weightings



Major Work Activity	Percentage
A - Performs common occupational skills	21%
B - Performs fabrication	28%
C - Installs air and material handling systems	34%
D - Installs roofing and specialty products	10%
E - Performs maintenance and repair	7%

This pie chart represents a breakdown of the interprovincial Red Seal examination. Percentages are based on the collective input from workers from the trade from across Canada. The Task Matrix on the next pages indicates the breakdown of tasks and sub-tasks within each Major Work Activity and the breakdown of questions assigned to the Tasks. The Interprovincial examination for this trade has 120 questions.

Task Matrix and Weightings

Major Work Activity A – Performs common occupational skills 21%

Task A-1 Maintains safe and healthy workplace 27%	Sub-task A-1.01 Uses personal protective equipment (PPE) and safety equipment	Sub-task A-1.02 Maintains safe work environment	Sub-task A-1.03 Performs lock-out and tag-out procedures
	Sub-task A-1.04 Participates in healthy and respectful workplace practices		
Task A-2 Uses and maintains tools and equipment 43%	Sub-task A-2.01 Uses hand and portable power tools	Sub-task A-2.02 Uses shop tools and equipment	Sub-task A-2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment
	Sub-task A-2.04 Uses resistance spot welding equipment	Sub-task A-2.05 Uses gas tungsten arc welding (GTAW) equipment	Sub-task A-2.06 Uses shielded metal arc welding (SMAW) equipment
	Sub-task A-2.07 Uses oxy-fuel, plasma arc and laser cutting equipment	Sub-task A-2.08 Uses laser welding and cleaning equipment (NOT COMMON CORE)	Sub-task A-2.09 Uses soldering and brazing equipment
	Sub-task A-2.10 Uses measuring and layout equipment	Sub-task A-2.11 Uses testing and inspection devices	Sub-task A-2.12 Uses access equipment

	Sub-task A-2.13 Uses hoisting, rigging and positioning equipment		
Task A-3 Organizes work 30%	Sub-task A-3.01 Uses trade-related documentation	Sub-task A-3.02 Interprets drawings and project specifications	Sub-task A-3.03 Organizes materials and equipment for project
	Sub-task A-3.04 Performs basic design and field modifications		
Task A-4 Maintains continuous learning 0%	Sub-task A-4.01 Upgrades in new trade practices and procedures	Sub-task A-4.02 Upgrades in emerging technologies	
Task A-5 Uses communication and mentoring techniques 0%	Sub-task A-5.01 Uses communication techniques	Sub-task A-5.02 Uses mentoring techniques	

Major Work Activity B – Performs fabrication

28%

Task B-6 Performs pattern development 31%	Sub-task B-6.01 Develops patterns using simple and straight line layout	Sub-task B-6.02 Develops patterns using parallel line method	Sub-task B-6.03 Develops patterns using radial line method
	Sub-task B-6.04 Develops patterns using triangulation method	Sub-task B-6.05 Uses computer technology for pattern development	
Task B-7 Fabricates sheet metal components for air and material handling systems 41%	Sub-task B-7.01 Cuts ductwork, fittings and components	Sub-task B-7.02 Forms ductwork, fittings and components	Sub-task B-7.03 Insulates ductwork, fittings and components
	Sub-task B-7.04 Assembles ductwork, fittings and components	Sub-task B-7.05 Fabricates dampers	Sub-task B-7.06 Fabricates hanger systems, supports and bases
Task B-8 Fabricates flashing, roofing, sheeting and cladding 15%	Sub-task B-8.01 Cuts material for flashing, roofing, sheeting and cladding	Sub-task B-8.02 Forms flashing, roofing, sheeting and cladding	
Task B-9 Fabricates specialty products 13%	Sub-task B-9.01 Cuts material for specialty products	Sub-task B-9.02 Forms specialty products	Sub-task B-9.03 Assembles specialty products
	Sub-task B-9.04 Finishes specialty products		

Major Work Activity C – Installs air and material handling systems 34%

<p>Task C-10 Prepares installation site 16%</p>	<p>Sub-task C-10.01 Performs on-site measurements</p>	<p>Sub-task C-10.02 Performs demolition for renovations</p>	<p>Sub-task C-10.03 Installs penetrations and sleeves</p>
	<p>Sub-task C-10.04 Installs supports and bases</p>	<p>Sub-task C-10.05 Installs hangers, cables, braces, brackets and seismic restraints</p>	
<p>Task C-11 Installs and connects chimneys, breeching and venting to exhaust appliances and mechanical equipment 18%</p>	<p>Sub-task C-11.01 Installs chimneys and stacks</p>	<p>Sub-task C-11.02 Connects appliances or mechanical equipment to chimney and breeching</p>	<p>Sub-task C-11.03 Installs high efficiency appliances and mechanical equipment</p>
<p>Task C-12 Installs air handling system components 31%</p>	<p>Sub-task C-12.01 Installs air handling equipment</p>	<p>Sub-task C-12.02 Installs ductwork and fittings</p>	<p>Sub-task C-12.03 Installs dampers</p>
	<p>Sub-task C-12.04 Installs fire and fire/smoke dampers</p>	<p>Sub-task C-12.05 Installs registers, grilles, diffusers and louvers</p>	<p>Sub-task C-12.06 Installs terminal boxes</p>
	<p>Sub-task C-12.07 Installs coils and duct heaters</p>	<p>Sub-task C-12.08 Installs system component accessories</p>	<p>Sub-task C-12.09 Installs plenums</p>
<p>Task C-13 Installs material handling system components 19%</p>	<p>Sub-task C-13.01 Installs pneumatic and gravity material handling system components</p>	<p>Sub-task C-13.02 Installs mechanized material handling system components</p>	

<p>Task C-14 Applies thermal insulation, lagging, cladding and flashing 8%</p>	<p>Sub-task C-14.01 Applies thermal insulation to components</p>	<p>Sub-task C-14.02 Applies lagging and cladding to components</p>	<p>Sub-task C-14.03 Applies flashing to components</p>
<p>Task C-15 Performs leak testing, air balancing and commissioning 8%</p>	<p>Sub-task C-15.01 Performs leak tests</p>	<p>Sub-task C-15.02 Performs testing, adjusting and balancing (TAB)</p>	<p>Sub-task C-15.03 Participates in the commissioning of air and material handling systems</p>

Major Work Activity D – Installs roofing and specialty products**10%**

Task D-16 Installs roofing and cladding systems 36%	Sub-task D-16.01 Lays out roof and walls	Sub-task D-16.02 Installs insulation, isolation material and building envelope components	Sub-task D-16.03 Installs roofing and cladding system components
	Sub-task D-16.04 Seals exposed joints	Sub-task D-16.05 Installs decking	
Task D-17 Installs exterior components 29%	Sub-task D-17.01 Prepares surface	Sub-task D-17.02 Fastens exterior components	
Task D-18 Installs specialty products 35%	Sub-task D-18.01 Installs stainless steel specialty products	Sub-task D-18.02 Installs non-stainless steel specialty products	Sub-task D-18.03 Installs marine products

Major Work Activity E – Performs maintenance and repair**7%**

Task E-19 Performs scheduled maintenance 50%	Sub-task E-19.01 Performs maintenance inspections	Sub-task E-19.02 Services components
Task E-20 Repairs faulty systems and components 50%	Sub-task E-20.01 Diagnoses system faults	Sub-task E-20.02 Repairs worn or faulty components

Harmonization of Apprenticeship Training

Provincial and territorial apprenticeship authorities are each responsible for their respective apprenticeship programs. In the spirit of continual improvement, and to facilitate mobility among apprentices in Canada, participating authorities have agreed to work towards harmonizing certain aspects of their programs where possible. After consulting with their stakeholders in the trade, they have reached consensus on the following elements. Note that implementation of these elements may vary from jurisdiction to jurisdiction, depending on their own circumstances. For more information on the implementation in any province and territory, please contact that jurisdiction’s apprenticeship authority.

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 this trade is 4.

3. Total Training Hours

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

4. Sequencing Topics and Related Sub-tasks

The topic titles in the table below are placed in a column for each apprenticeship level for technical training. Each topic is accompanied by the sub-tasks and their reference number. The topics in the grey shaded cells represent those that are covered “in context” with other training in the subsequent years.

Level 1	Level 2	Level 3	Level 4
	Context	Context	Context
	Safety and Health Related Functions	Safety and Health Related Functions	Safety and Health Related Functions
	Tools and Equipment	Tools and Equipment	Tools and Equipment
	Pattern Development	Pattern Development	Pattern Development
		Installation Site Preparation	Installation Site Preparation

Level 1	Level 2	Level 3	Level 4
		Organizes Work	Organizes Work
	Communication	Communication	Communication
			Specialty Product Fabrication
			Specialty Product Installation
		Chimney, Breeching and Venting Installation and Connection	Chimney, Breeching and Venting Installation and Connection
			Scheduled Maintenance
			Repair

Safety and Health Related Functions

1.01 Uses personal protective equipment (PPE) and safety equipment

1.02 Maintains safe work environment

1.03 Performs lock-out and tag-out procedures

1.04 Participates in healthy and respectful workplace practices

Level 1	Level 2	Level 3	Level 4
<p>Tools and Equipment</p> <p>2.01 Uses hand and portable power tools</p> <p>2.02 Uses shop tools and equipment</p> <p>2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment (ferrous)</p> <p>2.04 Uses resistance spot welding equipment</p> <p>2.07 Uses oxy-fuel, plasma arc and laser cutting equipment (oxy fuel and plasma arc in L1)</p> <p>2.09 Uses soldering and brazing equipment</p> <p>2.10 Uses measuring and layout equipment</p> <p>2.12 Uses access equipment</p> <p>2.13 Uses hoisting, rigging and positioning equipment</p>	<p>Tools and Equipment</p> <p>2.02 Uses shop tools and equipment</p> <p>2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment (ferrous)</p> <p>2.06 Uses shielded metal arc welding (SMAW) equipment</p> <p>2.09 Uses soldering and brazing equipment</p> <p>2.11 Uses testing and inspection devices</p>	<p>Tools and Equipment</p> <p>2.02 Uses shop tools and equipment</p> <p>2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment (non-ferrous)</p> <p>2.05 Uses gas tungsten arc welding (GTAW) equipment</p> <p>2.11 Uses testing and inspection devices</p>	<p>Tools and Equipment</p> <p>2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment (non-ferrous)</p> <p>2.07 Uses oxy-fuel, plasma arc and laser cutting equipment (laser cutting in L4)</p> <p>2.08 Uses laser welding and cleaning equipment (NOT COMMON CORE)</p> <p>2.11 Uses testing and inspection devices</p>

Level 1	Level 2	Level 3	Level 4
<p>Organizes Work</p> <p>3.01 Uses trade-related documentation</p> <p>3.02 Interprets drawings and project specifications</p> <p>3.03 Organizes materials and equipment for project</p>	<p>Organizes Work</p> <p>3.01 Uses trade-related documentation</p> <p>3.02 Interprets drawings and project specifications</p> <p>3.04 Performs basic design and field modifications</p>		<p>Organizes Work</p> <p>3.02 Interprets drawings and project specifications</p>
<p>Communication</p> <p>5.01 Uses communication techniques</p>			<p>Continuous Learning</p> <p>4.01 Upgrades in new trade practices and procedures</p> <p>4.02 Upgrades in emerging technologies</p>
			<p>Mentoring</p> <p>5.02 Uses mentoring techniques</p>

Level 1	Level 2	Level 3	Level 4
<p>Pattern Development</p> <p>6.01 Develops patterns using simple and straight line layout</p> <p>(Identification of other types of pattern development methods)</p>	<p>Pattern Development</p> <p>6.02 Develops patterns using parallel line method</p> <p>6.03 Develops patterns using radial line method</p> <p>6.04 Develops patterns using triangulation method</p>	<p>Pattern Development</p> <p>6.02 Develops patterns using parallel line method</p> <p>6.03 Develops patterns using radial line method</p> <p>6.04 Develops patterns using triangulation method</p>	<p>Pattern Development</p> <p>6.05 Uses computer technology for pattern development</p>
<p>Air/Material Handling Component Fabrication</p> <p>7.01 Cuts ductwork, fittings and components</p> <p>7.02 Forms ductwork, fittings and components</p> <p>7.03 Insulates ductwork, fittings and components</p> <p>7.04 Assembles ductwork, fittings and components</p> <p>7.06 Fabricates hanger systems, supports and bases</p>	<p>Air/Material Handling Component Fabrication</p> <p>7.02 Forms ductwork, fittings and components</p> <p>7.04 Assembles ductwork, fittings and components</p>	<p>Air/Material Handling Component Fabrication</p> <p>7.02 Forms ductwork, fittings and components</p> <p>7.04 Assembles ductwork, fittings and components</p>	<p>Air/Material Handling Component Fabrication</p> <p>7.02 Forms ductwork, fittings and components</p> <p>7.04 Assembles ductwork, fittings and components</p> <p>7.05 Fabricates dampers</p>

Level 1	Level 2	Level 3	Level 4
	<p>Flashing, Roofing, Sheeting, and Cladding Fabrication</p> <p>8.01 Cuts material for flashing, roofing, sheeting and cladding</p> <p>8.02 Forms flashing, roofing, sheeting and cladding</p>		
		<p>Specialty Product Fabrication</p> <p>9.01 Cuts material for specialty products</p> <p>9.02 Forms specialty products</p> <p>9.03 Assembles specialty products</p> <p>9.04 Finishes specialty products</p>	
		<p>Specialty Product Installation</p> <p>18.01 Installs stainless steel specialty products</p> <p>18.02 Installs non-stainless steel specialty products</p> <p>18.03 Installs marine products</p>	

Level 1	Level 2	Level 3	Level 4
	<p>Installation Site Preparation</p> <p>10.01 Performs on-site measurements</p> <p>10.02 Performs demolition for renovations</p> <p>10.03 Installs penetrations and sleeves</p> <p>10.04 Installs supports and bases</p> <p>10.05 Installs hangers, cables, braces, brackets and seismic restraints</p>		
	<p>Chimney, Breeching and Venting Installation and Connection</p> <p>11.01 Installs chimneys and stacks</p> <p>11.02 Connects appliances or mechanical equipment to chimney and breeching</p> <p>11.03 Installs high efficiency appliances and mechanical equipment</p>		

Level 1	Level 2	Level 3	Level 4
<p>Air Handling System Component Installation</p> <p>12.01 Installs air handling equipment</p> <p>12.02 Installs ductwork and fittings</p> <p>12.03 Installs dampers</p> <p>12.05 Installs registers, grilles, diffusers and louvers</p> <p>12.09 Installs plenums</p>	<p>Air Handling System Component Installation</p> <p>12.01 Installs air handling equipment</p> <p>12.04 Installs fire and fire/smoke dampers</p> <p>12.08 Installs system component accessories</p>	<p>Air Handling System Component Installation</p> <p>12.01 Installs air handling equipment</p> <p>12.06 Installs terminal boxes</p> <p>12.07 Installs coils and duct heaters</p> <p>12.08 Installs system component accessories</p> <p>12.09 Installs plenums</p>	<p>Air Handling System Component Installation</p> <p>12.01 Installs air handling equipment</p> <p>12.08 Installs system component accessories</p>
			<p>Material Handling System Component Installation</p> <p>13.01 Installs pneumatic and gravity material handling system components</p> <p>13.02 Installs mechanized material handling system components</p>

Level 1	Level 2	Level 3	Level 4
			<p>Thermal Insulation, Lagging, Cladding and Flashing</p> <p>14.01 Applies thermal insulation to components</p> <p>14.02 Applies lagging and cladding to components</p> <p>14.03 Applies flashing to components</p>
		<p>Leak Testing, Air Balancing, Commissioning</p> <p>15.01 Performs leak tests</p> <p>15.02 Performs testing, adjusting and balancing (TAB)</p> <p>15.03 Participates in the commissioning of air and material handling systems</p>	

Level 1	Level 2	Level 3	Level 4
	<p>Roofing and Cladding Systems</p> <p>16.01 Lays out roof and walls</p> <p>16.02 Installs insulation, isolation material and building envelope components</p> <p>16.03 Installs roofing and cladding system components</p> <p>16.04 Seals exposed joints</p> <p>16.05 Installs decking</p>		
	<p>Exterior Components Installation</p> <p>17.01 Prepares surface</p> <p>17.02 Fastens exterior components</p>		
		<p>Scheduled Maintenance</p> <p>19.01 Performs maintenance inspections</p> <p>19.02 Services components</p>	

Level 1	Level 2	Level 3	Level 4
		Repair 20.01 Diagnoses system faults 20.02 Repairs worn or faulty components	

Major Work Activity A – Performs common occupational skills

Task A-1 Maintains safe and healthy workplace

Task Descriptor

Sheet metal workers participate in ensuring a healthy and inclusive workplace. They must be able to protect themselves, others, property, and the environment. Therefore, they must comply with company and jurisdictional regulations. It is critical that they be constantly aware of their surroundings and the hazards they may encounter. The use and maintenance of personal protective equipment (PPE) and safety equipment are essential to every job.

A-1.01 Uses personal protective equipment (PPE) and safety equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.01.01P	select PPE and safety equipment	PPE and safety equipment are selected according to job requirements, jurisdictional regulations and site requirements
A-1.01.02P	inspect PPE and safety equipment	PPE and safety equipment are inspected before each use to verify operating condition and that they are free from damage
A-1.01.03P	verify that PPE fits properly	PPE is verified to ensure a proper fit according to safety standards
A-1.01.04P	identify site hazards and jurisdictional regulations requiring use of PPE and safety equipment	site hazards and jurisdictional regulations requiring use of PPE and safety equipment are identified according to inspections , toolbox talks and project specifications

A-1.01.05P	store PPE and safety equipment	PPE and safety equipment are stored to keep them free from contaminants and deterioration, and for longevity
A-1.01.06P	identify and remove from service worn, damaged and defective PPE and safety equipment	worn, damaged and defective PPE and safety equipment are identified and removed from service according to manufacturers' specifications and jurisdictional regulations
A-1.01.07P	maintain PPE and safety equipment and check certification and expiry dates	PPE and safety equipment is maintained , and certification and expiry dates are checked

Range of Variables (include, but not limited to)

jurisdictional regulations: Workplace Hazardous Material Information System (WHMIS), Occupational Health and Safety (OHS), Workers Compensation Board (WCB), site-specific regulations

inspections: pre-safety inspection (PSI), hazard assessments

maintenance: cleaning, disinfecting

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.01.01L	demonstrate knowledge of PPE and safety equipment, their characteristics, applications, maintenance, storage and procedures for use
	a. identify types of PPE and safety equipment, and describe their characteristics, applications and limitations
	b. describe operating principles of PPE and safety equipment
	c. interpret information about PPE and safety equipment found in specifications
A-1.01.02L	demonstrate knowledge of procedures to inspect, maintain, store and use PPE and safety equipment
	a. identify hazards, and describe safe work practices to use PPE and safety equipment
	b. describe procedures to inspect, maintain , store and use PPE and safety equipment
A-1.01.03L	demonstrate knowledge of additional training and certification requirements for PPE and safety equipment
	a. identify additional training and certification requirements for PPE and safety equipment

A-1.01.04L demonstrate knowledge of regulatory requirements for PPE and safety equipment

a. identify and interpret safety and health **jurisdictional regulations** and responsibilities to use PPE and safety equipment

b. describe roles and responsibilities of employers and employees to select and use PPE and safety equipment

Range of Variables (include, but not limited to)

inspections: pre-safety inspection (PSI), hazard assessments

maintenance: cleaning, disinfecting

jurisdictional regulations: Workplace Hazardous Material Information System (WHMIS), Occupational Health and Safety (OHS), Workers Compensation Board (WCB), site-specific regulations

A-1.02 Maintains safe work environment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.02.01P	perform preliminary site inspection	preliminary site inspection is performed according to site-specific practices to identify workplace hazards
A-1.02.02P	report workplace hazards	workplace hazards are reported
A-1.02.03P	install temporary safety protection	temporary safety protection is installed according to jurisdictional regulations or site-specific practices
A-1.02.04P	participate in daily or weekly toolbox meetings	toolbox meetings are held daily or weekly according to site-specific practices
A-1.02.05P	perform housekeeping tasks	housekeeping tasks are performed to prevent tripping hazards, falling objects and slips

A-1.02.06P	follow safety practices for using tools and equipment	safety practices for using tools and equipment are followed according to manufacturers' specifications and site-specific practices
A-1.02.07P	identify and report defects and deficiencies	defects and deficiencies are identified and reported according to site-specific practices

Range of Variables (include, but not limited to)

workplace hazards: fire, asbestos, hazardous openings, overhead hazards, fumes and particulate inhalation, arc flash, electrical shock, burns, damage to property, pinch/crush points, caustic substances, noise, working at heights, cuts, hazardous materials, confined spaces

safety protection: barriers to cover hazardous openings, guard rails, signage

jurisdictional regulations: WHMIS, OHS, WCB, site-specific regulations

housekeeping: sweeping, removing debris, storing materials and tools and equipment

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.02.01L	demonstrate knowledge of safe work practices and procedures
	a. describe company safety policies and procedures
	b. describe safe work practices, procedures and equipment
	c. describe good housekeeping practices
	d. interpret information about safe work practices and procedures found in specifications
	e. identify workplace hazards
	f. explain consequences of not identifying and reporting defects and deficiencies
A-1.02.02L	demonstrate knowledge of inspection procedures
	a. describe procedures to inspect sites
A-1.02.03L	demonstrate knowledge of additional training and certification requirements to perform safe work practices and procedures
	a. identify additional training and certification requirements to perform safe work practices and procedures
A-1.02.04L	demonstrate knowledge of regulatory requirements for safety
	a. identify and interpret workplace safety and health jurisdictional regulations
	b. identify safety protection used to secure sites

A-1.02.05L demonstrate knowledge of sustainability and environmental stewardship practices

- a. identify practices that contribute to environmental protection

Range of Variables (include, but not limited to)

safe work practices, procedures and equipment: lock-out/tag-out, fall arrest, awareness of hoisting practices, certification of mobile equipment, flagging/tapping off areas

housekeeping: sweeping, removing debris, storing materials and tools and equipment

workplace hazards: fire, asbestos, hazardous openings, overhead hazards, fumes and particulate inhalation, arc flash, electrical shock, burns, damage to property, pinch/crush points, caustic substances, noise, working at heights, cuts, hazardous materials, confined spaces

jurisdictional regulations: WHMIS, OHS, WCB, site-specific regulations

safety protection: barriers to cover hazardous openings, guard rails, signage

A-1.03 Performs lock-out and tag-out procedures

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.03.01P	coordinate lock-out and tag-out requirements	lock-out and tag-out requirements are coordinated with appropriate authorities and other trades according to jurisdictional regulations and job requirements
A-1.03.02P	locate all circuits and equipment that require lock-out and tag-out	circuits and equipment that require lock-out and tag-out are located according to job requirements
A-1.03.03P	select lock-out devices for lock-out and tag-out	lock-out devices are selected to ensure lock-out and tag-out according to job requirements and site policies
A-1.03.04P	isolate hazardous energies and de-energize locked-out equipment	hazardous energies are isolated and locked-out equipment is de-energized according to jurisdictional regulations

A-1.03.05P	verify lock-out and tag-out to be in zero energy state	lock-out and tag-out is verified to be in zero energy state by performing post-operational test
A-1.03.06P	remove lock-out and tag-out devices	lock-out and tag-out devices are removed after equipment has been repaired or replaced

Range of Variables (include, but not limited to)

lock-out devices: lock and key, chains and tags, lock-out scissor clamps, lock-box

hazardous energies: electricity, steam, fuel sources, hydraulic systems, pneumatic systems, magnetic systems, gravitational systems

locked-out equipment: machines, panels, valves, power tools

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.03.01L	demonstrate knowledge of lock-out and tag-out devices , their characteristics, applications and operation
	a. identify lock-out and tag-out devices , and describe their characteristics and applications
	b. describe operating principles of lock-out and tag-out devices
	c. interpret information about lock-out and tag-out devices found in specifications
A-1.03.02L	demonstrate knowledge of procedures to perform lock-out and tag-out
	a. identify situations, circuits and equipment that require lock-out and tag-out
	b. identify hazards, and describe safe work practices to perform lock-out and tag-out
	c. describe procedures to perform lock-out and tag-out on equipment and to remove lock-out and tag-out devices
A-1.03.03L	demonstrate knowledge of additional training and certification requirements to perform lock-out and tag-out
	a. identify additional training and certification requirements to perform lock-out and tag-out
A-1.03.04L	demonstrate knowledge of regulatory requirements to perform lock-out and tag-out
	a. identify safety jurisdictional regulations to perform lock-out and tag-out on hazardous energies equipment

Range of Variables (include, but not limited to)

lock-out devices: lock and key, chains and tags, lock-out scissor clamps, lock-box

hazardous energies: electricity, steam, fuel sources, hydraulic systems, pneumatic systems, magnetic systems, gravitational systems

A-1.04 Participates in healthy and respectful workplace practices

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.04.01P	perform self-assessment of physical and mental health	self-assessment of physical and mental health is performed, and health concerns are identified
A-1.04.02P	identify supports and resources for personal mental health	supports and resources for personal mental health are identified
A-1.04.03P	identify techniques to manage health and wellness	techniques to manage health and wellness are identified
A-1.04.04P	assess personal job satisfaction	personal job satisfaction is assessed, and concerns are discussed with management
A-1.04.05P	create plan to manage work-life balance	plan is created to manage work-life balance and discussed with supervisors
A-1.04.06P	support and promote anti- harassment and anti- discrimination practices in workplace	workplace is harassment and discrimination-free

Range of Variables (include, but not limited to)

supports and resources: professional networks and associations, collaboration with colleagues and community members, counselling, mentoring, peer support groups, paramedical services, employee assistance plan (EAP)

techniques to manage health and wellness: practicing techniques for remaining physically, psychologically, mentally and emotionally “fit for work”; managing personal and work life; recognizing effects and consequences of alcohol, over-the-counter drugs, prescription drugs or illegal drugs before, during and after work; using personal hygiene habits

personal job satisfaction: financial, hours, flexibility, supports, working conditions, goal setting mindset

harassment: as defined by Canadian and jurisdictional Human Rights Commissions

discrimination: as defined by Canadian Human Rights Act and jurisdictional human rights laws

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.04.01L	demonstrate knowledge of personal health and well-being
	a. describe how personal health and well-being impacts professional practice and healthy work environments
	b. identify and describe physical and emotional requirements of trade
	c. identify workplace stressors
	d. describe elements of healthy organizational cultures and importance of sense of collaboration and community
	e. identify behaviours that affect physical and mental health
A-1.04.02L	demonstrate knowledge of techniques to manage health and wellness
	a. describe stress and time management techniques
	b. identify supports to manage personal health and wellbeing
	c. describe techniques to manage health and wellness
A-1.04.03L	demonstrate knowledge of professionalism and professional ethics
	a. identify characteristics and purpose of professionalism and professional ethics
	b. describe factors that impact professionalism
	c. identify elements of codes of ethics, codes of conduct and other professional standards , and describe their characteristics and applications
A-1.04.04L	demonstrate knowledge of value of diversity, equity, inclusion and belonging in workplace
	a. recognize value of diversity and differences between individuals
	b. define equity and importance of individual's access to opportunities and resources
	c. define inclusion and creation of respectful work environments
	d. identify conduct that constitutes harassment and discrimination

Range of Variables (include, but not limited to)

behaviours: diet, fitness, sleep, managing stress and emotions

techniques to manage health and wellness: practicing techniques for remaining physically, psychologically, mentally and emotionally “fit for work”; managing personal and work life; recognizing effects and consequences of alcohol, over-the-counter drugs, prescription drugs or illegal drugs before, during and after work; using personal hygiene habits

professional ethics: personal and/or corporate standards of behavior expected by professionals; values and guiding principles to guide individuals in performing job functions

factors: presentation of self (appearance, hygiene), communication (verbal, written, body language, social media profile), conduct

elements of codes of ethics, codes of conduct and other professional standards: professional obligations signal accountability to public, maintain public trust and credibility of profession; define misconduct; support and promote anti-harassment and anti-discrimination practices

harassment: as defined by Canadian and jurisdictional Human Rights Commissions

discrimination: as defined by Canadian Human Rights Act and jurisdictional human rights laws

Task A-2 Uses and maintains tools and equipment

Task Descriptor

Sheet metal workers use and maintain tools and equipment to perform tasks in their trade. These include hoisting, rigging and positioning equipment and access equipment.

A-2.01 Uses hand and portable power tools

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.01.01P	select and use hand and portable power tools	hand and portable power tools are selected and used according to job requirements and manufacturers' specifications

A-2.01.02P	verify safety guards on power tools	safety guards on power tools are used according to manufacturers' specifications
A-2.01.03P	organize and store hand and portable power tools	hand and portable power tools are organized and stored in clean and dry environment to avoid damage
A-2.01.04P	clean and maintain hand and portable power tools	hand and portable power tools are cleaned and maintained to prevent corrosion and to promote ease of operation and longevity
A-2.01.05P	identify and replace worn, damaged and defective hand and portable power tools	worn, damaged and defective hand and portable power tools are tagged and removed from service
A-2.01.06P	charge batteries	batteries are charged according to manufacturers' specifications

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.01.01L	demonstrate knowledge of hand and portable power tools, their characteristics, applications and operations
	a. identify types of hand and portable power tools, and describe their characteristics and applications
	b. describe operating principles of hand and portable power tools
	c. interpret information about hand and portable power tools found in manufacturers' specifications
A-2.01.02L	demonstrate knowledge of procedures to use hand and portable power tools
	a. identify hazards, and describe safe work practices to use hand and portable power tools
	b. describe procedures to use hand and portable power tools
	c. describe procedures to maintain hand and portable power tools
	d. describe procedures to inspect hand and portable power tools
	e. identify criteria for replacement or repair of hand and portable power tools
A-2.01.03L	demonstrate knowledge of additional training and certification requirements to use powder-actuated tools

	a. identify additional training and certification requirements to use powder-actuated tools
A-2.01.04L	demonstrate knowledge of regulatory requirements to use powder-actuated tools
	a. identify specifications and jurisdictional regulations to use powder-actuated tools
A-2.01.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle hand tools and portable power tools

A-2.02 Uses shop tools and equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.02.01P	select and use shop tools and equipment	shop tools and equipment are selected and used according to job requirements and manufacturers' specifications
A-2.02.02P	clean and maintain shop tools and equipment	shop tools and equipment are cleaned and maintained to prevent corrosion and for ease of operation and longevity according to manufacturers' specifications
A-2.02.03P	identify and tag worn, damaged and defective shop tools and equipment	worn, damaged and defective shop tools and equipment are identified and tagged according to company policies and removed from service

A-2.02.04P	identify shop tools and equipment capacities, limitations and operational parameters	shop tools and equipment capacities, limitations and operational parameters are identified according to manufacturers' specifications
A-2.02.05P	change damaged, worn or dull components	damaged, worn or dull components are changed according to manufacturers' specifications
A-2.02.06P	monitor and top up fluids and gases for shop equipment	shop equipment is monitored for fluid and gas levels and topped up according to manufacturers' specifications and performance
A-2.02.07P	ensure exhaust procedures are followed	exhaust procedures are followed according to jurisdictional regulations and manufacturers' specifications

Range of Variables (include, but not limited to)

components: blades, dies, grinding wheels, grinding stones, safety guards, plasma/welding tips

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.02.01L	demonstrate knowledge of shop tools and equipment, their components , characteristics, applications and operation
	a. identify types of shop tools and equipment, and describe their characteristics and applications
	b. identify types of Computer Numerical Control (CNC) equipment , and describe their characteristics and applications
	c. describe operating principles of shop tools and equipment
	d. interpret information about shop tools and equipment found on warning and caution labels, and manufacturers' specifications
A-2.02.02L	demonstrate knowledge of procedures to use shop tools and equipment
	a. identify hazards, and describe safe work practices to use shop tools and equipment
	b. describe procedures to inspect shop tools and equipment
	c. describe procedures to maintain shop tools and equipment
	d. describe procedures to use shop tools and equipment

	e.	identify criteria for replacement or repair of shop tools and equipment
A-2.02.03L		demonstrate knowledge of additional training and certification requirements to use shop tools and equipment
	a.	identify additional training and certification requirements to use shop tools and equipment
A-2.02.04L		demonstrate knowledge of regulatory requirements to use shop tools and equipment
	a.	identify codes, standards and jurisdictional regulations to use shop tools and equipment
A-2.02.05L		demonstrate knowledge of sustainability and environmental stewardship practices
	a.	identify practices that contribute to environmental protection
	b.	describe procedures to dispose of and recycle shop tools and equipment
	c.	identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

components: blades, dies, grinding wheels, grinding stones, safety guards, plasma/welding tips

Computer Numerical Control (CNC) equipment: plasma tables, brake presses, laser cutting tables

A-2.03 Uses gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.03.01P	select gas metal arc welding (GMAW) and flux core arc welding (FCAW) equipment	GMAW and FCAW equipment are selected according to job requirements and manufacturers' specifications
A-2.03.02P	ensure work area is ventilated, and PPE is used	work area is ventilated according to project specifications and PPE is used according to job requirements

A-2.03.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.03.04P	set up GMAW and FCAW equipment	GMAW and FCAW equipment are set up according to job, material and manufacturers' specifications
A-2.03.05P	prepare material to be welded	material to be welded is prepared according to job requirements, material compatibility and engineered drawings
A-2.03.06P	select type of gases used for welding	type of gases used for welding are selected according to job requirements, material compatibility and manufacturers' specifications
A-2.03.07P	select and use welding wire	welding wire is selected and used according to job requirements, material compatibility and manufacturers' specifications
A-2.03.08P	perform welding process	welding process is performed according to job requirements, material compatibility and manufacturers' specifications
A-2.03.09P	inspect visual characteristics of weld	characteristics of weld are visually inspected for quality and deficiencies are identified

Range of Variables (include, but not limited to)

PPE: respirators, welding face shields, welding helmets, jackets/aprons, gloves

set up: polarity, gas flow rates, amperage, voltage, pre- and post-flow rates, run-in and run-out settings

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.03.01L	demonstrate knowledge of GMAW and FCAW equipment, their accessories , characteristics, applications and operation
	a. identify types of GMAW and FCAW equipment, consumables and accessories used to weld mild steel, aluminum and stainless steel, and describe their characteristics and applications
	b. describe operating principles of GMAW and FCAW equipment
	c. describe GMAW and FCAW process and its applications

	d. interpret symbols and information about GMAW and FCAW welding found on drawings and specifications
A-2.03.02L	demonstrate knowledge of procedures to weld using GMAW and FCAW equipment
	a. identify hazards , and describe safe work practices and procedures to use GMAW and FCAW equipment
	b. describe procedures to set up , adjust and shut down GMAW and FCAW equipment
	c. describe procedures to maintain and troubleshoot GMAW and FCAW equipment
	d. describe procedures to weld mild steel, aluminum and stainless steel using GMAW and FCAW equipment
	e. describe hot work procedures
	f. identify types of welds performed using GMAW and FCAW process
	g. identify weld characteristics and deficiencies
	h. describe weld defects , their causes and procedures to prevent and correct them
A-2.03.03L	demonstrate knowledge of additional training and certification requirements to use GMAW and FCAW equipment
	a. identify additional training and certification requirements to use GMAW and FCAW equipment
A-2.03.04L	demonstrate knowledge of regulatory requirements to use GMAW and FCAW equipment
	a. identify codes, standards and jurisdictional regulations to use GMAW and FCAW equipment
A-2.03.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle GMAW and FCAW equipment and consumables
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

accessories: chill bars/chill plates, strongbacks, foot pedals, water coolers, spool guns

hazards: fumes and particulate inhalation, arc flash, electrical shock, burns, damage to property

safe work practices and procedures: use of PPE, following confined space procedures, obtaining required permits, fire watch, positioning welding screens

set up: polarity, gas flow rates, amperage, voltage, pre- and post-flow rates, run-in and run-out settings

types of welds: plug, fillet, stitch, tack, edge, corner

weld defects: porosity, cracks, warping/distortion, undercut

A-2.04 Uses resistance spot welding equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.04.01P	select resistance spot welding equipment	resistance spot welding equipment is selected according to job requirements and manufacturers' specifications
A-2.04.02P	inspect and maintain resistance spot welding equipment	resistance spot welding equipment is maintained according to manufacturers' specifications
A-2.04.03P	ensure work area is ventilated, and PPE is used	work area is ventilated according to jurisdictional regulations and PPE is used according to job requirements
A-2.04.04P	set up and adjust spot welding equipment	spot welding equipment is set up and adjusted according to job, material and manufacturers' specifications
A-2.04.05P	prepare material to be welded	material to be welded is prepared according to job requirements, material compatibility and manufacturers' specifications
A-2.04.06P	perform spot welding process	spot welding process is performed according to job requirements, material compatibility and manufacturers' specifications
A-2.04.07P	verify welds	welds are verified to confirm fusion meets job requirements and deficiencies are identified

Range of Variables (include, but not limited to)

PPE: safety glasses, safety shields, gloves

set up and adjust: set time, determine amperage, adjust pressure, sharpen tips

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.04.01L	demonstrate knowledge of resistance spot welding equipment, their consumables, accessories, characteristics, applications and operation
	a. identify resistance spot welding equipment, and describe its characteristics and applications
	b. describe operating principles of resistance spot welding equipment
	c. interpret symbols and information about resistance spot welding equipment found on drawings and specifications
	d. identify considerations when determining resistance spot welding equipment setup
	e. describe procedures used to set up and adjust resistance spot welding equipment
	f. describe procedures to inspect resistance spot welding equipment
	g. describe procedures to maintain resistance spot welding equipment
	h. describe weld defects , their causes and procedures used to prevent and correct them
A-2.04.02L	demonstrate knowledge of procedures to weld using resistance spot welding equipment
	a. identify hazards , and describe safe work practices and procedures to use resistance spot welding equipment
	b. describe procedures to weld using resistance spot welding process
A-2.04.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle resistance spot welding equipment and consumables

Range of Variables (include, but not limited to)

considerations when determining resistance spot welding equipment setup:
specification requirements, base metal, properties, thickness

set up and adjust: set time, determine amperage, adjust pressure, sharpen tips

weld defects: burn through, incorrect fusion

hazards: pinch/crush points, burns, electrical shock, fire

safe work practices and procedures: using PPE, following confined space procedures, obtaining required permits

A-2.05 Uses gas tungsten arc welding (GTAW) equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.05.01P	select gas tungsten arc welding (GTAW) equipment	GTAW equipment is selected according to job requirements and manufacturers' specifications
A-2.05.02P	ensure work area is ventilated, and PPE is used	work area is ventilated according to project specifications and PPE is used according to job requirements
A-2.05.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.05.04P	set up GTAW equipment	GTAW equipment is set up according to job, material and manufacturers' specifications
A-2.05.05P	prepare material to be welded	material to be welded is prepared according to job requirements and material compatibility
A-2.05.06P	select type of gases used for welding	type of gases used for welding are selected according to job requirements, material compatibility and manufacturers' specifications
A-2.05.07P	select tungsten electrode	tungsten electrode is selected according to job requirements, material compatibility and manufacturers' specifications
A-2.05.08P	select and use filler material	filler material is selected and used according to job requirements, material compatibility and manufacturers' specifications

A-2.05.09P	perform GTAW processes	GTAW processes are performed according to job requirements, material compatibility and manufacturers' specifications
A-2.05.10P	inspect visual characteristics of weld	characteristics of weld are visually inspected for quality, and deficiencies are identified

Range of Variables (include, but not limited to)

PPE: respirators, welding face shields, welding helmets, jackets/aprons, gloves

set up: polarity, gas flow rates, amperage, pre- and post-flow rates, run-in and run-out settings

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.05.01L	demonstrate knowledge of GTAW equipment, its consumables, accessories , characteristics, applications and operation
	a. identify GTAW equipment, its consumables and accessories , and describe their characteristics and applications
	b. describe operating principles of GTAW equipment
	c. interpret symbols and information about GTAW equipment found on drawings and specifications
A-2.05.02L	demonstrate knowledge of procedures to weld using GTAW process
	a. identify hazards , and describe safe work practices and procedures to use GTAW equipment
	b. describe procedures to set up , adjust and shut down GTAW equipment
	c. describe procedures to maintain and troubleshoot GTAW equipment
	d. describe procedures to weld mild steel, aluminum and stainless steel using GTAW process
	e. describe hot work procedures
	f. identify types of welds performed using GTAW process
	g. identify weld characteristics and deficiencies
	h. describe weld defects , their causes and procedures used to prevent and correct them
A-2.05.03L	demonstrate knowledge of additional training and certification requirements to use GTAW equipment

	a. identify additional training and certification requirements to use GTAW equipment
A-2.05.04L	demonstrate knowledge of regulatory requirements to use GTAW equipment
	a. identify codes, standards and jurisdictional regulations to use GTAW equipment
A-2.05.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle GTAW equipment and consumables
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

accessories: chill bars/chill plates, strongbacks, foot pedals, tungsten grinders

hazards: fumes and particulate inhalation, arc flash, burns, damage to property, fire, electrical shock

safe work practices and procedures: using PPE, following confined space procedures, obtaining required permits, fire watch, positioning welding screens

set up: polarity, gas flow rates, amperage, pre- and post-flow rates, run-in and run-out settings

types of welds performed: plug, fillet, stitch, tack, edge, corner

weld defects: porosity, cracks, warping/distortion, undercut

A-2.06 Uses shielded metal arc welding (SMAW) equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.06.01P	select shielded metal arc welding (SMAW) equipment	SMAW equipment is selected according to job requirements and manufacturers' specifications
A-2.06.02P	ensure work area is ventilated, and PPE is used	work area is ventilated according to project specifications and PPE is used according to job requirements

A-2.06.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.06.04P	set up SMAW equipment	SMAW equipment is set up according to job, material and manufacturers' specifications
A-2.06.05P	prepare material to be welded	material to be welded is prepared according to job requirements and material compatibility
A-2.06.06P	select electrode	electrode is selected according to job requirements, material compatibility and manufacturers' specifications
A-2.06.07P	perform SMAW processes	SMAW processes are performed according to job requirements, material compatibility and manufacturers' specifications
A-2.06.08P	remove slag	slag is removed
A-2.06.09P	inspect visual characteristics of weld	characteristics of weld are visually inspected for quality, and deficiencies are identified

Range of Variables (include, but not limited to)

PPE: respirators, welding face shields, welding helmets, jackets/aprons, gloves

set up: polarity, amperage, run-in and run-out settings

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.06.01L	demonstrate knowledge of SMAW equipment, its accessories, consumables, characteristics, applications and operation
	a. identify SMAW equipment and its accessories, and describe their characteristics, limitations and applications
	b. identify consumables used for SMAW welding
	c. describe operating principles of SMAW equipment
	d. interpret electrode numbering system for application
	e. interpret symbols and information about SMAW equipment found on drawings and specifications
A-2.06.02L	demonstrate knowledge of procedures to weld using SMAW process

	a. identify hazards , and describe safe work practices and procedures to use SMAW equipment
	b. identify types of welds performed using SMAW process
	c. describe procedures to set up, adjust and shut down SMAW equipment
	d. describe procedures used to maintain and troubleshoot SMAW equipment
	e. describe hot work procedures
	f. describe procedures to weld mild steel, aluminum and stainless steel using SMAW process
	g. describe weld defects , their causes and procedures used to prevent and correct them
A-2.06.03L	demonstrate knowledge of additional training and certification requirements to use SMAW equipment
	a. identify additional training and certification requirements to use SMAW equipment
A-2.06.04L	demonstrate knowledge of regulatory requirements to use SMAW equipment
	a. identify codes, standards and jurisdictional regulations to use SMAW equipment
A-2.06.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle SMAW equipment and their consumables
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

hazards: fumes and particulate inhalation, arc flash, burns, damage to property, fire, electrical shock

safe work practices and procedures: using PPE, following confined space procedures, obtaining required permits, fire watch, positioning welding screens

types of welds performed: plug, fillet, stitch, tack, edge, corner

weld defects: porosity, cracks, warping/distortion, undercut

A-2.07 Uses oxy-fuel, plasma arc and laser cutting equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.07.01P	select oxy-fuel, plasma arc or laser cutting equipment	oxy-fuel, plasma arc or laser cutting equipment is selected according to job requirements
A-2.07.02P	ensure work area is ventilated, and PPE is used	work area is ventilated according to project specifications and PPE is used according to job requirements and jurisdictional regulations
A-2.07.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.07.04P	set up oxy-fuel, plasma arc or laser cutting equipment	oxy-fuel, plasma arc or laser cutting equipment is set up according to job requirements, material and manufacturers' specifications
A-2.07.05P	identify and prepare material to be cut	material to be cut is identified and prepared according to project and manufacturers' specifications
A-2.07.06P	select gases for cutting	gases for cutting are selected according to job requirements and manufacturers' specifications
A-2.07.07P	perform oxy-fuel cutting procedures	oxy-fuel cutting procedures are performed according to type of materials to be cut and site conditions
A-2.07.08P	perform plasma arc cutting procedures	plasma arc cutting procedures are performed according to type of materials to be cut and site conditions
A-2.07.09P	perform laser cutting procedures	laser cutting procedures are performed according to type of materials to be cut and site conditions

A-2.07.10P	select and maintain torch tips on oxy-fuel, plasma arc and laser cutting equipment	torch tips on oxy-fuel, plasma arc and laser cutting equipment are selected and maintained according to manufacturers' specifications
A-2.07.11P	inspect oxy-fuel cutting defects	cuts are visually inspected for quality, and deficiencies are identified
A-2.07.12P	inspect plasma arc cutting defects	cuts are visually inspected for quality, and deficiencies are identified
A-2.07.13P	inspect laser cutting defects	cuts are visually inspected for quality, and deficiencies are identified
A-2.07.14P	perform shut down procedures	shut down procedures are performed according to manufacturers' specifications
A-2.07.15P	perform post-cut cleaning	post-cut cleaning is performed according to job requirements

Range of Variables (include, but not limited to)

PPE: respirators, eye protection, jackets/aprons, gloves

gases: butane, propane, acetylene, oxygen, other assorted compressed gases, nitrogen

cutting defects: slag, kerf, speed, angle

post-cut cleaning: grinding, cleaning, chipping slag

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.07.01L	demonstrate knowledge of oxy-fuel, plasma arc and laser cutting equipment, their accessories, characteristics, applications and operation
	a. identify oxy-fuel, plasma arc and laser cutting equipment and their accessories, and describe their characteristics and applications
	b. describe operating principles of oxy-fuel, plasma arc and laser cutting equipment
	c. interpret symbols and information about oxy-fuel, plasma arc and laser cutting equipment found on drawings and specifications
	d. identify gases used with oxy-fuel, plasma arc and laser cutting equipment
A-2.07.02L	demonstrate knowledge of procedures to use oxy-fuel, plasma arc and laser cutting equipment

	a. identify hazards , and describe safe work practices and procedures to use oxy-fuel, plasma arc and laser cutting equipment
	b. describe hot work procedures
	c. describe procedures to prepare materials using oxy-fuel, plasma arc and laser cutting equipment
	d. describe procedures to cut materials using oxy-fuel, plasma arc and laser cutting equipment
	e. describe cutting defects , their causes and procedures used to prevent and correct them
	f. describe post-cut cleaning procedures
A-2.07.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection

Range of Variables (include, but not limited to)

gases: butane, propane, acetylene, oxygen, other assorted compressed gases, nitrogen

hazards: fumes and particulates inhalation, burns, damage to property, fire, electrical shock, bright light

safe work practices and procedures: using PPE, following confined space procedures, obtaining required permits, fire watch

cutting defects: slag, kerf, speed, angle

post-cut cleaning: grinding, cleaning, chipping slag

A-2.08 Uses laser welding and cleaning equipment (NOT COMMON CORE)

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
no	no	NV	yes	yes	yes	yes	yes	yes	no	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.08.01P	select laser welding and cleaning equipment	laser welding and cleaning equipment is selected according to job requirements, manufacturers' specifications and engineered drawings

A-2.08.02P	ensure work area is ventilated, and PPE and safety equipment is used	work area is ventilated according to project specifications and PPE and safety equipment is used according to job requirements
A-2.08.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.08.04P	set up laser welding and cleaning equipment	laser welding and cleaning equipment is set up according to job requirements, material and manufacturers' specifications
A-2.08.05P	identify and prepare material to be welded or cleaned	material to be welded or cleaned is identified and prepared according to job requirements and manufacturers' specifications
A-2.08.06P	select gases for welding and cleaning	gases for welding and cleaning are selected according to manufacturers' specifications
A-2.08.07P	perform laser welding procedures	laser welding procedures are performed according to type of materials to be welded, site conditions and jurisdictional regulations
A-2.08.08P	perform laser cleaning procedures	laser cleaning procedures are performed according to type of materials to be cleaned, site conditions and jurisdictional regulations
A-2.08.09P	select and maintain torch tips on laser welding and cleaning equipment	torch tips on laser welding and cleaning equipment are selected and maintained according to manufacturers' specifications
A-2.08.10P	inspect welding and cleaning defects	welds are visually inspected for quality, and deficiencies are identified
A-2.08.11P	perform shut down procedures	shut down procedures are performed according to manufacturers' specifications

Range of Variables (include, but not limited to)

PPE and safety equipment: respirators, eye protection, jackets/aprons, gloves, laser welding helmet, automatic kill switch

gases: butane, propane, acetylene, oxygen, other assorted compressed gases

welding and cleaning defects: slag, kerf, speed, angle

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.08.01L	demonstrate knowledge of laser welding and cleaning equipment, their accessories, characteristics, applications and operation
	a. identify laser welding and cleaning equipment and their accessories, and describe their characteristics and applications
	b. describe operating principles of laser welding and cleaning equipment
	c. interpret symbols and information about laser welding and cleaning equipment found on drawings and specifications
	d. identify gases used with laser welding and cleaning equipment
A-2.08.02L	demonstrate knowledge of procedures to use laser welding and cleaning equipment
	a. identify hazards , and describe safe work practices and procedures to use laser welding and cleaning equipment
	b. describe hot work procedures
	c. describe procedures to prepare materials using laser welding and cleaning equipment
	d. describe procedures to weld and clean materials using laser welding and cleaning equipment
	e. describe welding and cleaning defects , their causes and procedures used to prevent and correct them
A-2.08.03L	demonstrate knowledge of additional training and certification requirements to use laser welding and cleaning equipment
	a. identify additional training and certification requirements to use laser welding and cleaning equipment
A-2.08.04L	demonstrate knowledge of regulatory requirements to use laser welding and cleaning equipment
	a. identify codes, standards and jurisdictional regulations to use laser welding and cleaning equipment
A-2.08.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe procedures to dispose of and recycle laser welding and cleaning equipment

Range of Variables (include, but not limited to)

gases: butane, propane, acetylene, oxygen, other assorted compressed gases

hazards: fumes and particulates inhalation, burns, damage to property, fire, electrical shock

safe work practices and procedures: using PPE, following confined space procedures, obtaining required permits, fire watch

welding and cleaning defects: slag, kerf, speed, angle

A-2.09 Uses soldering and brazing equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.09.01P	select soldering and brazing equipment	soldering and brazing equipment is selected according to job requirements and manufacturers' specifications
A-2.09.02P	ensure work area is ventilated, and PPE is used	work area is ventilated according to project specifications and PPE is used according to job requirements
A-2.09.03P	follow hot work procedures	hot work procedures are followed according to job requirements
A-2.09.04P	set up soldering and brazing equipment	soldering and brazing equipment is set up according to job requirements, material and manufacturers' specifications
A-2.09.05P	clean and replace torch tips on brazing equipment	torch tips on brazing equipment are cleaned and replaced according to manufacturers' specifications
A-2.09.06P	clean and tin soldering irons	soldering irons are cleaned and tinned according to manufacturers' specifications

A-2.09.07P	perform soldering and brazing procedures	soldering and brazing procedures are performed according to type of materials to be fastened, site conditions and jurisdictional regulations
A-2.09.08P	store soldering and brazing equipment and supplies	soldering and brazing equipment and supplies are stored to avoid damage or injury according to jurisdictional regulations

Range of Variables (include, but not limited to)

PPE: respirators, eye protection, jackets/aprons, gloves

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.09.01L	demonstrate knowledge of soldering and brazing equipment, their accessories, characteristics, applications and operation
	a. identify types of soldering and brazing equipment and their accessories, and describe their characteristics and applications
	b. describe operating principles of soldering and brazing equipment
	c. interpret information about soldering and brazing equipment found on drawings and specifications
A-2.09.02L	demonstrate knowledge of procedures to use soldering and brazing equipment
	a. identify hazards, and describe safe work practices and procedures to use soldering and brazing equipment
	b. describe hot work procedures
	c. describe procedures to maintain and troubleshoot soldering and brazing equipment
	d. describe procedures to set up, adjust and shut down soldering and brazing equipment
	e. identify materials used to solder and braze, and describe their applications
	f. identify differences between hard soldering and soft soldering
	g. describe procedures used to solder and braze different types of metals
A-2.09.03L	demonstrate knowledge of regulatory requirements to use soldering and brazing equipment
	a. identify codes, standards and jurisdictional regulations to use soldering and brazing equipment

A-2.09.04L demonstrate knowledge of sustainability and environmental stewardship practices

- a. describe procedures to dispose of and recycle soldering and brazing equipment and consumables
-

Range of Variables (include, but not limited to)

safe work practices and procedures: using PPE, following WHMIS, following confined space procedures, obtaining required permits, fire watch

materials: fluxes, solders, fillers, fuel source

A-2.10 Uses measuring and layout equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.10.01P	select measuring and layout equipment	measuring and layout equipment is selected according to job requirements, manufacturers' specifications, drawings and dimensions
A-2.10.02P	clean and maintain measuring and layout equipment	measuring and layout equipment is cleaned and maintained
A-2.10.03P	verify accuracy of measuring equipment	accuracy of measuring equipment is verified according to manufacturers' specifications
A-2.10.04P	perform measuring and layout procedures	measuring and layout procedures are performed according to type of materials to be cut and site conditions

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.10.01L	demonstrate knowledge of measuring and layout equipment, their characteristics, applications and operation
	a. identify types of measuring and layout equipment, and describe their characteristics and applications
	b. identify types of drafting tools, and describe their characteristics and applications
	c. describe operating principles of measuring and layout equipment
	d. interpret information about measuring and layout equipment found on drawings and specifications
A-2.10.02L	demonstrate knowledge of procedures to use measuring and layout equipment
	a. identify hazards, and describe safe work practices and procedures to use measuring and layout equipment
	b. describe procedures to use measuring and layout equipment
	c. describe procedures to inspect and maintain measuring and layout equipment

A-2.11 Uses testing and inspection devices

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.11.01P	select testing and inspection devices	testing and inspection devices are selected according to project and manufacturers' specifications
A-2.11.02P	identify, tag and remove from service defective testing and inspection devices	defective testing and inspection devices are identified, tagged and removed from service according to manufacturers' specifications

A-2.11.03P	follow manufacturers' recommendations for regular calibration of testing and inspection devices	manufacturers' recommendations for regular calibration of testing and inspection devices are followed
A-2.11.04P	check service records of testing and inspection devices	service records of testing and inspection devices are checked prior to use to ensure effective operation
A-2.11.05P	use testing and inspection devices	testing and inspection devices are used according to project and manufacturers' specifications
A-2.11.06P	store testing and inspection devices	testing and inspection devices are stored according to manufacturers' specifications

Knowledge

Reference Code	Learning Outcomes and Objectives	
A-2.11.01L	demonstrate knowledge of testing and inspection devices, their components, characteristics, applications and operation	
	a. identify types of testing and inspection devices, and describe their characteristics and applications	
	b. describe operating principles of testing and inspection devices	
	c. interpret information about testing and inspection devices found on drawings and specifications	
A-2.11.02L	demonstrate knowledge of procedures to use testing and inspection devices	
	a. identify hazards, and describe safe work practices and procedures to use testing and inspection devices	
	b. describe procedures to inspect, maintain and store testing and inspection devices	
	c. describe procedures to set up and use testing and inspection devices	
A-2.11.03L	demonstrate knowledge of sustainability and environmental stewardship practices	
	a. identify practices that contribute to environmental protection	

A-2.12 Uses access equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.12.01P	select access equipment	access equipment is selected according to size, site conditions, job requirements and jurisdictional regulations
A-2.12.02P	inspect, identify, tag and remove from service worn, damaged and defective access equipment	access equipment is inspected for damage and missing components, and are tagged and removed from service according to site requirements, project specifications and jurisdictional regulations
A-2.12.03P	identify hazards when erecting access equipment	hazards are identified according to site conditions
A-2.12.04P	secure access equipment	access equipment is secured according to safety regulations and manufacturers' specifications
A-2.12.05P	erect, level and remove access equipment	access equipment is erected, levelled and removed according to site requirements and jurisdictional regulations
A-2.12.06P	operate access equipment within limitations	access equipment is operated within limitations according to manufacturers' specifications and jurisdictional regulations
A-2.12.07P	document safe work procedures and maintenance	safe work procedures and maintenance are documented according to jurisdictional regulations and manufacturers' specifications

Range of Variables (include, but not limited to)

hazards: power lines, excess loads, uneven surfaces, pinch points, crush injuries

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.12.01L	demonstrate knowledge of access equipment, their components, characteristics, applications and operation
	a. identify types of access equipment, and describe their characteristics and applications
	b. describe operating principles of access equipment
	c. interpret information about access equipment found on drawings and specifications
A-2.12.02L	demonstrate knowledge of procedures to use access equipment
	a. identify hazards , and describe safe work practices and procedures to use access equipment
	b. describe procedures to erect and remove access equipment
	c. describe procedures to inspect, maintain and store access equipment
A-2.12.03L	demonstrate knowledge of additional training and certification requirements to use access equipment
	a. identify additional training and certification requirements to use access equipment
A-2.12.04L	demonstrate knowledge of regulatory requirements to use access equipment
	a. identify codes, standards and jurisdictional regulations to use access equipment
A-2.12.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe procedures to dispose of and recycle access equipment
	b. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

hazards: power lines, excess loads, uneven surfaces, pinch points, crush injuries

A-2.13 Uses hoisting, rigging and positioning equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.13.01P	select hoisting, rigging and positioning equipment	hoisting, rigging and positioning equipment is selected according to job requirements, load size and capacities
A-2.13.02P	inspect hoisting, rigging and positioning equipment before and after use	hoisting, rigging and positioning equipment is inspected before and after use according to manufacturers' specifications and jurisdictional regulations
A-2.13.03P	identify worn, damaged or defective hoisting, rigging and positioning equipment, and tag and remove from service	worn, damaged or defective hoisting, rigging and positioning equipment is identified, tagged and removed from service according to manufacturers' specifications and jurisdictional regulations
A-2.13.04P	set up hoisting, rigging and positioning equipment	hoisting, rigging and positioning equipment is set up according to job requirements, material, manufacturers' specifications and jurisdictional regulations
A-2.13.05P	maintain hoisting, rigging and positioning equipment	hoisting, rigging and positioning equipment is maintained according to manufacturers' specifications and jurisdictional regulations
A-2.13.06P	identify centre of gravity of load	centre of gravity of load is identified according to drawings and pre-lift checks
A-2.13.07P	secure load to rigging	load is secured to rigging using rigging equipment according to manufacturers' specifications and jurisdictional regulations

A-2.13.08P	communicate with personnel involved in lift	personnel involved in lift use procedures used to communicate
A-2.13.09P	restrict access to lift area	access to lift area is restricted using barriers
A-2.13.10P	perform hoisting, rigging and positioning procedures	hoisting, rigging and positioning procedures are performed according to project specifications, site and environmental conditions, and jurisdictional regulations
A-2.13.11P	store hoisting, rigging and positioning equipment	hoisting, rigging and positioning equipment is stored according to jurisdictional regulations and manufacturers' specifications

Range of Variables (include, but not limited to)

procedures used to communicate: hand signals, electronic communications, audible/visual

barriers: signs, barricades, danger/caution tape

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.13.01L	demonstrate knowledge of hoisting, rigging and positioning equipment, their characteristics, limitations, applications and operation
	a. identify types of hoisting, rigging and positioning equipment, and describe their characteristics, limitations and applications
	b. describe operating principles of hoisting, rigging and positioning equipment
	c. interpret information about hoisting, rigging and positioning equipment found on drawings and specifications
A-2.13.02L	demonstrate knowledge of procedures to use hoisting, rigging and positioning equipment
	a. identify hazards, and describe safe work practices and procedures to use hoisting, rigging and positioning equipment
	b. identify factors to consider when selecting hoisting, rigging and positioning equipment
	c. describe procedures used to communicate during hoisting, rigging and positioning operations
	d. describe procedures used to ensure work area is safe for hoisting, rigging and positioning operations

	e. describe procedures to inspect, maintain and store hoisting, rigging and positioning equipment
A-2.13.03L	demonstrate knowledge of basic hoisting, rigging and positioning techniques
	a. identify types of knots, hitches, splices and bends , and describe procedures used to tie them
	b. identify types of slings
	c. determine sling angle when preparing for hoisting and positioning operations
	d. describe procedures used for attaching rigging equipment to load
	e. describe procedures used to perform lift
A-2.13.04L	demonstrate knowledge of additional training and certification requirements to use hoisting, rigging and positioning equipment
	a. identify additional training and certification requirements to use hoisting, rigging and positioning equipment
A-2.13.05L	demonstrate knowledge of regulatory requirements to use hoisting, rigging and positioning
	a. identify codes, standards and jurisdictional regulations to use hoisting, rigging and positioning

Range of Variables (include, but not limited to)

factors to consider: load characteristics, environment, safety factors, anchor points, sling angles

procedures used to communicate: hand signals, electronic communications, audible/visual

barriers: signs, barricades, danger/caution tape

procedures used to ensure work area is safe: supervision of lift, securing work area, communication

types of knots, hitches, splices and bends: bowline, running bowline, square/reef, half-hitch, barrel hitch

procedures used to perform lift: load determination, communication methods, pre-lift checks, placement of load, post-lift inspection

Task A-3 Organizes Work

Task Descriptor

To organize their work, sheet metal workers must be able to use documents and drawings, plan their project tasks, and obtain and organize required materials. A well-organized job reduces costs, minimizes mistakes and ensures a productive and safe workplace.

A-3.01 Uses trade-related documentation

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.01.01P	fill out trade-related documentation	trade-related documentation is filled out according to trade and shop standards
A-3.01.02P	complete safety-related documentation	safety-related documentation is completed according to jurisdictional regulations and company policies
A-3.01.03P	record maintenance, repairs and recommendations for follow-up action	maintenance, repairs and recommendations are recorded for follow-up action according to company policies
A-3.01.04P	sketch and dimension components to be fabricated and assembled	components to be fabricated and assembled are sketched and dimensioned according to shop standards
A-3.01.05P	complete material take-off lists (tear sheets)	material take-off lists (tear sheets) are completed with information according to drawings and project specifications
A-3.01.06P	review maintenance records and safety-related documentation	maintenance records and safety-related documentation are reviewed to identify potential hazards

A-3.01.07P	locate information in reference materials	information in reference materials is located for job planning and to ensure project specifications are met
A-3.01.08P	complete deficiency reports for quality control	deficiency reports are completed for quality control according to manufacturers' specifications and reference materials

Range of Variables (include, but not limited to)

trade-related documentation: timecards, as-builts, work orders, change orders, change directives, invoices, requests for information (RFI), drawings and specifications

safety-related documentation: accident/incident reports, near-miss reports, safety inspection reports, WHMIS labels, Safety Data Sheets (SDS), job hazard assessments

material take-off lists: material estimation, material installation

information: material and equipment needed, number of components to be fabricated

reference materials: Sheet Metal and Air Conditioning National Association (SMACNA), local and national construction codes, drawings and specifications, manufacturers' specifications, standards

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.01.01L	demonstrate knowledge of trade-related and safety-related documentation , their characteristics and applications
	a. identify types of trade-related and safety-related documentation , and describe their characteristics and applications
A-3.01.02L	demonstrate knowledge of procedures to prepare trade-related and safety-related documentation
	a. explain responsibilities associated with completing and signing trade-related and safety-related documentation
	b. describe procedures used to complete trade-related and safety-related documentation
	c. describe procedures to develop and interpret sketches
	d. identify types of material take-off lists , and describe their applications and procedures used to produce them
A-3.01.03L	demonstrate knowledge of additional training and certification requirements to complete trade-related and safety-related documentation
	a. identify additional training and certification requirements to complete trade-related and safety-related documentation

A-3.01.04L demonstrate knowledge of regulatory requirements for **trade-related** and **safety-related documentation**

- a. identify codes, standards and jurisdictional regulations for **trade-related** and **safety-related documentation**

Range of Variables (include, but not limited to)

trade-related documentation: timecards, as-builts, work orders, change orders, change directives, invoices, requests for information (RFI), drawings and specifications

safety-related documentation: accident/incident reports, near-miss reports, safety inspection reports, WHMIS labels, Safety Data Sheets (SDS), job hazard assessments

material take-off lists: material estimation, material installation

A-3.02 Interprets drawings and project specifications

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.02.01P	locate information on drawings	information on drawings is located
A-3.02.02P	interpret sizing of actual dimensions	sizing of actual dimensions is interpreted according to scale readings
A-3.02.03P	check drawings for dimensioning and locations	drawings are checked for dimensioning and locations
A-3.02.04P	identify obstructions and needs for coordinating work with others	obstructions are identified by visualizing finished product and work is coordinated with others to facilitate installation
A-3.02.05P	cross-reference information on drawings	information on drawings is cross-referenced with project specifications and reference materials

Range of Variables (include, but not limited to)

drawings: pictorial, orthographic, architectural, mechanical, structural, electrical, interference, shop, sketches, as-builts, legends, schedules, details, prints

reference materials: SMACNA, local and national construction codes, drawings, specifications

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.02.01L	demonstrate knowledge of drawings and project specifications, their characteristics and applications
	a. identify types of drawings and project specifications, and describe their characteristics and applications
	b. identify views used on drawings
	c. identify parts of a drawing and describe their purpose and applications
	d. explain purpose of drawings and project specifications
A-3.02.02L	demonstrate knowledge of procedures to interpret and extract information from drawings and project specifications
	a. identify and interpret common symbols and abbreviations found on drawings
	b. describe how to use scale rulers
	c. describe metric and imperial systems of measurement
A-3.02.03L	demonstrate knowledge of additional training and certification requirements for drawings for dimensioning and locations
	a. identify additional training and certification requirements for drawings for dimensioning and locations
A-3.02.04L	demonstrate knowledge of other trades and mechanical interferences
	a. identify codes, standards and jurisdictional regulations for other trades and mechanical interferences

Range of Variables (include, but not limited to)

drawings: pictorial, orthographic, architectural, mechanical, structural, electrical, interference, shop, sketches, as-builts, legends, schedules, details, prints

views used on drawings: elevation, plan, section, detail, auxiliary, orthographic, isometric

parts of a drawing: lines, legend, symbols, abbreviations, title block, notes, specifications

A-3.03 Organizes materials and equipment for project

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.03.01P	use materials and equipment	materials and equipment are used according to job requirements
A-3.03.02P	label materials and equipment	materials and equipment are labelled by transferring information from drawings to fittings to ensure correct fabrication, assembly, shipping and installation
A-3.03.03P	manage inventory of materials and equipment	inventory of materials and equipment is managed according to shop standards
A-3.03.04P	estimate time, materials and equipment requirements	time, materials and equipment requirements are estimated for time management and work coordination purposes
A-3.03.05P	manage and store job site materials and equipment	job site materials and equipment are managed and stored according to environmental conditions, construction schedule and to coordinate work with other trades
A-3.03.06P	load and unload materials and equipment	materials and equipment are loaded and unloaded considering hazards of loading/unloading

Range of Variables (include, but not limited to)

materials and equipment: consumables, fasteners, sheets, sealants, ductwork, hoisting, air handling components, hazardous materials, material lifts

hazards of loading/unloading: uneven weight distribution, capacity of hoisting equipment and landing area, over-sized loads, pinch/crush points

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.03.01L	demonstrate knowledge of materials and equipment , their characteristics and applications
	a. identify types of materials and equipment , and describe their characteristics and applications
	b. interpret information about materials and equipment found on drawings and specifications
A-3.03.02L	demonstrate knowledge of procedures to organize materials and equipment for projects
	a. describe considerations for determining materials and equipment supply requirements
	b. describe procedures to organize, store and maintain inventory of materials and equipment
A-3.03.03L	demonstrate knowledge of safe handling practices for materials and equipment
	a. identify hazards of loading/unloading , and describe safe handling practices and procedures for materials and equipment
A-3.03.04L	demonstrate knowledge of procedures to plan and organize jobs
	a. identify sources of information relevant to job planning
	b. identify considerations when determining job requirements
	c. describe procedures used to plan job tasks
A-3.03.05L	demonstrate knowledge of additional training and certification requirements for estimating and project management
	a. identify additional training and certification requirements to estimating and project management
A-3.03.06L	demonstrate knowledge of regulatory requirements to load and unload materials and equipment
	a. identify codes, standards and jurisdictional regulations to load and unload materials and equipment
A-3.03.07L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of hazardous materials
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

materials and equipment: consumables, fasteners, sheets, sealants, ductwork, hoisting, air handling components, hazardous materials, material lifts

considerations for determining materials and equipment supply requirements: plans, specifications, drawings, environment

hazards of loading/unloading: uneven weight distribution, capacity of hoisting equipment and landing area, over-sized loads, pinch/crush points

sources of information relevant to job planning: documentation, drawings, specifications, professionals in related trades, clients, Leadership in Energy and Environmental Design (LEED) requirements

considerations when determining job requirements: personnel, tools and equipment, materials, permits, specifications, LEED requirements

procedures used to plan job tasks: scheduling, estimating

A-3.04 Performs basic design and field modifications

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.04.01P	perform preliminary site inspection	preliminary site inspection is performed to identify potential conflicts or design modifications by comparing drawings and project specifications to site conditions
A-3.04.02P	modify design for installation	design for installation is modified using site measurements
A-3.04.03P	design and modify sheet metal systems, materials and routing	sheet metal systems, materials and routing are designed and modified according to job site conditions and interference drawings
A-3.04.04P	sketch modifications	modifications to accommodate changes in construction and installation requirements are sketched according to project specifications

A-3.04.05P	determine design conflicts and implement field modifications	design conflicts are determined, and field modifications are implemented according to project specifications and approvals
A-3.04.06P	verify and validate accuracy of measurements, dimensions, scales and benchmarks on plans and designs, and make required corrections	measurements, dimensions, scales and benchmarks on plans and designs are verified and validated, and required corrections are made

Knowledge

Reference Code	Learning Outcomes and Objectives	
A-3.04.01L	demonstrate knowledge of basic pattern development and layout	
	a. identify layout tools and describe their applications and procedures for use	
	b. identify layout methods and describe their applications	
	c. describe procedures used to develop basic drawings and sketches	
A-3.04.02L	demonstrate knowledge of procedures to perform basic design and field modifications	
	a. identify hazards, and describe safe work practices when performing basic design and field modifications	
	b. describe procedures to inspect site	
	c. describe procedures to take field measurements	
	d. describe procedures to perform basic design and field modifications	
	e. identify conflicts and implement field modifications	
A-3.04.03L	demonstrate knowledge of duct systems and their associated design principles	
	a. identify types of basic duct systems , and describe their associated design principles	
	b. describe procedures used to perform heat gain/loss calculations and their applications	
	c. identify air patterns and describe their impact on operation of duct systems	
	d. explain air pressure and its impact on operation of duct systems	
	e. identify formulas used in duct system design and describe their applications	
	f. identify considerations and requirements when determining duct system design	

A-3.04.04L demonstrate knowledge of regulatory requirements for basic design and field modifications

- a. identify codes and jurisdictional regulations for basic design and field modifications
-

A-3.04.05L demonstrate knowledge of sustainability and environmental stewardship practices

- a. identify practices that contribute to environmental protection
-

- b. describe procedures to dispose of and recycle material
-

- c. identify practices that contribute to net-zero and carbon neutral efforts
-

Range of Variables (include, but not limited to)

layout methods: simple/straight line, parallel line, radial line, triangulation, computerized, combination

basic drawings and sketches: pictorial, orthographic

types of basic duct systems: air handling systems (single path, variable air volume [VAV]), material handling systems (positive, negative)

formulas used in duct system design: fan laws, velocity, quantity, pressure

considerations and requirements when determining duct system design: equal friction, air duct calculations, static regain, constant velocity

Task A-4 Maintains continuous learning

Task Descriptor

Sheet metal workers must stay current on building science principles and sustainable and emerging technologies being introduced in the trade. They need to keep informed about new and changing codes and jurisdictional regulations, types of equipment, products and materials.

A-4.01 Upgrades in new trade practices and procedures

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.01.01P	apply continuous learning methods	continuous learning methods are applied
A-4.01.02P	develop and maintain personal and professional development plan	personal and professional development plan is developed and maintained with established learning goals (short and long term) and time frames
A-4.01.03P	identify available supports and resources for learning	available supports and resources for learning are identified

Range of Variables (include, but not limited to)

continuous learning methods: actively engaging in performance review processes and taking action to address feedback, seeking out and actively participating in and embracing learning opportunities (seminars, webinars, trainings, podcasts, independent research), maintaining all required certifications and training, upgrading and maintaining computer and technology skills, sharing learning outcomes and concepts with others, transferring knowledge into practice

supports and resources: professional networks and associations, manufacturers' seminars, collaboration with colleagues and community members, counselling, mentoring, peer support groups, online resources, trade shows, language supports, accommodations

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.01.01L	demonstrate knowledge of upgrading in new trade practices and procedures
	a. identify continuous learning methods
	b. explain importance of staying current on new trade practices and procedures
	c. identify supports and resources for learning
A-4.01.02L	demonstrate knowledge of personal and professional development plan
	a. identify elements of a professional portfolio
	b. identify link between professionalism and continuous learning
	c. describe how to assess personal learning needs
	d. identify factors that may impact learning needs and goals

Range of Variables (include, but not limited to)

continuous learning methods: actively engaging in performance review processes and taking action to address feedback, seeking out and actively participating in and embracing learning opportunities (seminars, webinars, trainings, podcasts, independent research), maintaining all required certifications and training, upgrading and maintaining computer and technology skills, sharing learning outcomes and concepts with others, transferring knowledge into practice

supports and resources: professional networks and associations, manufacturers' seminars, collaboration with colleagues and community members, counselling, mentoring, peer support groups, online resources, trade shows, language supports, accommodations

elements of a professional portfolio: résumé, certificates, licenses, diplomas, degrees, transcripts, marketable skills, professional accomplishments, work samples, awards, references

factors: new technology, sector trends and practices, skills updating, legislative and regulatory changes, barriers to learning

A-4.02 Upgrades in emerging technologies

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.02.01P	read information about latest advancements and emerging technologies	information about latest advancements and emerging technologies is read to stay informed
A-4.02.02P	attend seminars, webinars and information sessions	seminars, webinars and information sessions organized by manufacturers, suppliers, unions and employers are attended
A-4.02.03P	share information on emerging technologies with colleagues and management	information on emerging technologies is shared with colleagues and management, and advantages and disadvantages are explained

Range of Variables (include, but not limited to)

information: manufacturers' literature, online resources, trade journals and magazines

emerging technologies: cloud communication platforms and apps, geolocation technologies and 3D modeling, 3D scanners, Building Information Modeling (BIM), virtual reality (VR), augmented reality (AR)

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.02.01L	demonstrate knowledge of upgrading in emerging technologies
	a. identify types of information on emerging technologies
	b. explain importance of staying current on emerging technologies

Range of Variables (include, but not limited to)

emerging technologies: cloud communication platforms and apps, geolocation technologies and 3D modeling, 3D scanners, Building Information Modeling (BIM), virtual reality (VR), augmented reality (AR)

information: manufacturers' literature, online resources, trade journals and magazines

Task A-5 Uses communication and mentoring techniques

Task Descriptor

Learning in the trades is done primarily in the workplace with tradespeople passing on their skills and knowledge to apprentices, as well as sharing knowledge among themselves. Apprenticeship is, and always has been about mentoring, which is learning workplace skills and passing them onto others. Because of the importance of this to the trade, this task covers the activities related to communication in the workplace and mentoring skills.

A-5.01 Uses communication techniques

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-5.01.01P	demonstrate communication techniques with individuals or in a group	instructions and messages are interpreted by all parties involved in communication
A-5.01.02P	listen using active listening techniques	active listening techniques are utilized
A-5.01.03P	speak clearly using correct industry terminology to ensure understanding	understanding of message is confirmed by both parties
A-5.01.04P	receive and respond to instructions	response to instructions indicates understanding
A-5.01.05P	receive and respond to feedback on work completed or performed	response to feedback indicates understanding and corrective measures are taken

A-5.01.06P	explain and provide feedback	explanation and feedback is provided, and task is carried out as directed
A-5.01.07P	communicate understanding and comfort level in performing trade tasks	opportunities for practice and gradual exposure to new tasks is offered and understanding is confirmed
A-5.01.08P	use questions to improve communication	questions are used to enhance understanding, on-the-job training and goal setting
A-5.01.09P	participate in safety and information meetings	meetings are attended, information is relayed to employees, and is applied
A-5.01.10P	establish effective lines of communication with crew before starting hazardous work	effective communication is established so that work proceeds smoothly and is completed without incident
A-5.01.11P	send and receive electronic messages	electronic messages are sent and received using professionalism, plain language and clear statements according to company policies and procedures
A-5.01.12P	use online tools	online tools are used to communicate

Range of Variables (include, but not limited to)

active listening: hearing, interpreting, reflecting, responding, paraphrasing

electronic messages: email, text messages

online tools: video conferencing, teleconferencing, apps

Knowledge

Reference Code	Learning Outcomes and Objectives
A-5.01.01L	demonstrate knowledge of trade terminology
	a. define terminology used in trade
A-5.01.02L	demonstrate knowledge of effective communication practices
	a. describe importance of using effective verbal and non-verbal communication with people in the workplace
	b. describe importance of teamwork
	c. identify sources of information used to effectively communicate

-
- d. identify communication and learning styles

 - e. describe effective listening and speaking skills

 - f. describe how to receive and give instructions effectively

 - g. identify **personal responsibilities and attitudes** that contribute to on-the-job success

 - h. identify verbal and non-verbal communication that constitutes bullying, **harassment** and **discrimination**

 - i. identify communication styles appropriate to different systems and applications of **electronic messages** and **online tools**
-

Range of Variables (include, but not limited to)

people in the workplace: other tradespeople, colleagues, apprentices, supervisors, clients, jurisdictional representatives, manufacturers, office administrators

teamwork: effective and efficient collaboration, communication to achieve common goal

sources of information: jurisdictional regulations, codes, occupational health and safety requirements, prints, drawings, specifications, company and client documentation, learning styles (visual, auditory, kinesthetic)

personal responsibilities and attitudes: asking questions, working safely, accepting constructive feedback, time management and punctuality, respect for authority, good stewardship of materials, tools and property, efficient work practice

harassment: as defined by the Canadian and jurisdictional Human Rights Commissions

discrimination: as defined by the Canadian Human Rights Act and jurisdictional human rights laws

electronic messages: email, text messages

online tools: video conferencing, teleconferencing, apps

A-5.02 Uses mentoring techniques

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-5.02.01P	identify and communicate learning objective and point of lesson	apprentice or learner can explain objective and point of lesson
A-5.02.02P	link lesson to other lessons and project	sequence of lessons are defined and unplanned learning opportunities are identified
A-5.02.03P	demonstrate performance of a skill to an apprentice or learner	steps required to demonstrate a skill are performed
A-5.02.04P	set up conditions required for apprentice or learner to practice a skill	practice conditions are set up so that skill can be practiced safely by apprentice or learner
A-5.02.05P	set up conditions where apprentice or learner feels comfortable communicating and asking questions	conditions are such that apprentice or learner feels comfortable communicating and asking questions
A-5.02.06P	recognize and discuss multiple techniques for performing trade tasks and options that may be best for apprentice or learner	multiple techniques for performing trade tasks and options that may be best for apprentice or learner are recognized and discussed
A-5.02.07P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice or learner improves with practice to a point where task can be done with little supervision
A-5.02.08P	give supportive and constructive feedback	apprentice or learner adopts best practice after receiving supportive or constructive feedback
A-5.02.09P	support apprentices or learners in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-5.02.10P	support anti- harassment and anti- discrimination practices in workplace	workplace is harassment and discrimination -free

A-5.02.11P	support accommodations and alternate work practices that are appropriate for apprentice or learner	accommodations and alternate work practices that are appropriate for apprentice or learner are supported
------------	--	--

Range of Variables (include, but not limited to)

harassment: as defined by the Canadian and jurisdictional Human Rights Commissions
discrimination: as defined by the Canadian Human Rights Act and jurisdictional human rights laws

Knowledge

Reference Code	Learning Outcomes and Objectives
----------------	----------------------------------

A-5.02.01L	demonstrate knowledge of strategies for learning skills in workplace
	a. describe importance of individual experience
	b. describe shared responsibilities for workplace learning
	c. determine one’s own learning preferences and explain how these relate to learning new skills
	d. describe importance of different types of skills in workplace
	e. describe importance of skills for success (essential skills) in workplace
	f. identify different learning styles
	g. identify different learning needs and strategies to meet them
	h. identify strategies to assist in learning a skill
A-5.02.02L	demonstrate knowledge of strategies for teaching workplace skills
	a. identify different roles played by workplace mentor
	b. explain importance of identifying point of lesson
	c. identify how to choose a good time to present lesson
	d. explain importance of linking lessons
	e. identify context for learning skills
	f. describe considerations in setting up opportunities for skill practice
	g. explain importance of providing feedback
	h. identify techniques for giving effective feedback
	i. describe a skills assessment
	j. identify methods of assessing progress
	k. explain how to adjust lesson to different situations

Range of Variables (include, but not limited to)

skills for success (essential skills): adaptability, collaboration, communication, creativity and innovation, digital, numeracy, problem solving, reading, writing

learning styles: visual, auditory, kinesthetic

learning needs: learning accommodations, learning preferences, language proficiency

strategies to assist in learning a skill: understanding basic principles of instruction, developing coaching skills, being mature and patient, providing feedback, practicing through repetition

Major Work Activity B – Performs fabrication

Task B-6 Performs pattern development

Task Descriptor

Pattern development is the starting point of fabrication and one of the most important steps. Sheet metal workers develop a pattern by hand or computer using one or more of the four methods of layout to build a finished product. They need to be able to identify which method to use.

B-6.01 Develops patterns using simple and straight line layout

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-6.01.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-6.01.02P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-6.01.03P	determine cut size of blank piece	cut size of blank piece is determined while allowing for seams and edges and to minimize waste
B-6.01.04P	mark material	material is marked to identify seams and bend marks
B-6.01.05P	mark braking lines and braking diagrams on pattern	braking lines and braking diagrams on pattern are marked for future forming according to order of operation
B-6.01.06P	label pieces	pieces are labelled for future forming and assembly

Knowledge

Reference Code	Learning Outcomes and Objectives
B-6.01.01L	demonstrate knowledge of simple and straight line layout, its applications and associated calculations
	a. identify types of basic patterns and fittings that require simple and straight line layout
	b. identify calculations used in simple and straight line layout
	c. describe procedures to perform calculations used in simple and straight line layout
	d. apply information from applicable standards to develop patterns using simple and straight line layout
B-6.01.02L	demonstrate knowledge of procedures to develop patterns using simple and straight line layout
	a. identify tools and equipment used to develop patterns using simple and straight line layout, and describe their procedures for use
	b. describe procedures to develop patterns using simple and straight line layout
B-6.01.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe layout practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

procedures to develop patterns using simple and straight line layout: determining views; labelling lines and points; preparing patterns; determining true length of lines; determining types of seams, joints and edges; calculating allowances; determining stretch-outs; checking pattern accuracy; cutting pattern; labelling pieces

B-6.02 Develops patterns using parallel line method

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-6.02.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-6.02.02P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-6.02.03P	develop plan and elevation views	plan and elevation views required for fitting are developed according to drawings and dimensions
B-6.02.04P	divide plan and elevation into equal parts	plan and elevation are divided into equal parts to achieve required accuracy
B-6.02.05P	calculate stretch-out	stretch-out is calculated according to required dimensions
B-6.02.06P	divide stretch-out lengths into equal parts	stretch-out lengths are divided into equal parts, and spaced according to developed plan and elevation views
B-6.02.07P	connect points to finish pattern	points to finish pattern are connected, and allowances for seams and edges are added
B-6.02.08P	mark forming lines and forming diagrams on pattern	forming lines and forming diagrams are marked on pattern for future forming and according to order of operations
B-6.02.09P	label pieces	pieces are labelled for future forming and assembly

Knowledge

Reference Code	Learning Outcomes and Objectives
B-6.02.01L	demonstrate knowledge of parallel line development for round duct fittings , its applications and associated calculations
	a. describe types of round duct fittings that require parallel line development
	b. identify calculations used in parallel line development for round duct fittings
	c. describe procedures to perform calculations used in parallel line development for round duct fittings
	d. apply information from applicable standards to develop patterns using parallel line development for round duct fittings
B-6.02.02L	demonstrate knowledge of procedures to develop patterns using parallel line development for round duct fittings
	a. identify tools and equipment used to develop patterns using parallel line development for round duct fittings , and describe their procedures for use
	b. describe procedures to develop patterns using parallel line development for round duct fittings
B-6.02.03L	demonstrate knowledge of procedures to develop patterns using parallel line development for architectural applications and its associated calculations
	a. identify tools and equipment used to develop patterns using parallel line development for architectural applications, and describe their procedures for use
	b. identify types of fittings and components for architectural applications that require parallel line development
	c. describe procedures to perform calculations used to develop patterns using parallel line development for architectural applications
B-6.02.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe layout practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

round duct fittings: tees, round elbows, round offsets

procedures to develop patterns using parallel line development: determining required views; labelling lines and points; preparing patterns; determining true length of lines; determining types of seams, joints and edges; calculating allowances; determining stretch-outs; checking pattern accuracy; cutting pattern; labelling pieces

fittings and components for architectural applications: copings, gutters, mitred flashings, skylights, finials, straight-sided roof jacks

B-6.03 Develops patterns using radial line method

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-6.03.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-6.03.02P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-6.03.03P	develop plan and elevation views	plan and elevation views required for fittings are developed according to drawings and dimensions
B-6.03.04P	find apex	apex is found using layout tools and mathematical formulas
B-6.03.05P	calculate circumference stretch-out	circumference stretch-out is calculated
B-6.03.06P	divide stretch-out lengths into equal parts	stretch-out lengths are divided into equal parts, spaced according to dimension of fitting , and plan and elevation views are developed
B-6.03.07P	transfer points from plan and elevation views to pattern	points from plan and elevation views are transferred to pattern, and allowances are added for seams and edges

B-6.03.08P	connect points to finish pattern	points to finish pattern are connected according to layout
B-6.03.09P	mark forming lines and forming diagrams on pattern	forming lines and forming diagrams are marked on pattern for future forming according to order of operations
B-6.03.10P	label pieces	pieces are labelled for future forming and assembly

Range of Variables (include, but not limited to)

fittings: conical shapes, reducers, tapers

Knowledge

Reference Code	Learning Outcomes and Objectives	
B-6.03.01L	demonstrate knowledge of radial line development for right cones, its applications and associated calculations	
	a.	identify calculations used in radial line development for right cones
	b.	describe procedures used to perform calculations used in radial line development for right cones
	c.	apply information from applicable standards to develop patterns using radial line development for right cones
B-6.03.02L	demonstrate knowledge of procedures to develop patterns for fittings based on right cones using radial line development	
	a.	identify tools and equipment used to develop patterns for fittings based on right cones using radial line development, and describe their procedures for use
	b.	describe procedures to develop patterns for fittings based on right cones using radial line development
B-6.03.03L	demonstrate knowledge of radial line development for oblique fittings and components, its applications and associated calculations	
	a.	identify types of oblique fittings and components that require radial line development
	b.	identify calculations used in radial line development for oblique fittings and components
	c.	describe procedures to perform calculations used in radial line development for oblique fittings and components
	d.	apply information from applicable standards to develop patterns using radial line development for oblique fittings and components

B-6.03.04L	demonstrate knowledge of procedures to develop patterns for oblique fittings and components using radial line development
	a. identify tools and equipment used to develop patterns for oblique fittings and components using radial line development, and describe their procedures for use
	b. describe procedures to develop patterns for oblique fittings and components using radial line development
B-6.03.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe layout practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

procedures to develop patterns: determining required views; labelling lines and points; preparing patterns; determining true length of lines; determining types of seams, joints and edges; calculating allowances; determining stretch-outs; checking pattern accuracy; cutting pattern; labelling pieces

fittings: conical shapes, reducers, tapers

B-6.04 Develops patterns using triangulation method

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-6.04.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-6.04.02P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-6.04.03P	develop plan and elevation views	plan and elevation views required for fittings are developed according to drawings and dimensions
B-6.04.04P	find true lengths	true lengths are found using two known points and according to drawings and dimensions

B-6.04.05P	lay out flat pattern	flat pattern is laid out and transverse joint and longitudinal seam allowances are allowed for according to shop standards and specifications
B-6.04.06P	connect points to finish pattern	points to finish pattern are connected using layout tools and according to layout
B-6.04.07P	mark forming lines and forming diagrams on pattern	forming lines and forming diagrams are marked on pattern for future forming according to order of operation
B-6.04.08P	label pieces	pieces are labelled for future forming and assembly

Knowledge

Reference Code	Learning Outcomes and Objectives	
B-6.04.01L	demonstrate knowledge of triangulation method from plan view, its applications and associated calculations	
	a. describe types of fittings that require triangulation method from plan view	
	b. apply information from applicable standards to develop patterns using triangulation method	
B-6.04.02L	demonstrate knowledge of procedures to develop patterns for fittings using triangulation method from plan view	
	a. identify tools and equipment used to develop patterns for fittings using triangulation method from plan view, and describe their procedures for use	
	b. identify calculations used in triangulation method from plan view	
	c. describe procedures to perform calculations using triangulation method from plan view	
	d. describe procedures used to develop patterns for fittings using triangulation method from plan view	
B-6.04.03L	demonstrate knowledge of triangulation method from elevation, its applications and associated calculations	
	a. identify types of fittings that require triangulation method from elevation	
	b. describe procedures to perform calculations using triangulation method from elevation	
	c. describe procedures to develop patterns for fittings and components using triangulation method from elevation	

B-6.04.04L demonstrate knowledge of sustainability and environmental stewardship practices

a. describe layout practices that minimize waste

b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

fittings: transitions, tapers, square-to-rounds

procedures to develop patterns: determining required views; labelling lines and points; preparing patterns; determining true length of lines; determining types of seams, joints and edges; calculating allowances; determining stretch-outs; checking pattern accuracy; cutting pattern; labelling pieces

B-6.05 Uses computer technology for pattern development

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-6.05.01P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-6.05.02P	select required product to be developed from computer database	required product to be developed is selected from computer database
B-6.05.03P	input dimensions into computer	dimensions are input into computer based on type and size of finished product
B-6.05.04P	select joint and seam information from computer database	joint and seam information is selected from computer database according to finished product requirements
B-6.05.05P	use computer programs to develop patterns	computer programs to develop patterns are used according to project requirements
B-6.05.06P	label blank pieces with forming information	blank pieces are labelled with forming information according to drawing and dimensions

Range of Variables (include, but not limited to)

computer programs: CAD, three-dimensional modeling

forming information: layout and assembly of pieces, braking lines, seams, allowances, joints, gauges

Knowledge

Reference Code	Learning Outcomes and Objectives
B-6.05.01L	demonstrate knowledge of computer technology and computer programs used for pattern development and layout, their characteristics, applications and operation
	a. identify computer technology and computer programs used for pattern development and layout, and describe their characteristics and applications
	b. describe operating principles of computer technology and computer programs used for pattern development and layout
	c. apply information from applicable standards to develop patterns using computer technology and computer programs
B-6.05.02L	demonstrate knowledge of procedures to use computer technology and computer programs for pattern development and layout
	a. identify layout methods that use computer technology and computer programs and describe their applications
	b. describe procedures to perform pattern development using computer technology
B-6.05.03L	demonstrate knowledge of additional training requirements to use computer technology for pattern development and layout
	a. identify additional training requirements to use computer technology for pattern development and layout
B-6.05.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe layout practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

computer programs: CAD, three-dimensional modeling

procedures to perform pattern development using computer technology: determining required views; labelling lines and points; preparing patterns; determining true length of lines; determining types of seams, joints and edges; calculating allowances; determining stretch-outs; checking pattern accuracy; cutting pattern; labelling pieces

Task B-7 Fabricates sheet metal components for air and material handling systems

Task Descriptor

Fabrication of air and material handling systems is the process of producing finished ductwork or fittings from a flat pattern (using simple, straight, radial, triangulation or parallel line pattern development techniques) or sheet using various tools.

B-7.01 Cuts ductwork, fittings and components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.01.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-7.01.02P	verify measurements	measurements are verified according to seam allowances and duct length
B-7.01.03P	create cut list	cut list is created according to drawing to minimize waste
B-7.01.04P	cut blanks	blanks are cut according to cut list
B-7.01.05P	mark allowances	allowances are marked for transverse, mitred and longitudinal seams
B-7.01.06P	notch material	material is notched according to seam allowances and pattern
B-7.01.07P	mark forming lines and forming diagrams on pieces	forming lines and forming diagrams are marked on pieces for future forming according to order of operation

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.01.01L	demonstrate knowledge of procedures to fabricate ductwork and fittings
	a. identify tools and equipment used to fabricate components and describe their applications and procedures for use
	b. interpret information about fabrication of components found on drawings and specifications
	c. identify types of materials used to fabricate components, and describe their characteristics and applications
	d. identify and describe components associated with air and material handling systems
	e. identify considerations and requirements when fabricating components for air and material handling systems
B-7.01.02L	demonstrate knowledge of calculations required to measure ductwork, fittings and components
	a. calculate measurements required for seam allowances
B-7.01.03L	demonstrate knowledge of procedures to cut ductwork, fittings and components
	a. identify tools and equipment used to cut ductwork, fittings and components, and describe their applications and procedures for use
	b. identify hazards, and describe safe work practices and procedures to cut ductwork, fittings and components
B-7.01.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe cutting practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

types of materials: sheet metal, composites, plastics

components associated with air and material handling systems: ductwork, fittings, dampers, fire dampers, flexible connections, hangers, equipment supports/bases, louvers, attenuators (silencers), blast gates, clean-outs, access doors, plenums

considerations and requirements: load bearing capacities, system specifications, environmental conditions, architectural conditions

B-7.02 Forms ductwork, fittings and components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.02.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-7.02.02P	examine forming diagrams	forming diagrams are examined to establish order of operations
B-7.02.03P	cross-brake or bead pieces	pieces are cross-broken or beaded to strengthen piece and eliminate vibration and noise
B-7.02.04P	form longitudinal seams	longitudinal seams are formed according to forming diagram and marking
B-7.02.05P	form transverse seams	transverse seams are formed according to forming diagram and marking
B-7.02.06P	form ductwork, fittings and components	ductwork, fittings and components are formed according to forming diagram and marking
B-7.02.07P	identify types of duct reinforcement	types of duct reinforcement are identified according to SMACNA and project specifications

Range of Variables (include, but not limited to)

components: turning vanes, splitter vanes, flex connectors, access doors

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.02.01L	demonstrate knowledge of metallurgic principles and material properties
	a. identify types of metals , and describe their characteristics and applications

	b. identify other materials used for ductwork, fittings and components
	c. identify types of surface finishes , and describe their characteristics and applications
	d. identify methods used to work with metals and other materials
B-7.02.02L	demonstrate knowledge of procedures to form ductwork, fittings and components
	a. identify tools and equipment used to form ductwork, fittings and components , and describe their limitations and procedures for use
	b. identify information from applicable standards to form ductwork, fittings and components
	c. identify hazards, and describe safe work practices and procedures to form ductwork, fittings and components
	d. identify considerations and requirements when forming ductwork, fittings and components for air and material handling systems
	e. identify types of seams and joints to form ductwork, fittings and components and describe the procedures used to produce them
	f. identify types of edges used to fabricate ductwork and fittings, and describe procedures used to produce them
	g. identify types of fastening methods used to fabricate ductwork, fittings and components , and describe their associated procedures
	h. identify types of duct reinforcement
	i. describe procedures used to fabricate ductwork, fittings and components
B-7.02.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe fabrication practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

types of metals: steel (hot rolled, cold rolled, coated), copper, brass, aluminum, stainless steel

other materials: composites, plastics

components: turning vanes, splitter vanes, flex connectors, access doors

types of surface finishes: mill, brushed, mirrored, dull

methods used to work with metals and other materials: forming, cutting/shearing, punching, drilling, joining

considerations and requirements: load bearing capacities, system specifications, environmental conditions

types of seams and joints: longitudinal, Pittsburgh locks, groove seams, acme locks, snap/button locks, transverse (transverse duct flange [TDF], transverse duct connectors [TDC]), slip & drive, companion flanges

types of edges: hems, wired, raw

types of fastening methods: mechanical, adhesives, welding

B-7.03 Insulates ductwork, fittings and components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.03.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-7.03.02P	select insulation thicknesses, properties and types	insulation thicknesses, properties and types are selected according to project specifications
B-7.03.03P	measure and cut insulation	insulation is measured and cut according to type and thickness
B-7.03.04P	select fastening method	fastening method is selected according to project specifications
B-7.03.05P	seal cut edges of insulation	edges of cut insulation are sealed according to project specifications
B-7.03.06P	apply insulation	insulation is applied using selected fastening method and according to project specifications
B-7.03.07P	apply perforated metal	perforated metal is applied according to project specifications using application methods
B-7.03.08P	install internal supports	internal supports are installed according to project requirements
B-7.03.09P	apply nosing	nosing is applied according to specifications using application methods
B-7.03.10P	check that work area is ventilated, and PPE is used	work area is ventilated according to jurisdictional regulations and PPE is used according to project requirements

Range of Variables (include, but not limited to)

fastening methods: adhesives, pins, foil tape

application methods: screws, rivets

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.03.01L	demonstrate knowledge of metals, their properties, characteristics and applications
	a. identify types of metals , and describe their characteristics and applications
B-7.03.02L	demonstrate knowledge of insulation used for insulating ductwork, fittings and components
	a. identify types and properties of insulation used for insulating ductwork, fittings and components
B-7.03.03L	demonstrate knowledge of procedures to insulate ductwork, fittings and components
	a. identify tools and equipment used to insulate ductwork, fittings and components , and describe their applications, limitations and procedures for use
	b. identify hazards, and describe safe work practices for insulating ductwork, fittings and components
	c. interpret information about insulation of ductwork, fittings and components found on drawings and specifications
	d. describe procedures to insulate ductwork, fittings and components
B-7.03.04L	demonstrate knowledge of codes and standards to insulate ductwork, fittings and components
	a. identify codes and standards to insulate ductwork, fittings and components
B-7.03.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe insulation practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

types of metals: steel (hot rolled, cold rolled, coated), copper, brass, aluminum, cast iron, stainless steel

components: turning vanes, splitter vanes, flex connectors, access doors, plenum doors, attenuators (silencers)

B-7.04 Assembles ductwork, fittings and components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.04.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-7.04.02P	select and use welding equipment for assembly	welding equipment is selected and used for assembly according to project requirements
B-7.04.03P	select and use fasteners	fasteners are selected and used according to project specifications
B-7.04.04P	select and use sealants	sealants are selected and used according to project specifications
B-7.04.05P	refer to labels and diagrams	labels and diagrams are referred to for order of assembly and orientation of pieces
B-7.04.06P	align and fasten pieces	pieces are aligned and fastened according to locks and seams
B-7.04.07P	install or form transverse joints	transverse joints are installed or formed according to standards, project requirements and specifications
B-7.04.08P	assemble flexible connectors	flexible connectors are assembled using fasteners , glue and/or staples according to manufacturers' recommendations
B-7.04.09P	install components	components are installed according to standards, project requirements and specifications

Range of Variables (include, but not limited to)

fasteners: rivets, spot welds, screws

components: turning vanes, splitter vanes, flex connectors, access doors, plenum doors, burglar bars, takeoffs

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.04.01L	demonstrate knowledge of procedures to assemble ductwork, fittings and components
	a. identify tools and equipment used to assemble ductwork, fittings and components , and describe their applications, limitations and procedures for use
	b. apply information from applicable standards to assemble ductwork, fittings and components
	c. identify types of materials used to assemble ductwork, fittings and components , and describe their characteristics and applications
	d. identify hazards, and describe safe work practices to assemble ductwork, fittings and components
	e. describe procedures to assemble ductwork, fittings and components
B-7.04.02L	demonstrate knowledge of codes and standards to assemble ductwork, fittings and components
	a. identify codes and standards to assemble ductwork, fittings and components

Range of Variables (include, but not limited to)

components: turning vanes, splitter vanes, flex connectors, access doors, plenum doors, burglar bars, takeoffs

B-7.05 Fabricates dampers

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.05.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements

B-7.05.02P	determine type of damper required	type of damper required is determined according to project specifications
B-7.05.03P	measure and size damper	damper is measured and sized according to application
B-7.05.04P	select hardware required for damper	hardware required for damper is selected according to project specifications
B-7.05.05P	cut and form damper blades and body	damper blades and body are cut and formed according to jurisdictional regulations and project specifications
B-7.05.06P	assemble damper blades, hardware and body	damper blades, hardware and body are assembled according to damper type
B-7.05.07P	verify damper operation	damper operation is verified according to orientation and blade movement

Range of Variables (include, but not limited to)

dampers: splitters, opposed blade dampers (OBD), parallel blades, blast gates, fire, smoke, explosion, iris, rotary valve, backdraft, relief, motorized, VAV/mixing box, volume, barometric

hardware: quadrant arms, linkages, ball joints

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.05.01L	demonstrate knowledge of dampers , their characteristics, applications and operation
	a. identify types of dampers , and describe their characteristics and applications
	b. describe operating principles of dampers
	c. identify types of materials used to fabricate dampers and describe their characteristics and applications
	d. interpret information about fabrication of dampers found on drawings and specifications
B-7.05.02L	demonstrate knowledge of procedures to fabricate dampers
	a. identify tools and equipment used to fabricate dampers , and describe their procedures for use

	b. identify hazards, and describe safe work practices to fabricate dampers
	c. describe procedures to fabricate dampers
	d. explain calculations related to fabrication of dampers
B-7.05.03L	demonstrate knowledge of regulatory requirements for dampers
	a. identify codes, standards and jurisdictional regulations for dampers
B-7.05.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe damper fabrication practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

dampers: splitters, opposed blade dampers (OBD), parallel blades, blast gates, fire, smoke, explosion, iris, rotary valve, backdraft, relief, motorized, VAV/mixing box, volume, barometric

calculations related to fabrication of dampers: frame size, bend allowances, number of blades, material thickness, sizing requirements

B-7.06 Fabricates hanger systems, supports and bases

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.06.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-7.06.02P	confirm size and weight of equipment and materials to be supported	size and weight of equipment and materials to be supported are confirmed according to manufacturers' specifications and standards
B-7.06.03P	confirm materials and components	materials and components are confirmed based on isolation and seismic restraint requirements and according to project specifications

B-7.06.04P	select hangers and supports	hangers and supports are selected for size and load of air and material handling systems according to project specifications, standards and jurisdictional regulations
B-7.06.05P	confirm number and spacing of hangers	required number and spacing of hangers for specified length of air and material handling systems are confirmed according to standards and project specifications
B-7.06.06P	confirm location for required installation	location is confirmed according to drawings, standards and equipment manufacturers' specifications
B-7.06.07P	perform layout for hanger systems, supports and bases	hanger systems, supports and bases are laid out
B-7.06.08P	pre-drill holes for mounting hanger systems, supports and bases	holes for mounting hanger systems, supports and bases are pre-drilled according to project specifications
B-7.06.09P	assemble components of hanger systems, supports and bases	components of hanger systems, supports and bases are assembled according to manufacturers' specifications and drawings

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, NBC, Canadian Welding Bureau (CWB)

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.06.01L	demonstrate knowledge of hanger systems, supports and bases, their components, characteristics, applications and operation
	a. identify hanger systems, supports and bases, and describe their characteristics and applications
	b. describe operating principles of hanger systems, supports and bases
	c. identify types of materials used to fabricate hanger systems, supports and bases, and describe their characteristics and applications
	d. apply information from applicable standards to fabricate hanger systems, supports and bases
B-7.06.02L	demonstrate knowledge of procedures to fabricate hanger systems, supports and bases

	a. identify tools and equipment used to fabricate hanger systems, supports and bases, and describe their procedures for use
	b. identify hazards, and describe safe work practices and procedures to fabricate hanger systems, supports and bases
	c. describe procedures to fabricate hanger systems, supports and bases
B-7.06.03L	demonstrate knowledge of additional training and certification requirements to fabricate hanger systems, supports and bases
	a. identify additional training and certification requirements to fabricate hanger systems, supports and bases
B-7.06.04L	demonstrate knowledge of standards to fabricate hanger systems, supports and bases
	a. identify standards to fabricate hanger systems, supports and bases
B-7.06.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe fabrication practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

applications (of hanger systems, supports and bases): ducting, material handling equipment, air handling equipment, mechanical equipment racks, seismic restraints, inertia pads

standards: SMACNA, ASHRAE, NBC, Canadian Welding Bureau (CWB)

Task B-8 Fabricates flashing, roofing, sheeting and cladding

Task Descriptor

Flashing, roofing, sheeting and cladding are fabricated to provide protection and aesthetics to structures. Fabrication of flashing, roofing (and roofing drainage systems), sheeting and cladding is the process of producing finished products from a flat pattern or sheet using a variety of tools.

B-8.01 Cuts material for flashing, roofing, sheeting and cladding

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.01.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-8.01.02P	select seam type	seam type is selected according to strength, aesthetics, type of material being used and project specifications
B-8.01.03P	calculate and measure material	material is calculated and measured according to factors
B-8.01.04P	calculate size of area to be covered	size of area to be covered is calculated to determine material required and to minimize waste
B-8.01.05P	shear material to blank size	material is sheared to blank size according to project requirements
B-8.01.06P	notch material	material is notched according to selected seams, joints and edges
B-8.01.07P	recycle or dispose of waste materials	waste materials are recycled or disposed of according to project requirements

Range of Variables (include, but not limited to)

material: sheet metal, composites, plastics

factors: expansion, contraction, seam allowances, joints, bend allowances

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.01.01L	demonstrate knowledge of flashing, roofing, sheeting and cladding, their characteristics and applications
	a. identify flashing, roofing, sheeting and cladding, and describe their characteristics and applications
	b. identify materials used for flashing, roofing, sheeting and cladding
	c. apply information from applicable standards to fabricate flashing, roofing, sheeting and cladding
	d. identify types of seams used for flashing, roofing, sheeting and cladding installations
B-8.01.02L	demonstrate knowledge of procedures to cut materials for flashing, roofing, sheeting and cladding
	a. identify tools and equipment used to cut materials for flashing, roofing, sheeting and cladding, and describe their procedures for use
	b. identify hazards, and describe safe work practices and procedures to cut materials for flashing, roofing, sheeting and cladding
	c. describe procedures to cut materials for flashing, roofing, sheeting and cladding
B-8.01.03L	demonstrate knowledge of calculations required to measure material for cutting
	a. calculate and measure area to be covered
	b. identify factors to calculate and measure material to be cut
B-8.01.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe fabrication practices that minimize waste
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

materials: sheet metal, composites, plastics

factors: expansion, contraction, seam allowances, joints, bend allowances

B-8.02 Forms flashing, roofing, sheeting and cladding

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.02.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-8.02.02P	mark forming lines and diagrams on pieces	forming lines and diagrams on pieces are marked
B-8.02.03P	bend or roll material	material is bent or rolled according to forming lines and diagrams
B-8.02.04P	confirm sealing and joining methods required	sealing and joining methods are confirmed according to project specifications
B-8.02.05P	label pieces	pieces are labelled for assembly and installation

Range of Variables (include, but not limited to)

sealing and joining methods: adhesives, sealants, soldering, mechanical fasteners

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.02.01L	demonstrate knowledge of flashing, roofing, sheeting and cladding, their characteristics and applications
	a. identify flashing, roofing, sheeting and cladding, and describe their characteristics and applications
	b. identify materials used for flashing, roofing, sheeting and cladding
	c. apply information from applicable standards to form flashing, roofing, sheeting and cladding
B-8.02.02L	demonstrate knowledge of procedures to form flashing, roofing, sheeting and cladding

-
- a. identify tools and equipment used to form flashing, roofing, sheeting and cladding, and describe their procedures for use
-
- b. identify hazards, and describe safe work practices and procedures to form flashing, roofing, sheeting and cladding
-
- c. describe procedures to form flashing, roofing, sheeting and cladding and their components
-
- d. identify **sealing and joining methods**
-

Range of Variables (include, but not limited to)

materials: sheet metal, composites, plastics

sealing and joining methods: adhesives, sealants, soldering, mechanical fasteners

Task B-9 Fabricates specialty products

Task Descriptor

Sheet metal workers produce finished specialty products from designs. Specialty products may include kitchen equipment, medical facility products, food processing equipment, pharmaceutical laboratory products, decorative accessories, plastic and marine products.

B-9.01 Cuts material for specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.01.01P	select and use tools and equipment	tools and equipment for cutting material are selected and used according to project requirements
B-9.01.02P	select material	material is selected according to drawings and project specifications
B-9.01.03P	select fabrication methods	fabrication methods are selected according to drawings and project specifications
B-9.01.04P	calculate and measure material	material is calculated and measured according to factors

B-9.01.05P	shear and cut material	material is sheared and cut according to industry standards
B-9.01.06P	notch material	material is notched according to allowances
B-9.01.07P	mark braking lines and diagrams	braking lines and diagrams are marked according to allowances
B-9.01.08P	recycle or dispose of waste materials	waste materials are recycled or disposed of according to project requirements

Range of Variables (include, but not limited to)

material: plastic, PVC-coated, stainless steel, copper, brass, mild steel, aluminum, composites

factors: expansion, contraction, seam allowances, bend allowances

Knowledge

Reference Code	Learning Outcomes and Objectives	
B-9.01.01L	demonstrate knowledge of specialty products , their components, characteristics and applications	
	a.	identify types of specialty products , and describe their characteristics and applications
	b.	apply information from applicable standards to cut materials for specialty products
B-9.01.02L	demonstrate knowledge of materials used to fabricate specialty products , their properties, characteristics and applications	
	a.	identify types of materials used to fabricate specialty products , and describe their properties, characteristics and applications
	b.	describe identification systems for materials
B-9.01.03L	demonstrate knowledge of metallurgic principles	
	a.	describe effects metal working has on metallurgic properties
	b.	identify practices that can create problems when working with metals, and describe procedures used to prevent or correct these problems
B-9.01.04L	demonstrate knowledge of plastic and polyvinyl chloride (PVC) materials	
	a.	describe effects working on materials has on plastics and PVC
	b.	identify practices that can create problems when working with plastics and PVC, and describe procedures used to prevent or correct these problems

B-9.01.05L	demonstrate knowledge of procedures to cut material for specialty products
a.	identify tools and equipment used to cut material for specialty products , and describe their procedures for use
b.	identify hazards, and describe safe work practices and procedures to cut material for specialty products
c.	describe procedures to cut material for specialty products
B-9.01.06L	demonstrate knowledge of calculations required to measure material for cutting
a.	identify factors to calculate and measure material to be cut
B-9.01.07L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	describe cutting practices that minimize waste
b.	describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

material: plastic, PVC-coated, stainless steel, copper, brass, mild steel, aluminum, composites

factors: expansion, contraction, seam allowances, bend allowances

B-9.02 Forms specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.02.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-9.02.02P	use specialized procedures for forming specialty products	specialized procedures for forming specialty products are used according to industry standards

B-9.02.03P	plan and follow order of operations for forming materials	order of operations for forming materials is planned and followed
B-9.02.04P	bend or roll material according to forming lines and diagrams	material is bent or rolled according to forming lines and diagrams
B-9.02.05P	label pieces	pieces are labelled for assembly and installation

Range of Variables (include, but not limited to)

specialized procedures: pre-heating material for bending, annealing to relieve stress

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

materials: plastic, PVC-coated, stainless steel, copper, brass, aluminum, black iron (hot rolled/cold rolled), composite

Knowledge

Reference Code	Learning Outcomes and Objectives	
B-9.02.01L	demonstrate knowledge of specialty products , their components, characteristics and applications	
	a. identify types of specialty products , and describe their characteristics and applications	
	b. apply information from applicable standards to form specialty products	
B-9.02.02L	demonstrate knowledge of materials used to form specialty products , their components, properties, characteristics and applications	
	a. identify types of materials used to form specialty products and their components, and describe their properties, characteristics and applications	
	b. describe identification systems for materials	
B-9.02.03L	demonstrate knowledge of procedures to form specialty products	
	a. identify tools and equipment used to form specialty products , and describe their procedures for use	
	b. identify hazards, and describe safe work practices and procedures to form specialty products	
	c. describe procedures to form specialty products	
	d. describe specialized procedures to form specialty products	
B-9.02.04L	demonstrate knowledge of regulatory requirements and considerations to form specialty products	
	a. identify codes, standards, jurisdictional regulations and considerations to form specialty products	

Range of Variables (include, but not limited to)

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

materials: plastic, PVC-coated, stainless steel, copper, brass, aluminum, black iron (hot rolled/cold rolled), composite

specialized procedures: pre-heating material for bending, annealing to relieve stress

considerations: manufacturers' specifications, environmental regulations, sanitation, AHJ, SMACNA, ASHRAE, NFPA

B-9.03 Assembles specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.03.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-9.03.02P	select and use fasteners	fasteners are selected and used according to material and project specifications
B-9.03.03P	assemble specialty product components	specialty product components are assembled according to drawings and project specifications
B-9.03.04P	select and use welding processes and equipment	welding processes and equipment are selected according to material and project specifications

Range of Variables (include, but not limited to)

fasteners: rivets, screws, nuts and bolts

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

welding processes: GMAW, SMAW, GTAW, brazing, soldering, plastic welding laser

Knowledge

Reference Code	Learning Outcomes and Objectives
B-9.03.01L	demonstrate knowledge of specialty products , their components, characteristics and applications
	a. identify types of specialty products and their components, and describe their characteristics and applications
	b. apply information from applicable standards to assemble specialty products and their components
B-9.03.02L	demonstrate knowledge of procedures to assemble specialty products and their components
	a. identify tools and equipment used to assemble specialty products and their components, and describe their procedures for use
	b. identify hazards, and describe safe work practices and procedures to assemble specialty products and their components
	c. describe procedures and welding processes used to assemble specialty products and their components
	d. identify types of fasteners used to assemble specialty products and their components
B-9.03.03L	demonstrate knowledge of additional training and certification requirements to weld specialty products and their components
	a. identify additional training and certification requirements to weld specialty products and their components
B-9.03.04L	demonstrate knowledge of regulatory requirements and considerations to assemble specialty products and their components
	a. identify codes, standards, jurisdictional regulations and considerations to assemble specialty products and their components

Range of Variables (include, but not limited to)

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

fasteners: rivets, screws, nuts and bolts

welding processes: GMAW, SMAW, GTAW, brazing, soldering, plastic welding laser

considerations: manufacturers' specifications, environmental regulations, sanitation, AHJ, SMACNA, ASHRAE, NFPA

B-9.04 Finishes specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.04.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
B-9.04.02P	finish specialty product using procedures	specialty product is finished using procedures according to project specifications and requirements
B-9.04.03P	identify and correct specialty product deficiencies	specialty product deficiencies are identified and corrected

Range of Variables (include, but not limited to)

tools and equipment: buffers, grinders, files, chemical compounds

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

Knowledge

Reference Code	Learning Outcomes and Objectives
B-9.04.01L	demonstrate knowledge of specialty products , their characteristics and applications
	a. identify types of specialty products , and describe their characteristics and applications
	b. apply information from applicable standards to finish specialty products
B-9.04.02L	demonstrate knowledge of procedures to finish specialty products
	a. identify tools and equipment used to finish specialty products , and describe their procedures for use
	b. identify hazards and describe safe work practices and procedures to finish specialty products
	c. identify types of materials used to finish specialty products , and describe their characteristics and applications

	d. identify types of surface finishing products, and describe their characteristics and applications
	e. describe procedures to finish specialty products
	f. describe procedures to inspect specialty products and recognize deficiencies
B-9.04.03L	demonstrate knowledge of additional training requirements to finish specialty products
	a. identify additional training requirements to finish specialty products
B-9.04.04L	demonstrate knowledge of regulatory requirements and considerations to finish specialty products
	a. identify codes, standards, jurisdictional regulations and considerations to finish specialty products
B-9.04.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe procedures to dispose of and recycle materials and hazardous products

Range of Variables (include, but not limited to)

specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, marine, underground ductwork, decorative

tools and equipment: buffers, grinders, files, chemical compounds

types of materials: ferrous, non-ferrous, PVC, composites

procedures to finish specialty products: grinding, filing, buffing, using chemical compounds, using sealants, passivation

considerations: manufacturers' specifications, project specifications, environmental regulations, safety, sanitation, AHJ

Major Work Activity C – Installs air and material handling systems

Task C-10 Prepares installation site

Task Descriptor

Sheet metal workers need to confirm field measurements and prepare the site prior to installation of air and material handling systems to ensure safe, smooth and efficient installation.

C-10.01 Performs on-site measurements

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements and manufacturers' specifications
C-10.01.02P	coordinate locations of installations with other trades for clearances	locations of installations are coordinated with other trades for clearances according to project specifications
C-10.01.03P	measure and verify work area dimensions	work area dimensions are measured, verified on-site and compared to drawings and manufacturers' and project specifications for discrepancies
C-10.01.04P	identify obstructions and problems	obstructions and problems to be resolved are identified
C-10.01.05P	identify penetrations and sleeve locations	penetrations and sleeve locations for duct fittings are identified according to drawings

C-10.01.06P	verify location and size of penetrations and sleeves	location and size of penetrations and sleeves are verified on-site according to drawings and project specifications
C-10.01.07P	mark penetrations	penetrations are marked according to drawings and project specifications
C-10.01.08P	determine position of hangers, braces and brackets	position of hangers, braces and brackets are determined according to jurisdictional regulations and project specifications
C-10.01.09P	verify duct design to achieve airflow capacity	duct design is verified to achieve airflow capacity

Range of Variables (include, but not limited to)

clearances: code requirements, service access

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.01.01L	demonstrate knowledge of procedures to perform on-site measurements prior to installation of air and material handling systems
	a. identify tools and equipment used to perform on-site measurements, and describe their procedures for use
	b. identify hazards, and describe safe work practices to perform on-site measurements
	c. describe procedures to perform on-site measurements
	d. interpret information about positioning of air and material handling systems found on drawings and project specifications
	e. identify types of obstructions that could prevent installation
	f. identify importance of duct design to achieve airflow capacity
C-10.01.02L	demonstrate knowledge of calculations required to measure work area
	a. calculate orientation, alignment and air flow projections
C-10.01.03L	demonstrate knowledge of regulatory requirements and project specifications for measurements and installation of hangers, braces and brackets
	a. identify standards and project specifications for measuring and installation of hangers, braces and brackets

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, AHJ, NFPA, CSA, NBC, Underwriters Laboratories of Canada (ULC), Health Canada, site-specific

C-10.02 Performs demolition for renovations

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.02.01P	prepare removal plan for materials and equipment	removal plan for materials and equipment is prepared considering factors and according to job requirements, site conditions and sequence
C-10.02.02P	identify materials and equipment to be removed	materials and equipment to be removed are identified according to removal plans and demolition drawings
C-10.02.03P	identify potential hazards and when other specialized personnel are required	potential hazards and other specialized personnel required are identified
C-10.02.04P	arrange for containment of demolition area	demolition area is contained according to site conditions, potential hazards and jurisdictional regulations
C-10.02.05P	select and use tools and equipment	tools and equipment are selected and used according to project requirements and removal plan
C-10.02.06P	place barricades	barricades are placed to isolate demolition site according to project and safety requirements
C-10.02.07P	dismantle and remove materials and equipment	materials and equipment are dismantled and removed according to removal plan and jurisdictional regulations

C-10.02.08P	recycle or dispose of waste materials and equipment	waste materials and equipment are recycled or disposed of according to project and safety requirements, and jurisdictional regulations
-------------	---	--

Range of Variables (include, but not limited to)

factors: containment of particles, hazardous materials, noise levels, biohazards, radiation

hazards: asbestos, mildew, mold, radiation, electricity, gas, water, contaminated air

tools and equipment: grinders, hammers, saws, hoisting equipment, drills, specialized PPE and safety equipment, high efficiency particulate air (HEPA) filters with fans

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.02.01L	demonstrate knowledge of procedures to dismantle materials and equipment
	a. identify tools and equipment used to dismantle materials and equipment, and describe their procedures for use
	b. identify hazards , and describe safe work practices to dismantle materials and equipment
	c. list factors to consider when analyzing integrity of waste materials and equipment
	d. describe procedures and processes to dismantle, demolish and remove materials and equipment
	e. describe process and factors for sorting material to be removed
C-10.02.02L	demonstrate knowledge of regulatory requirements to dispose of and recycle waste materials
	a. identify codes, standards, jurisdictional regulations and specifications to dispose of and recycle waste materials
C-10.02.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle waste materials
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

tools and equipment: grinders, hammers, saws, hoisting equipment, drills, specialized PPE and safety equipment, high efficiency particulate air (HEPA) filters with fans

hazards: asbestos, mildew, mold, radiation, electricity, gas, water, contaminated air

safe work practices: de-energization and physical isolation of energy sources

C-10.03 Installs penetrations and sleeves

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-10.03.02P	measure and lay out penetrations	penetrations are measured and laid out to ensure accuracy and clearances
C-10.03.03P	identify obstructions and hidden hazards in surrounding area	obstructions and hidden hazards in surrounding area are identified for safety and architectural reasons
C-10.03.04P	isolate cutting area	cutting area is isolated before beginning to cut to prevent damage to equipment, property and injury to people
C-10.03.05P	coordinate installation with other trades	work is coordinated with other trades
C-10.03.06P	perform cut	cut is performed according to markings, drawings and project specifications
C-10.03.07P	install sleeves	sleeves are installed according to drawings and project specifications

Range of Variables (include, but not limited to)

obstructions and hidden hazards: electrical, structural members, plumbing, hazardous materials (asbestos)

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.03.01L	demonstrate knowledge of penetrations and sleeves, their components, characteristics and applications
	a. identify penetrations and sleeves, and describe their characteristics and applications
	b. interpret information about penetrations and sleeves found on drawings and project specifications
C-10.03.02L	demonstrate knowledge of procedures to cut penetrations and install sleeves
	a. identify tools and equipment used to cut penetrations and install sleeves, and describe their procedures for use
	b. identify hazards, and describe safe work practices to cut penetrations and install sleeves
	c. describe procedures to cut penetrations and install sleeves
	d. describe cutting methods using manual and mechanical processes
	e. describe procedures to cut materials of various thicknesses
C-10.03.03L	demonstrate knowledge of regulatory requirements to install sleeves and components
	a. identify codes, standards and jurisdictional regulations to install sleeves and components

C-10.04 Installs supports and bases

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.04.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements

C-10.04.02P	verify drawings and specifications of equipment	drawings and specifications of equipment to be installed are verified
C-10.04.03P	determine anchor positions	anchor positions are determined according to drawings, and manufacturers' and project specifications
C-10.04.04P	select and use fasteners	fasteners to support load are selected and used according to engineered drawings, and manufacturers' and project specifications
C-10.04.05P	install isolators	isolators are installed according to engineered drawings, and manufacturers' and project specifications to isolate system from vibration
C-10.04.06P	install supports and bases	supports and bases are installed according to manufacturers' and project specifications
C-10.04.07P	install seismic restraints	seismic restraints are installed according to engineered drawings, project specifications and standards

Range of Variables (include, but not limited to)

fasteners: screws, inserts, rivets, glue, welds, anchors

supports and bases: gussets, riser clamps, inertia bases, housekeeping pads, equipment rails

standards: SMACNA, CWB, NBC, AHJ, NFPA, industry

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.04.01L	demonstrate knowledge of supports and bases , their components, characteristics, applications and operation
	a. identify supports and bases , and describe their characteristics and applications
	b. describe operating principles of supports and bases
	c. interpret information about supports and bases found on drawings and project specifications

C-10.04.02L	demonstrate knowledge of procedures to install supports and bases
a.	identify tools and equipment used to install supports and bases , and describe their procedures for use
b.	identify hazards, and describe safe work practices to install supports and bases
c.	describe procedures to install supports and bases
C-10.04.03L	demonstrate knowledge of regulatory requirements to install supports and bases
a.	identify standards to install supports and bases
b.	identify codes and standards related to seismic restraints

Range of Variables (include, but not limited to)

supports and bases: gussets, riser clamps, inertia bases, housekeeping pads, equipment rails

standards: SMACNA, CWB, NBC, AHJ, NFPA, industry

C-10.05 Installs hangers, cables, braces, brackets and seismic restraints

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.05.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-10.05.02P	verify drawings and specifications	drawings and specifications of equipment to be installed are verified
C-10.05.03P	determine anchor positions	anchor positions are determined according to drawings, project specifications and site conditions
C-10.05.04P	select components	components to be used are selected according to drawings, project specifications, standards and jurisdictional regulations

C-10.05.05P	measure and cut material	material to fabricate hangers, cable assemblies, braces and brackets is measured and cut according to project requirements
C-10.05.06P	secure anchors and fasteners	anchors and fasteners to support load are secured according to standards and manufacturers' specifications
C-10.05.07P	install seismic restraints	seismic restraints are installed according to engineered drawings, manufacturers' specifications and standards

Range of Variables (include, but not limited to)

components: anchors, braces, cables and locks, brackets, inserts, epoxy, structural shapes, threaded rod

standards: SMACNA, CWB, NBC, AHJ, NFPA

materials: angle, square tubing, steel, aluminum, copper, stainless steel

Knowledge

Reference Code	Learning Outcomes and Objectives	
C-10.05.01L	demonstrate knowledge of hangers, cables, braces, brackets and seismic restraints, their components , characteristics and applications	
	a.	identify types of hangers, cables, braces, brackets and seismic restraints, and their components , and describe their characteristics and applications
	b.	identify types of materials used to fabricate hangers, cables, braces, brackets and seismic restraints, and describe their characteristics and applications
	c.	interpret information about hangers, cables, braces, brackets and seismic restraints found on drawings and specifications
C-10.05.02L	demonstrate knowledge of procedures to install hangers, cables, braces, brackets and seismic restraints	
	a.	identify tools and equipment used to install hangers, cables, braces, brackets and seismic restraints, and describe their procedures for use
	b.	identify hazards, and describe safe work practices to install hangers, cables, braces, brackets and seismic restraints
	c.	describe procedures to install hangers, cables, braces, brackets and seismic restraints

C-10.05.03L demonstrate knowledge of regulatory requirements to install hangers, cables, braces, brackets and seismic restraints

a. identify **standards** and project specifications to install hangers, cables, braces, brackets and seismic restraints

b. identify codes, drawings and **standards** related to seismic restraints

C-10.05.04L demonstrate knowledge of sustainability and environmental stewardship practices

a. identify practices that contribute to environmental protection

b. describe procedures to dispose of and recycle **materials**

Range of Variables (include, but not limited to)

components: anchors, braces, cables and locks, brackets, inserts, epoxy, structural shapes, threaded rod

materials: angle, square tubing, steel, aluminum, copper, stainless steel

standards: SMACNA, CWB, NBC, AHJ, NFPA

Task C-11 Installs and connects chimneys, breeching and venting to exhaust appliances and mechanical equipment

Task Descriptor

Chimneys are the vertical section used to vent gases, smoke and other products of combustion to the atmosphere. Stacks are the industrial version of chimneys. Breeching is the section of venting that connects one or more appliances or mechanical equipment to the chimney. Proper installation methods are important to ensure indoor and outdoor air quality and safety. Additional certification may be required by some jurisdictions to install products.

C-11.01 Installs chimneys and stacks

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-11.01.01P	select and size chimney system	chimney system is selected and sized according to jurisdictional regulations, codes and manufacturers' specifications
C-11.01.02P	plan location of chimney	location of chimney is planned to minimize interference and conflicts while ensuring most direct path according to jurisdictional regulations, codes , drawings, and project and manufacturers' specifications
C-11.01.03P	select and use tools and equipment	tools and equipment are selected and used according to project specifications
C-11.01.04P	assemble and fasten sections	sections are assembled and fastened according to manufacturers' specifications
C-11.01.05P	flash and seal roof penetration	roof penetration is flashed and sealed to weatherproof according to project specifications

C-11.01.06P	install clean-out	clean-out at base of chimney is installed for removal of debris or cleaning
C-11.01.07P	seal chimney	chimney is sealed according to manufacturers' specifications

Range of Variables (include, but not limited to)

chimney systems: B-vent, BW-vent, A-vent, special venting systems, combustion air
codes: Natural gas and propane installation code (CSA B149), Installation code for oil-burning equipment (CSA B139), NBC, NFPA

Knowledge

Reference Code	Learning Outcomes and Objectives
C-11.01.01L	demonstrate knowledge of chimney systems , their components, characteristics, applications and operation
	a. identify chimney systems and their components, and describe their characteristics and applications
	b. describe operating principles of chimney systems
	c. interpret information about chimney systems found on drawings and specifications
C-11.01.02L	demonstrate knowledge of procedures to install chimney systems
	a. identify tools and equipment used to install chimney systems , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install chimney systems
	c. describe procedures to install chimney systems
	d. identify flashing requirements pertaining to chimneys
	e. describe calculations and measurements related to installation, sizing and site conditions
C-11.01.03L	demonstrate knowledge of regulatory requirements to install chimney systems
	a. identify codes , standards and jurisdictional regulations to install chimney systems

C-11.01.04L demonstrate knowledge of sustainability and environmental stewardship practices

a. identify practices that contribute to **environmental protection**

b. describe procedures to dispose of and recycle chimney material waste

c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

chimney systems: B-vent, BW-vent, A-vent, special venting systems, combustion air calculations and measurements related to installation, sizing and site conditions:

combustion air, vent calculations, run, rise, equivalent length, equipment requirements

codes: Natural gas and propane installation code (CSA B149), Installation code for oil-burning equipment (CSA B139), NBC, NFPA

environmental protection: use of specialty equipment to condition exhaust products that could be harmful to wildlife, use of scrubbers to reduce carbon emissions

C-11.02 Connects appliances or mechanical equipment to chimney and breeching

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-11.02.01P	select appliance and mechanical equipment to connect to chimney	appliance and mechanical equipment to connect to chimney are selected according to manufacturers' specifications
C-11.02.02P	select venting materials	venting materials are selected according to manufacturers' specifications
C-11.02.03P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-11.02.04P	plan location of breeching for appliance or mechanical equipment	location of breeching for appliance or mechanical equipment is planned according to engineered drawings, manufacturers' specifications, jurisdictional regulations and codes

C-11.02.05P	select breaching components, size, thickness and material	breaching components, size, thickness and material are selected according to codes and jurisdictional regulations
C-11.02.06P	identify and report all energy sources or dangerous conditions related to venting appliances or equipment, and implement measures for confining or securing them	energy sources and dangerous conditions related to venting appliances or equipment are identified and reported, and confining and securing measures are applied
C-11.02.07P	assemble and fasten breaching	breaching is assembled and fastened according to codes and jurisdictional regulations
C-11.02.08P	fasten breaching to appliance	breaching is fastened to appliance according to manufacturers' specifications
C-11.02.09P	fasten breaching to chimney	breaching is fastened to chimney according to manufacturers' specifications
C-11.02.10P	sequence appliance or mechanical equipment connection	appliance or mechanical equipment connection is sequenced to breaching according to codes and jurisdictional regulations
C-11.02.11P	seal breaching	breaching is sealed to appliance or mechanical equipment according to manufacturers' specifications, codes and local authorities

Range of Variables (include, but not limited to)

codes: CSA B149, CSA B139

Knowledge

Reference Code	Learning Outcomes and Objectives
C-11.02.01L	demonstrate knowledge of breaching, their components, characteristics, applications and operation
	a. identify types of breaching, and describe their characteristics and applications
	b. describe operating principles of breaching
C-11.02.02L	demonstrate knowledge of procedures to connect appliances and mechanical equipment to chimneys and breaching

	a. identify tools and equipment used to connect appliances and mechanical equipment to chimneys and breeching, and describe their procedures for use
	b. identify hazards, and describe safe work practices to connect appliances and mechanical equipment to chimneys and breeching
	c. interpret information to connect appliances and mechanical equipment to chimneys and breeching found on drawings and specifications
	d. describe procedures to connect appliances and mechanical equipment to chimneys and breeching
C-11.02.03L	demonstrate knowledge of regulatory requirements to connect appliances and mechanical equipment to chimneys and breeching
	a. identify codes, standards and jurisdictional regulations to connect appliances and mechanical equipment to chimneys and breeching

Range of Variables (include, but not limited to)

codes: CSA B149, CSA B139

standards: CWB, AHJ, Wood Energy Transfer Technology (WETT)

C-11.03 Installs high efficiency appliances and mechanical equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-11.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-11.03.02P	plan location of venting	location of venting is planned to minimize offsets while maintaining grade according to site conditions, manufacturers' specifications and jurisdictional regulations
C-11.03.03P	select venting size and material	venting size and material are selected according to codes , jurisdictional regulations and manufacturers' specifications

C-11.03.04P	assemble and fasten pre-fabricated sections	pre-fabricated sections are assembled and fastened according to codes , jurisdictional regulations and manufacturers' specifications
C-11.03.05P	connect high efficiency appliances and mechanical equipment to venting	high efficiency appliances and mechanical equipment are connected to venting according to codes , jurisdictional regulations and manufacturers' specifications
C-11.03.06P	install exterior vent termination	exterior vent termination is installed according to codes , jurisdictional regulations and manufacturers' specifications
C-11.03.07P	seal and weatherproof exterior vent termination	exterior vent termination is sealed and weatherproofed according to codes , jurisdictional regulations and manufacturers' specifications

Range of Variables (include, but not limited to)

codes: CSA B149, CSA B139

pre-fabricated sections: pipe, elbows (45°, 90°), tees, fittings, termination kits, couplings

Knowledge

Reference Code	Learning Outcomes and Objectives
C-11.03.01L	demonstrate knowledge of high efficiency appliances and mechanical equipment, their components, characteristics, applications and operation
	a. identify types of high efficiency appliances and mechanical equipment, and describe their characteristics and applications
	b. interpret information about high efficiency appliances and mechanical equipment found on drawings and specifications
C-11.03.02L	demonstrate knowledge of procedures to install high efficiency appliances and mechanical equipment
	a. identify tools and equipment used to install high efficiency appliances and mechanical equipment, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install high efficiency appliances and mechanical equipment
	c. describe procedures to install high efficiency appliances and mechanical equipment

C-11.03.03L demonstrate knowledge of regulatory requirements to install high efficiency appliances and mechanical equipment

- a. identify **codes**, standards and jurisdictional regulations to install high efficiency appliances and mechanical equipment

Range of Variables (include, but not limited to)

codes: CSA B149, CSA B139

Task C-12 Installs air handling system components

Task Descriptor

Sheet metal workers install air handling systems to ensure comfort, air quality and efficiency. There are many components manufactured to be installed in air handling systems. They can be used for climate control, humidity control, indoor air quality, security, noise attenuation and fire prevention.

C-12.01 Installs air handling equipment

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.01.02P	assemble air handling equipment components	air handling equipment components are assembled according to manufacturers' specifications
C-12.01.03P	place and secure air handling equipment	air handling equipment is placed and secured to base/structure according to manufacturers' and project specifications, and drawings
C-12.01.04P	install flexible connections	flexible connections are installed according to project and manufacturers' specifications

C-12.01.05P	remove shipping brackets	shipping brackets are removed prior to unit start-up
C-12.01.06P	verify tightness and alignment of pulleys and belts, and direction of fan rotation	tightness and alignment of pulleys and belts, and direction of fan rotation are verified according to manufacturers' specifications
C-12.01.07P	attach condensate drain	condensate drain is attached according to manufacturers' specifications

Range of Variables (include, but not limited to)

air handling equipment: heat recovery ventilators (HRV), energy recovery ventilators (ERV), air handlers, make-up air units (MUA), roof top units (RTU), unit heaters, air curtains, fans, furnaces, fan coils

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.01.01L	demonstrate knowledge of air handling equipment , their components, characteristics, applications and operation
	a. identify types of air handling equipment , and describe their characteristics and applications
	b. describe operating principles of air handling equipment
	c. interpret information about air handling equipment found on drawings and specifications
C-12.01.02L	demonstrate knowledge of procedures to install air handling equipment
	a. identify tools and equipment used to install air handling equipment , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install air handling equipment
	c. describe procedures used to prepare for installation of air handling equipment
	d. identify considerations and requirements when installing air handling equipment
	e. describe procedures to install air handling equipment
C-12.01.03L	demonstrate knowledge of basic concepts of electricity
	a. identify hazards, and describe safe work practices to work on or around electrical equipment and sources
	b. explain basic principles of electricity

	c. identify electrical devices , and describe their characteristics and applications
C-12.01.04L	demonstrate knowledge of air quality management
	a. identify hazards, and describe safe work practices for air quality management
	b. identify considerations and requirements for air quality management
	c. identify areas requiring special air quality ventilation
	d. identify methods of improving or correcting problems with air quality
	e. identify methods used to determine air quality relating to humidity and temperature
	f. identify air quality problems and describe procedures used to prevent or correct them
	g. describe impact improper system or component installation can have on air quality
	h. explain importance of indoor air quality
C-12.01.05L	demonstrate knowledge of regulatory requirements for air handling equipment
	a. identify codes, standards and jurisdictional regulations to install air handling equipment
	b. identify codes, standards and jurisdictional regulations for air quality management

Range of Variables (include, but not limited to)

air handling equipment: heat recovery ventilators (HRV), energy recovery ventilators (ERV), air handlers, make-up air units (MUA), roof top units (RTU), unit heaters, air curtains, fans, furnaces, fan coils

procedures used to prepare for installation of air handling equipment: determining equipment requirements, determining penetration locations, performing site measurements, demolishing and removing existing systems and components, performing on-site coordination, staging (storing material), planning, distributing (material to installation area), sectioning (pre-assembling on-site), erecting, performing final inspection (completing)

considerations and requirements when installing air handling equipment: manufacturers' specifications, isolators, building materials, environmental conditions, field design modifications, LEED requirements, indoor air quality, seismic requirements

electrical devices: circuit breakers, disconnects, overload heaters, ground fault interrupters (GFI), fuses, programmable logic controllers (PLC), motors, capacitors

considerations and requirements for air quality management: environmental conditions, intake locations, exhaust locations

areas requiring special air quality ventilation: clean/sterile rooms, industrial/commercial settings

methods of improving or correcting problems with air quality: heating/cooling, ventilation, conditioning (filtration, sterilization, purification, humidification/dehumidification), noise attenuation

air quality problems: contamination, humidity, temperature (hot/cold zones), air motion

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.02 Installs ductwork and fittings

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.02.02P	select and lay out fittings and components	fittings and components are selected and laid out according to drawings and sequence to be installed
C-12.02.03P	connect and seal joints	joints are connected and sealed to ensure integrity according to project specifications and standards
C-12.02.04P	secure ductwork	ductwork is secured to support system according to project specifications and standards
C-12.02.05P	align ductwork with building lines	ductwork is aligned with building lines to ensure uniformity and aesthetics, and according to project specifications

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

ductwork: sheet metal, polyethylene, fibreglass, fabric, phenolic, flexible

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.02.01L	demonstrate knowledge of ductwork and fittings, their components, characteristics, applications and operation
	<ul style="list-style-type: none"> a. identify types of ductwork and fittings, and describe their characteristics and applications b. interpret information about ductwork and fittings found on drawings and specifications
C-12.02.02L	demonstrate knowledge of procedures to install ductwork and fittings
	<ul style="list-style-type: none"> a. identify tools and equipment used to install ductwork and fittings, and describe their procedures for use b. identify hazards, and describe safe work practices to install ductwork and fittings c. describe procedures to install ductwork and fittings
C-12.02.03L	demonstrate knowledge of regulatory requirements to install ductwork and fittings
	<ul style="list-style-type: none"> a. identify codes, standards and jurisdictional regulations to install ductwork and fittings

Range of Variables (include, but not limited to)

ductwork: sheet metal, polyethylene, fibreglass, fabric, phenolic, flexible

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.03 Installs dampers

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements

C-12.03.02P	select dampers	dampers are selected according to size, use and project specifications
C-12.03.03P	determine damper positions and access	damper positions and access are determined according to factors
C-12.03.04P	prepare ductwork	ductwork is prepared using processes to receive dampers
C-12.03.05P	prepare sectional dampers	sectional dampers are prepared using methods and according to manufacturers' specifications to allow blades to move in unison and are free of obstruction
C-12.03.06P	measure dampers	dampers are measured to verify that they are true
C-12.03.07P	secure dampers and control mechanisms	dampers and control mechanisms are secured using fasteners according to manufacturers' specifications
C-12.03.08P	mark or slot shafts	shafts are marked or slotted to identify blade position
C-12.03.09P	cycle dampers	dampers are cycled to ensure free movement of parts
C-12.03.10P	set dampers	dampers are set according to project specifications

Range of Variables (include, but not limited to)

dampers: splitters, OBD, parallel blades, blast gates, fire, smoke, explosion, iris, rotary valve, backdraft, relief, motorized, VAV/mixing box, volume, barometric

factors: air direction, shaft access, duct orientation, environmental conditions, project specifications

ductwork: sheet metal, polyethylene, fibreglass, fabric, phenolic, flexible

processes: installing retaining brackets, slotting ductwork, sleeving dampers

methods: bolting sections together, adding stiffeners to damper frames, adding brackets to damper blades, connecting brackets to linkages, installing motors

fasteners: screws, rivets, bolts, welds

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.03.01L	demonstrate knowledge of dampers , their components, characteristics, applications and operation
	a. identify types of dampers , and describe their characteristics and applications
	b. describe operating principles of dampers
	c. interpret information about dampers found on drawings and specifications
C-12.03.02L	demonstrate knowledge of procedures to install dampers
	a. identify tools and equipment used to install dampers , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install dampers
	c. identify hazards, and describe safe work practices to work on or around electrical equipment and sources
	d. describe procedures to install dampers
C-12.03.03L	demonstrate knowledge of regulatory requirements to install dampers
	a. identify codes, standards and jurisdictional regulations to install dampers

Range of Variables (include, but not limited to)

dampers: splitters, OBD, parallel blades, blast gates, fire, smoke, explosion, iris, rotary valve, backdraft, relief, motorized, VAV/mixing box, volume, barometric

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.04 Installs fire and fire/smoke dampers

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.04.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements

C-12.04.02P	select fire and fire/smoke dampers	fire and fire/smoke dampers are selected according to size, duct orientation, application and project specifications
C-12.04.03P	choose location for installation of fire and fire/smoke dampers and access doors	location of fire and fire/smoke dampers and access doors are chosen according to application, and project and manufacturers' specifications
C-12.04.04P	select and prepare sleeves	sleeves are selected and prepared according to application, codes, jurisdictional regulations and manufacturers' specifications
C-12.04.05P	measure fire and fire/smoke dampers	fire and fire/smoke dampers are measured and compared to drawings and project specifications
C-12.04.06P	prepare sectional fire and fire/smoke dampers	sectional fire and fire/smoke dampers are prepared by bolting sections together and adding stiffeners to fire and fire/smoke damper frames, according to manufacturers' specifications
C-12.04.07P	secure fire and fire/smoke dampers	fire and fire/smoke dampers are secured using fasteners and retaining angles according to codes, jurisdictional regulations and manufacturers' specifications
C-12.04.08P	test fire and fire/smoke dampers	fire and fire/smoke dampers are tested to ensure free movement of parts according to project specifications
C-12.04.09P	install access doors on ductwork	access doors on ductwork are installed for easy access to perform tests and visual inspections and to reset fire and fire/smoke dampers
C-12.04.10P	install breakaway joints	breakaway joints are installed according to jurisdictional regulations, codes and manufacturers' specifications

C-12.04.11P	seal fire and fire/smoke dampers	fire and fire/smoke dampers are sealed at retaining angles to maintain fire separation according to jurisdictional regulations and manufacturers' specifications
-------------	----------------------------------	--

Knowledge

Reference Code	Learning Outcomes and Objectives
----------------	----------------------------------

C-12.04.01L	demonstrate knowledge of fire and fire/smoke dampers, their components, characteristics, applications and operation
-------------	---

- | | |
|----|--|
| a. | identify types of fire and fire/smoke dampers, and describe their characteristics and applications |
| b. | describe operating principles of fire and fire/smoke dampers |
| c. | interpret information about fire and fire/smoke dampers found on drawings and specifications |

C-12.04.02L	demonstrate knowledge of procedures to install fire and fire/smoke dampers
-------------	--

- | | |
|----|---|
| a. | identify tools and equipment used to install fire and fire/smoke dampers, and describe their procedures for use |
| b. | identify hazards, and describe safe work practices to install fire and fire/smoke dampers |
| c. | identify hazards, and describe safe work practices to work on or around electrical equipment and sources |
| d. | describe procedures to install fire and fire/smoke dampers |

C-12.04.03L	demonstrate knowledge of regulatory requirements to install fire and fire/smoke dampers
-------------	---

- | | |
|----|--|
| a. | identify codes, standards and jurisdictional regulations to install fire and fire/smoke dampers |
|----|--|

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.05 Installs registers, grilles, diffusers and louvers

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.05.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.05.02P	select registers, grilles, diffusers and louvers	registers, grilles, diffusers and louvers are selected according to drawings and project specifications
C-12.05.03P	connect registers, grilles, diffusers and louvers to ductwork	registers, grilles, diffusers and louvers are connected to ductwork using flex and rigid connections, placing in ceiling grid/wall/floor, and taking directional considerations into account
C-12.05.04P	align registers, grilles, diffusers and louvers	registers, grilles, diffusers and louvers are aligned for aesthetic reasons
C-12.05.05P	assemble registers, grilles, diffusers, louvers and their components	registers, grilles, diffusers, louvers and their components are assembled according to manufacturers' specifications
C-12.05.06P	install access doors	access doors are installed according to jurisdictional regulations and project specifications
C-12.05.07P	seal grilles, diffusers and louvers	grilles, diffusers and louvers are sealed according to job requirements

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.05.01L	demonstrate knowledge of registers, grilles, diffusers and louvers, their components, characteristics, applications and operation
	a. identify types of registers, grilles, diffusers and louvers, and describe their characteristics and applications
	b. describe operating principles of registers, grilles, diffusers and louvers
	c. interpret information about registers, grilles, diffusers and louvers found on drawings and specifications
C-12.05.02L	demonstrate knowledge of procedures to install registers, grilles, diffusers and louvers
	a. identify tools and equipment used to install registers, grilles, diffusers and louvers, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install registers, grilles, diffusers and louvers
	c. describe procedures to install registers, grilles, diffusers and louvers
C-12.05.03L	demonstrate knowledge of regulatory requirements to install registers, grilles, diffusers and louvers
	a. identify codes, standards and jurisdictional regulations to install registers, grilles, diffusers and louvers

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.06 Installs terminal boxes

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.06.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements

C-12.06.02P	determine terminal box position	terminal box position is determined according to factors
C-12.06.03P	install access doors on ductwork	access doors on ductwork are installed according to drawings, and project and manufacturers' specifications for testing and cleaning purposes
C-12.06.04P	secure and seal terminal boxes	terminal boxes are secured and sealed to ductwork, plenums or units using mechanical fasteners
C-12.06.05P	determine duct inlet straight length requirements	duct inlet straight length requirements are determined prior to connection to main ductwork for optimal operation according to project and manufacturers' specifications

Range of Variables (include, but not limited to)

factors: airflow direction marked on box, duct inlet straight length requirements, access to connections and shafts, drawings, project and manufacturers' specifications

mechanical fasteners: S-cleats, drive cleats, screws

Knowledge

Reference Code	Learning Outcomes and Objectives	
C-12.06.01L	demonstrate knowledge of terminal boxes, their components, characteristics, applications and operation	
	a. identify terminal boxes, and describe their characteristics and applications	
	b. describe operating principles of terminal boxes	
	c. interpret information about terminal boxes found on drawings and specifications	
C-12.06.02L	demonstrate knowledge of procedures to install terminal boxes	
	a. identify tools and equipment used to install terminal boxes, and describe their procedures for use	
	b. identify hazards, and describe safe work practices to install terminal boxes	
	c. describe procedures to install terminal boxes	
C-12.06.03L	demonstrate knowledge of regulatory requirements to install terminal boxes	
	a. identify codes, standards and jurisdictional regulations to install terminal boxes	

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, ANSI, NBC, CSA, ULC, AHJ

C-12.07 Installs coils and duct heaters

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.07.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.07.02P	verify coil and duct heater sizing	sizing of coil and duct heater is verified according to load
C-12.07.03P	determine coil and duct heater position	coil and duct heater position is determined according to factors
C-12.07.04P	install access doors on ductwork	access doors on ductwork are installed for testing and cleaning purposes according to drawings, and project and manufacturers' specifications
C-12.07.05P	place, secure and seal coils and duct heater	coils and duct heater are placed, secured and sealed to ductwork, plenums and units by installing channels, drain pans and blanking using mechanical fasteners

Range of Variables (include, but not limited to)

factors: airflow direction marked on coil and duct heater, access to connections, for easy removal and service, spacing requirements, drawings, project specifications, manufacturers' specifications

mechanical fasteners: S-cleats, drive cleats, screws, bolts

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.07.01L	demonstrate knowledge of coils and duct heaters, their components, characteristics, applications and operation
	a. identify coils and duct heaters, and describe their characteristics and applications
	b. describe operating principles of coils and duct heaters
	c. interpret information about coils and duct heaters found on drawings and specifications
C-12.07.02L	demonstrate knowledge of procedures to install coils and duct heaters
	a. identify tools and equipment used to install coils and duct heaters, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install coils and duct heaters
	c. identify hazards, and describe safe work practices about air quality management
	d. identify hazards, and describe safe work practices to work on or around electrical equipment and sources
	e. describe procedures to install coils and duct heaters
C-12.07.03L	demonstrate knowledge of regulatory requirements to install coils and duct heaters
	a. identify codes, standards and jurisdictional regulations to install coils and duct heaters

Range of Variables (include, but not limited to)

standards: SMACNA, ASHRAE, ANSI, NBC, NFPA, CSA, ULC, AHJ

C-12.08 Installs system component accessories

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.08.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.08.02P	determine installation requirements for system component accessories	installation requirements for system component accessories are determined according to drawings, and project and manufacturers' specifications
C-12.08.03P	determine location of system component accessories	location of system component accessories is determined according to accessibility, and project and manufacturers' specifications
C-12.08.04P	secure system component accessories	system component accessories are secured using mechanical fasteners according to job requirements and manufacturers' specifications

Range of Variables (include, but not limited to)

system component accessories: air balancing test ports; burglar bars; humidifiers; dehumidifiers; spark arrestors; air, noise and odour filtration systems; access doors; airflow sensors; temperature sensors; controls

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.08.01L	demonstrate knowledge of system component accessories , their components, characteristics, applications and operation
	a. identify types of system component accessories , and describe their characteristics and applications

	b. describe operating principles of system component accessories
	c. interpret information about system component accessories found on drawings and specifications
C-12.08.02L	demonstrate knowledge of procedures to install system component accessories
	a. identify tools and equipment used to install system component accessories , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install system component accessories
	c. identify hazards, and describe safe work practices for air quality management
	d. identify hazards, and describe safe work practices to work on or around electrical equipment and sources
	e. describe procedures to install system component accessories
C-12.08.03L	demonstrate knowledge of regulatory requirements to install system component accessories
	a. identify codes, standards and jurisdictional regulations to install system component accessories

Range of Variables (include, but not limited to)

system component accessories: air balancing test ports; burglar bars; humidifiers; dehumidifiers; spark arrestors; air, noise and odour filtration systems; access doors; airflow sensors; temperature sensors; controls

C-12.09 Installs plenums

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.09.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-12.09.02P	select and lay out plenums and components	plenums and components are selected and laid out according to drawings and installation sequence

C-12.09.03P	assemble plenums and components	plenums and components are assembled according to labelling, tagging and drawings
C-12.09.04P	connect and seal joints	joints are connected and sealed to ensure integrity according to project specifications and standards
C-12.09.05P	place and secure plenums	plenums are placed and secured to support system according to project specifications and standards

Range of Variables (include, but not limited to)

components: coils, duct heaters, fans, humidifiers, dehumidifiers, flexible connections, filters, louvers, dampers, drains, drain pans, doors, diffusers

standards: SMACNA, ASHRAE, ANSI, NBC, CWB, NFPA, AHJ

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.09.01L	demonstrate knowledge of plenums, their components , characteristics, applications and operation
	a. identify plenums and their components , and describe their characteristics and applications
	b. describe operating principles of plenums and their components
	c. interpret information about plenums and their components found on drawings and specifications
C-12.09.02L	demonstrate knowledge of procedures to install plenums
	a. identify tools and equipment used to install plenums, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install plenums
	c. describe procedures to install plenums
C-12.09.03L	demonstrate knowledge of regulatory requirements to install plenums
	a. identify codes, standards and jurisdictional regulations to install plenums

Range of Variables (include, but not limited to)

components: coils, duct heaters, fans, humidifiers, dehumidifiers, flexible connections, filters, louvers, dampers, drains, drain pans, doors, diffusers

standards: SMACNA, ASHRAE, ANSI, NBC, CWB, NFPA, AHJ

Task C-13 Installs material handling system components

Task Descriptor

Material handling system components have specific applications such as dust collection, product separation and conveyance, and handling materials. These components may be installed for convenience, safety, cleanliness and cost-saving.

C-13.01 Installs pneumatic and gravity material handling system components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-13.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-13.01.02P	determine location of components	location of components is determined according to project specifications
C-13.01.03P	assemble ductwork, fittings and components	ductwork, fittings and components are assembled according to tagging, drawings and manufacturers' specifications
C-13.01.04P	check ground wires are installed	ground wires are checked to ensure they are installed
C-13.01.05P	complete transverse connections	transverse connections are completed by welding or fastening to limit protrusions according to manufacturers' specifications
C-13.01.06P	secure ducts and fittings	ducts and fittings are secured to support systems according to project specifications and standards

C-13.01.07P	select and install components	components are selected and installed to ensure a smooth passage of materials through system by minimizing angle and direction changes
C-13.01.08P	select and install material handling lining	material handling lining is selected and installed according to manufacturers' and project specifications

Range of Variables (include, but not limited to)

components: chutes, explosion ducts, blast gates, relief vents, explosion dampers, blowers, separating devices (bag houses, cyclones), air locks, isolators, hoppers, bins

standards: SMACNA, ASHRAE, NBC, ANSI, CSA, NFPA, CWB

material handling lining: ceramic, ultra high molecular weight (UHMW) polyurethane, composite

Knowledge

Reference Code	Learning Outcomes and Objectives
C-13.01.01L	demonstrate knowledge of pneumatic and gravity material handling system components , their characteristics, applications and operation
	a. identify types of pneumatic and gravity material handling system components , and describe their characteristics and applications
	b. describe operating principles of pneumatic and gravity material handling system components
	c. interpret information about pneumatic and gravity material handling system components found on drawings and specifications
C-13.01.02L	demonstrate knowledge of procedures to install pneumatic and gravity material handling system components
	a. identify tools and equipment used to install pneumatic and gravity material handling system components , and describe their procedures for use
	b. identify hazards , and describe safe work practices to install pneumatic and gravity material handling system components
	c. describe procedures to prepare for installation of pneumatic and gravity material handling system components
	d. identify considerations when installing pneumatic and gravity material handling system components
	e. describe procedures to install pneumatic and gravity material handling system components

C-13.01.03L demonstrate knowledge of regulatory requirements to install pneumatic and gravity material handling system **components**

- a. identify codes and **standards** to install pneumatic and gravity material handling system **components**

Range of Variables (include, but not limited to)

components: chutes, explosion ducts, blast gates, relief vents, explosion dampers, blowers, separating devices (bag houses, cyclones), air locks, isolators, hoppers, bins

hazards: pinch/crush points, system pressure hazards

procedures to prepare for installation of pneumatic and gravity material handling system components:

determining equipment requirements, verifying duct sizing, determining penetration locations, performing site measurements, demolishing and removing existing systems and components, performing on-site coordination, staging (storing material), planning, distributing (material to installation area), sectioning (pre-assembling on-site), erecting, completing final inspection

considerations when installing pneumatic and gravity material handling system components:

manufacturers' specifications, building materials, environmental conditions, field design modifications, site conditions, equipment requirements, design limitations

standards: SMACNA, ASHRAE, NBC, ANSI, CSA, NFPA, CWB

C-13.02 Installs mechanized material handling system components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-13.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-13.02.02P	determine location of mechanized material handling system components	location of mechanized material handling system components is determined according to project and manufacturers' specifications
C-13.02.03P	assemble mechanized material handling system components	mechanized material handling system components are assembled according to tagging, drawings and project specifications

C-13.02.04P	complete connections	connections are welded and fastened according to drawings and project specifications
C-13.02.05P	secure mechanized material handling system components	mechanized material handling system components are secured to supports, bases or hanging systems according to project specifications
C-13.02.06P	select and install fittings and mechanized material handling system components	fittings and mechanized material handling system components are selected and installed according to project specifications
C-13.02.07P	select and install material handling lining	material handling lining is selected and installed according to project specifications

Range of Variables (include, but not limited to)

mechanized material handling system components: chutes, slides, conveyors, augers

material handling linings: ceramic, UHMW polyurethane, composite

Knowledge

Reference Code	Learning Outcomes and Objectives	
C-13.02.01L	demonstrate knowledge of mechanized material handling system components , their characteristics, applications and operation	
	a.	identify types of mechanized material handling system components , and describe their characteristics and applications
	b.	identify types of material handling linings , and describe their characteristics and applications
	c.	describe operating principles of mechanized material handling system components
	d.	interpret information about mechanized material handling system components found on drawings and specifications
C-13.02.02L	demonstrate knowledge of procedures to install mechanized material handling system components	
	a.	identify tools and equipment used to install mechanized material handling system components , and describe their procedures for use
	b.	identify hazards, and describe safe work practices and procedures to install mechanized material handling system components

c. describe procedures to install **mechanized material handling system components**

d. describe procedures to complete a connection

C-13.02.03L demonstrate knowledge of regulatory requirements to install **mechanized material handling system components**

a. identify **standards** to install **mechanized material handling system components**

Range of Variables (include, but not limited to)

mechanized material handling system components: chutes, slides, conveyors, augers

material handling linings: ceramic, UHMW polyurethane, composite

safe work practices and procedures: lock-out and tag-out, identifying pinch/crush points, working around moving equipment

standards: SMACNA, ASHRAE, NBC, ANSI, CSA, NFPA

Task C-14 Applies thermal insulation, lagging, cladding and flashing

Task Descriptor

Sheet metal workers apply insulation, lagging, cladding and flashing to prevent condensation, limit operating costs, increase the efficiency of equipment through the conservation of energy, and to protect insulation and ductwork from damage due to environmental exposure. For this task, application may include on-site fabrication.

C-14.01 Applies thermal insulation to components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-14.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-14.01.02P	select insulation	insulation is selected according to project specifications and standards

C-14.01.03P	identify location to be insulated	location to be insulated is identified according to drawings, project specifications and standards
C-14.01.04P	measure, lay out and cut insulation pieces	insulation pieces are measured, laid out and cut
C-14.01.05P	secure insulation	insulation is secured by applying fasteners and components

Range of Variables (include, but not limited to)

tools and equipment: knives, end cutters, pin spotters, banders, snips, glue guns, paint brushes

standards: SMACNA, NFPA, NBC

fasteners and components: pins, z-bars, glue, insulation washers, bands

thermal insulation: ceramic wool, fibreglass, mineral wool, closed cell, foam glass

safe work practices and procedures: using PPE, elevating devices, keeping areas well-ventilated

Knowledge

Reference Code	Learning Outcomes and Objectives	
C-14.01.01L	demonstrate knowledge of thermal insulation , their characteristics and applications	
	a.	identify types of thermal insulation , and describe their characteristics and applications
	b.	identify types of fasteners and components used to apply thermal insulation, and describe their characteristics and applications
	c.	interpret information about thermal insulation found on drawings and specifications
C-14.01.02L	demonstrate knowledge of procedures to apply thermal insulation	
	a.	identify tools and equipment used to apply thermal insulation , and describe their procedures for use
	b.	identify hazards, and describe safe work practices and procedures to apply thermal insulation
	c.	describe procedures to apply thermal insulation
C-14.01.03L	demonstrate knowledge of regulatory requirements to apply thermal insulation	
	a.	identify codes, standards and jurisdictional regulations to apply thermal insulation

Range of Variables (include, but not limited to)

thermal insulation: ceramic wool, fibreglass, mineral wool, closed cell, foam glass

fasteners and components: pins, z-bars, glue, insulation washers, bands

tools and equipment: knives, end cutters, pin spotters, banders, snips, glue guns, paint brushes

safe work practices and procedures: using PPE, elevating devices, keeping areas well-ventilated

standards: SMACNA, NFPA, NBC

C-14.02 Applies lagging and cladding to components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-14.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-14.02.02P	select material and fasteners	material and fasteners are selected according to drawings and job requirements
C-14.02.03P	measure, lay out, cut and form material	material is measured, laid out, cut and formed to ensure fit
C-14.02.04P	select seams and joints	seams and joints are selected according to SMACNA
C-14.02.05P	form seams and joints for lagging and cladding	seams and joints for lagging and cladding are formed according to drawings and project specifications
C-14.02.06P	overlap seams and joints and slope material	seams and joints are overlapped, and material is sloped to shed moisture
C-14.02.07P	secure and seal material	material is secured and sealed using fasteners

Range of Variables (include, but not limited to)

materials: metal (copper, aluminum, stainless steel), plastic, composite

fasteners: banding, screws, sealants, adhesives, expansion springs

seams and joints: slip-lock, lapped, Pittsburgh

Knowledge

Reference Code	Learning Outcomes and Objectives
C-14.02.01L	demonstrate knowledge of lagging and cladding, their characteristics and applications
	a. identify lagging and cladding, and describe their characteristics and applications
	b. identify types of material, fasteners, seams and joints used for lagging and cladding, and describe their characteristics and applications
	c. interpret information about lagging and cladding found on drawings and specifications
C-14.02.02L	demonstrate knowledge of procedures to apply lagging and cladding to components
	a. identify tools and equipment used to apply lagging and cladding to components, and describe their procedures for use
	b. identify hazards, and describe safe work practices to apply lagging and cladding to components
	c. describe procedures to apply lagging and cladding to components
	d. identify methods used to secure and seal material , and seams and joints
	e. identify layout methods
	f. calculate measurements of materials before cutting
	g. calculate seam and joint allowances
C-14.02.03L	demonstrate knowledge of regulatory requirements to apply lagging and cladding to components
	a. identify standards to apply lagging and cladding to components

Range of Variables (include, but not limited to)

materials: metal (copper, aluminum, stainless steel), plastic, composite

fasteners: banding, screws, sealants, adhesives, expansion springs

seams and joints: slip-lock, lapped, Pittsburgh

C-14.03 Applies flashing to components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-14.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-14.03.02P	select material	material is selected according to drawings and project specifications
C-14.03.03P	measure and modify flashing	flashing is measured and modified to fit on-site conditions
C-14.03.04P	complete seams and joints	seams and joints are completed to shed moisture
C-14.03.05P	secure and seal material	material is secured and sealed using fasteners to ensure a weather-tight seal

Range of Variables (include, but not limited to)

fasteners: screws, sealants, adhesives, rivets

Knowledge

Reference Code	Learning Outcomes and Objectives
C-14.03.01L	demonstrate knowledge of flashing, their characteristics and applications
	a. identify flashing, and describe their characteristics and applications
	b. identify types of fasteners used to apply flashing, and describe their characteristics and applications
	c. interpret information about flashing found on drawings and specifications
C-14.03.02L	demonstrate knowledge of procedures to apply flashing to components
	a. identify tools and equipment used to apply flashing to components, and describe their procedures for use
	b. identify hazards, and describe safe work practices to apply flashing to components

-
- c. describe procedures to apply flashing to components
 - d. identify **considerations** when installing flashing to components
-

Range of Variables (include, but not limited to)

fasteners: screws, sealants, adhesives, rivets

considerations: isolators, building materials, environmental conditions, field design modifications

Task C-15 Performs leak testing, air balancing and commissioning

Task Descriptor

Sheet metal workers perform testing, adjusting, balancing and leak testing to ensure that the system operates efficiently at its specified performance level. Sheet metal workers also participate in the commissioning of building systems.

C-15.01 Performs leak tests

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-15.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
C-15.01.02P	seal and cap test section using materials	test section is sealed and capped using materials according to job requirements and project specifications
C-15.01.03P	determine allowable system leakage rate	allowable system leakage rate is determined by comparing leakage test results to standards and project specifications

C-15.01.04P	pressurize ductwork to predetermined pressure	ductwork is pressurized to predetermined pressure by attaching blower to duct according to standards and project specifications
C-15.01.05P	identify and mark leaking areas	leaking areas are identified and marked when leakage is higher than allowable leakage rate
C-15.01.06P	reseal and retest leaking areas	leaking areas are resealed and retested once sealant has cured according to manufacturers' specifications
C-15.01.07P	document test results	test results are documented according to project specifications

Range of Variables (include, but not limited to)

materials: end caps, polyethylene, tape, sealers, gaskets

standards: SMACNA; ASHRAE; AHJ; LEED; Testing, Adjusting and Balancing Bureau (TABB)

Knowledge

Reference Code	Learning Outcomes and Objectives
C-15.01.01L	demonstrate knowledge of leak tests , their characteristics, limitations and applications
	a. identify types of leak tests , and describe their characteristics, limitations and applications
	b. interpret information about leak tests found on drawings and specifications
C-15.01.02L	demonstrate knowledge of procedures to perform leak tests
	a. identify tools and equipment used to perform leak tests , and describe their procedures for use
	b. identify hazards, and describe safe work practices to perform leak tests
	c. describe procedures to perform leak tests
	d. identify problems pertaining to air and material handling systems , and describe procedures to prevent and correct them
C-15.01.03L	demonstrate knowledge of additional training and certification requirements to perform leak tests
	a. identify additional training and certification requirements to perform leak tests

C-15.01.04L demonstrate knowledge of regulatory requirements to perform **leak tests**

a. identify **standards** and jurisdictional regulations to perform **leak tests**

Range of Variables (include, but not limited to)

leak tests: pressure test, smoke test

problems pertaining to air and material handling systems: lack of or excessive air pressure, improper installation (duct sizing, noise)

training and certification: in some jurisdictions TABB training and certification may be required

standards: SMACNA; ASHRAE; AHJ; LEED; Testing, Adjusting and Balancing Bureau (TABB)

C-15.02 Performs testing, adjusting and balancing (TAB)

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-15.02.01P	select and use tools and testing equipment	tools and testing equipment are selected and used according to job requirements
C-15.02.02P	verify dampers, filters and coils	dampers are verified to ensure they are operational, and filters and coils are verified for cleanliness
C-15.02.03P	perform duct traverse	duct traverse is performed by creating test ports in ductwork by drilling holes, to determine volume and velocity of system
C-15.02.04P	perform calculations	calculations are performed to determine airflow and compare to project specifications
C-15.02.05P	adjust air handling system equipment and components	air handling system equipment and components are adjusted to achieve required airflow at unit

C-15.02.06P	test and adjust main, zone and branch ductwork and individual outlets	main, zone and branch ductwork and individual outlets are adjusted to meet project specifications
C-15.02.07P	document balancing results	balancing results are documented according to project specifications

Range of Variables (include, but not limited to)

air handling system equipment and components: motor pulleys, dampers, blower pulleys, three-stage fans, variable speed drives, test ports

Knowledge

Reference Code	Learning Outcomes and Objectives
C-15.02.01L	demonstrate knowledge of testing, adjusting and balancing (TAB) on air handling systems, their characteristics, limitations and applications
	a. identify TAB on air handling systems, and describe their characteristics, limitations and applications
	b. interpret information about performing TAB on air handling systems found on drawings and specifications
C-15.02.02L	demonstrate knowledge of procedures to perform TAB on air handling systems
	a. identify tools and testing equipment used to perform TAB on air handling systems, and describe their procedures for use
	b. identify hazards, and describe safe work practices to perform TAB on air handling systems
	c. identify problems pertaining to air handling systems, and describe procedures to prevent and correct them
	d. explain importance of TAB to ensure optimal system performance
	e. describe procedures to perform TAB on air handling systems
	f. describe procedures to adjust air handling system equipment and components to optimize performance
C-15.02.03L	demonstrate knowledge of regulatory requirements to perform TAB on air handling systems
	a. identify codes, standards and jurisdictional regulations to perform TAB on air handling systems

Range of Variables (include, but not limited to)

air handling system equipment and components: motor pulleys, dampers, blower pulleys, three-stage fans, variable speed drives, test ports

standards: TABB, SMACNA

C-15.03 Participates in commissioning of air and material handling systems

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-15.03.01P	meet with commissioning agent throughout project	meetings with commissioning agent are held throughout project to verify work completed so far
C-15.03.02P	provide documentation to commissioning agent	documentation is provided to commissioning agent according to project specifications
C-15.03.03P	perform walk-around with commissioning agent	walk-around with commissioning agent is performed to identify locations of equipment and deficiencies
C-15.03.04P	address deficiencies cited on commissioning report	deficiencies cited on commissioning report are addressed
C-15.03.05P	label equipment	equipment is labelled according to project specifications for purpose of identification, commissioning and maintenance
C-15.03.06P	educate building manager or owner on system operation and maintenance, and provide turnover documents	building manager or owner is educated on system operation and maintenance, and information is provided in turnover documents

Range of Variables (include, but not limited to)

documentation: equipment shop drawings, as-built drawings, test results

Knowledge

Reference Code	Learning Outcomes and Objectives
-----------------------	---

C-15.03.01L	demonstrate knowledge of commissioning of air and material handling systems, its characteristics and applications
-------------	---

	a. identify purpose of commissioning air and material handling systems, and describe its characteristics and applications
--	---

	b. interpret documentation about commissioning of air and material handling systems
--	--

C-15.03.02L	demonstrate knowledge of procedures to participate in commissioning of air and material handling systems
-------------	--

	a. describe procedures to participate in commissioning of air and material handling systems
--	---

Range of Variables (include, but not limited to)

documentation: equipment shop drawings, as-built drawings, test results

Major Work Activity D – Installs roofing and specialty products

Task D-16 Installs roofing and cladding systems

Task Descriptor

Sheet metal workers install green and metal roofing systems, and cladding products to provide low maintenance, longevity of the building and protection from the elements. Various types of roof and cladding systems can also add to the aesthetics of the building.

D-16.01 Lays out roof and walls

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-16.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-16.01.02P	inspect building	building is inspected according to standards and project specifications
D-16.01.03P	establish reference lines	reference lines are established according to project specifications using tools and equipment
D-16.01.04P	confirm site measurements	site measurements are confirmed according to project specifications
D-16.01.05P	mark openings	openings are marked according to project specifications
D-16.01.06P	determine orientation of seams and joints	orientation of seams and joints are determined according to building dimensions, standards and project specifications , taking into consideration prevailing wind

D-16.01.07P	determine desired overall appearance	desired overall appearance is determined according to project specifications
D-16.01.08P	prepare sheeting for installation procedures	sheeting is prepared for installation procedures according to site conditions, standards and project specifications

Range of Variables (include, but not limited to)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, American Society for Testing and Materials (ASTM)

project specifications: penetrations, structural supports, manufacturers' specifications, engineering and architectural specifications, drawings (shop, details, sketches, interference)

prepare sheeting: pre-drilling, prepare for hoisting

Knowledge

Reference Code	Learning Outcomes and Objectives
D-16.01.01L	demonstrate knowledge of roofing and walls, their components , characteristics and applications
	a. identify types of roofing and walls and their components , and describe their characteristics and applications
	b. interpret information about roofing and walls found on drawings and specifications
	c. identify types of materials used in fabricating roofing and walls
	d. identify types of roof structures and construction features, and describe their characteristics and applications
D-16.01.02L	demonstrate knowledge of procedures to lay out roofing and walls and their components
	a. identify tools and equipment used to lay out roofing and walls, and describe their procedures for use
	b. identify hazards, and describe safe work practices to lay out roofing and walls
	c. calculate materials required in preparation for installation of roofing and walls
	d. describe procedures used to install materials to roofs and walls in preparation for installation of roofing and walls
	e. describe procedures to lay out roofing and walls and their components

D-16.01.03L demonstrate knowledge of regulatory requirements to lay out roofing and walls

- a. identify codes, **standards** and jurisdictional regulations to lay out roofing and walls

Range of Variables (include, but not limited to)

components: roof drainage, flashing, soffit and fascia, roof vents, wall panels, roof panels, cladding, skylights, domes, copula

roof structures: hip, gable, pitched, flat, green

procedures to lay out roofing and walls and their components: check for square, determine starting point, establish reference lines

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, American Society for Testing and Materials (ASTM)

D-16.02 Installs insulation, isolation material and building envelope components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-16.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-16.02.02P	install building envelope components	building envelope components are installed according to project specifications and standards
D-16.02.03P	select and use fasteners	fasteners are selected and used according to project specifications
D-16.02.04P	determine paneling system requirements	paneling system requirements are determined according to manufacturers' specifications and engineered drawings
D-16.02.05P	install panel mounting system	panel mounting system is installed according to project specifications , and engineered drawings

D-16.02.06P	apply and fasten insulation to structure	insulation is applied and fastened to structure according to site conditions, project specifications and engineered drawings
D-16.02.07P	apply isolation materials and components to structure	isolation materials and components are applied to structure according to design and manufacturers' specifications

Range of Variables (include, but not limited to)

building envelope components: felt paper, ice and water shield, self-adhesive membrane, wall and roof panels, vapour barrier, sleeves for penetrations, slip sheet

project specifications: penetrations, structural supports, manufacturers' specifications, engineering and architectural specifications, drawings (shop, details, sketches, interference)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

fasteners: pin bolts, screws, powder-actuated fasteners, rivets

panel mounting systems: z-bars, stand-offs, j-bars, clips, cleats

isolation materials and components: neoprene, caulking, wood, tape, paint, thermal clips

Knowledge

Reference Code	Learning Outcomes and Objectives
D-16.02.01L	demonstrate knowledge of insulation, isolation materials and components , and building envelope components , their characteristics, applications and operation
	a. identify types of insulation, isolation materials and components and building envelope components , and describe their characteristics and applications
	b. identify types of fasteners used to install insulation, isolation materials and components , and building envelope components
	c. interpret information about insulation, isolation materials and components , and building envelope components found on drawings and specifications
D-16.02.02L	demonstrate knowledge of procedures to install insulation, isolation materials and components , and building envelope components
	a. identify tools and equipment used to install insulation, isolation materials and components , and building envelope components , and describe their procedures for use

	b. identify hazards, and describe safe work practices to install insulation, isolation materials and components , and building envelope components
	c. describe procedures to install insulation, isolation materials and components , and building envelope components
	d. calculate materials required to install insulation, isolation materials and components , and building envelope components
D-16.02.03L	demonstrate knowledge of regulatory requirements to install insulation, isolation materials and components , and building envelope components
	a. identify codes, standards and jurisdictional regulations to install insulation, isolation materials and components , and building envelope components
D-16.02.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle insulation, isolation materials and components , and building envelope components
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

isolation materials and components: neoprene, caulking, wood, tape, paint, thermal clips

building envelope components: felt paper, ice and water shield, self-adhesive membrane, wall and roof panels, vapour barrier, sleeves for penetrations, slip sheet

fasteners: pin bolts, screws, powder-actuated fasteners, rivets

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

D-16.03 Installs roofing and cladding system components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-16.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements

D-16.03.02P	select and use fasteners	fasteners are selected and used according to project specifications and standards
D-16.03.03P	determine starting point	starting point is determined according to project specifications and standards to achieve minimal waste and finished appearance
D-16.03.04P	install required flashing	flashing required is installed according to project specifications and standards
D-16.03.05P	cut, fit and fasten panels to structure and mounting system	panels are cut, fitted and fastened to structure and mounting system following reference lines
D-16.03.06P	install expansion joints	expansion joints are installed according to project specifications and standards
D-16.03.07P	install coping, finish flashing, drainage and downspouts	coping, finish flashing, drainage and downspouts are installed according to project specifications and standards

Range of Variables (include, but not limited to)

fasteners: pre-engineered fasteners, screws, nails, bolts, welding, powder-actuated fasteners, expansion anchors

project specifications: penetrations, structural supports, manufacturers' specifications, engineering and architectural specifications, drawings (shop, details, sketches, interference)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

Knowledge

Reference Code	Learning Outcomes and Objectives
D-16.03.01L	demonstrate knowledge of roofing and cladding system components, their characteristics and applications
	a. identify types of roofing and cladding system components, and describe their characteristics and applications
	b. identify types of fasteners used to install roofing and cladding system components
	c. interpret information about fasteners and roofing and cladding system components found on drawings and specifications

D-16.03.02L	demonstrate knowledge of procedures, considerations and requirements to install roofing and cladding system components
	a. identify tools and equipment used to install roofing and cladding system components, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install roofing and cladding system components
	c. describe procedures to install materials to roofs or walls in preparation for installation of roofing and cladding system components
	d. describe procedures to install roofing and cladding system components
	e. calculate materials required to install roofing and cladding system components
D-16.03.03L	demonstrate knowledge of additional manufacturer training and certification requirements for installing roofing and cladding system components
	a. identify additional manufacturer training and certification requirements for installing roofing and cladding system components
D-16.03.04L	demonstrate knowledge of regulatory requirements to install roofing and cladding system components
	a. identify codes, standards and jurisdictional regulations to install roofing and cladding system components
D-16.03.05L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle roofing and cladding system components
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

fasteners: pre-engineered fasteners, screws, nails, bolts, welding, powder-actuated fasteners, expansion anchors

considerations and requirements: building materials, roof slope, expansion and contraction, prevailing winds and weather conditions, appearance

procedures to install roofing and cladding system components: cut, fit, secure, seal

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

D-16.04 Seals exposed joints

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-16.04.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-16.04.02P	select sealant	sealant is selected according to project specifications and standards
D-16.04.03P	prepare surface for sealant	surface is prepared for sealant by cleaning, pre-tinning and installing backer rod according to job requirements
D-16.04.04P	apply sealant	sealant is applied according to project specifications, standards and weather conditions
D-16.04.05P	apply joint and seam caps	joint and seam caps are applied to secure and seal, and for watershed

Range of Variables (include, but not limited to)

sealants: caulking, solder, mastic, butyl tape

project specifications: engineering, architectural and manufacturers' specifications, drawings (shop, details, sketches)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

Knowledge

Reference Code	Learning Outcomes and Objectives
D-16.04.01L	demonstrate knowledge of sealants , their characteristics and applications
	a. identify types of sealants used to seal joints, and describe their characteristics and applications
	b. identify types of backer rods used to seal joints, and describe their characteristics and applications

	c. interpret information about sealants and backer rods found on drawings and specifications
D-16.04.02L	demonstrate knowledge of procedures to seal exposed joints
	a. identify tools and equipment used to seal exposed joints, and describe their procedures for use
	b. identify hazards, and describe safe work practices to seal exposed joints
	c. describe procedures to seal exposed joints
D-16.04.03L	demonstrate knowledge of regulatory requirements to seal exposed joints
	a. identify codes, standards and jurisdictional regulations to seal exposed joints
D-16.04.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle sealants
	c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

sealants: caulking, solder, mastic, butyl tape

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

D-16.05 Installs decking

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	no	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-16.05.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-16.05.02P	determine material required	material required for job is determined according to standards and project specifications
D-16.05.03P	cut and fit decking	decking is cut and fitted according to standards and project specifications

D-16.05.04P	fasten decking	decking is fastened using fasteners according to standards and project specifications
D-16.05.05P	frame out non-structural openings	non-structural openings are framed out according to standards and project specifications
D-16.05.06P	finish exposed welds	exposed welds are finished according to standards and project specifications to prevent corrosion

Range of Variables (include, but not limited to)

material: metal pans, Q decking

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

project specifications: engineering, architectural and manufacturers' specifications, penetrations, structural supports, drawings (shop, details, sketches)

fasteners: screws, dimple tools, rivets, welds, powder-actuated

Knowledge

Reference Code	Learning Outcomes and Objectives
D-16.05.01L	demonstrate knowledge of decking, their components, characteristics and applications
	a. identify types of decking, and describe their characteristics and applications
	b. identify types of fasteners used to install decking, and describe their characteristics and applications
	c. identify types of material used for decking, and describe their characteristics and applications
	d. interpret information about decking found on drawings and specifications
D-16.05.02L	demonstrate knowledge of procedures to install decking
	a. identify tools and equipment used to install decking, and describe their procedures for use
	b. identify hazards, and describe safe work practices to install decking
	c. describe procedures to install decking
	d. calculate materials required to install decking
D-16.05.03L	demonstrate knowledge of additional training and certification requirements for puddle welding decking
	a. identify additional training and certification requirements for puddle welding decking
D-16.05.04L	demonstrate knowledge of regulatory requirements to install decking

- a. identify codes, **standards** and jurisdictional regulations to install decking
-
- D-16.05.05L demonstrate knowledge of sustainability and environmental stewardship practices
-
- a. identify practices that contribute to environmental protection
 - b. describe procedures to dispose of and recycle decking
 - c. identify practices that contribute to net-zero and carbon neutral efforts

Range of Variables (include, but not limited to)

fasteners: screws, dimple tools, rivets, welds, powder-actuated

material: metal pans, Q decking

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

Task D-17 Installs exterior components

Task Descriptor

Sheet metal workers install exterior components. They calculate, prepare and align surfaces for the installation of exterior components such as awnings and signage for functional and aesthetic reasons.

D-17.01 Prepares surface

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-17.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-17.01.02P	verify alignment (plumb, level, square) of exterior surface	alignment (plumb, level, square) of exterior surface is verified for aesthetic purposes and project specifications to ensure ease of installation

D-17.01.03P	identify fastening points	fastening points are identified according to site conditions and project specifications
D-17.01.04P	determine fastening system	fastening system is determined according to product material type, standards and project specifications
D-17.01.05P	clean installation area	installation area is cleaned using cleaning tools and cleaning products according to project specifications
D-17.01.06P	score surface	surface is scored for adherence according to material type and manufacturers' specifications
D-17.01.07P	apply waterproofing membrane and flashing	waterproofing membrane and flashing are applied according to project specifications to ensure watertight construction
D-17.01.08P	install fastening system	fastening system is installed according to standards and project specifications

Range of Variables (include, but not limited to)

project specifications: penetrations, structural supports, manufacturers' specifications, engineering and architectural specifications, drawings (shop, details, sketches, interference)

fastening systems: backing material, structural supports, stand-offs, clips

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

cleaning tools: scrapers, grinders, wire brushes

cleaning products: degreasers, acids, primers, paint

Knowledge

Reference Code	Learning Outcomes and Objectives
D-17.01.01L	demonstrate knowledge of fastening systems , their components, characteristics and applications
	a. identify types of fastening systems used for installation of exterior components
	b. interpret information about fastening systems found on drawings and specifications

D-17.01.02L	demonstrate knowledge of procedures to install fastening systems
a.	identify tools and equipment used to install fastening systems , and describe their procedures for use
b.	identify hazards, and describe safe work practices to install fastening systems
c.	describe procedure for identifying fastening points
d.	describe procedures to install fastening systems
D-17.01.03L	demonstrate knowledge of procedures to prepare surfaces for installation of exterior components
a.	identify tools and equipment used to prepare surfaces, and describe their procedures for use
b.	identify hazards, and describe safe work practices to prepare surfaces
c.	describe procedures to prepare surfaces for installation of exterior components
d.	identify types of cleaning tools , and cleaning products used for preparing surfaces for installation of exterior components
D-17.01.04L	demonstrate knowledge of regulatory requirements to install fastening systems
a.	identify codes, standards and jurisdictional regulations to install fastening systems and prepare surfaces for installation of exterior components
D-17.01.05L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	identify practices that contribute to environmental protection
b.	describe procedures to dispose of and recycle cleaning products

Range of Variables (include, but not limited to)

fastening systems: backing material, structural supports, stand-offs, clips

cleaning tools: scrapers, grinders, wire brushes

cleaning products: degreasers, acids, primers, paint

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, WHMIS

D-17.02 Fastens exterior components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-17.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-17.02.02P	select exterior components and fasteners	exterior components and fasteners are selected according to project specifications
D-17.02.03P	modify exterior components	exterior components are modified according to job conditions and requirements
D-17.02.04P	mount exterior components	exterior components are mounted according to standards and project specifications using fasteners
D-17.02.05P	seal joints	joints are sealed according to standards and project specifications to maintain weatherproof seal

Range of Variables (include, but not limited to)

exterior components: awnings, signage

fasteners: anchors, nail-ins, screws, adhesives

project specifications: engineering, architectural and manufacturers' specifications; penetrations; drawings (shop drawings, details, sketches)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, WHMIS

Knowledge

Reference Code	Learning Outcomes and Objectives
D-17.02.01L	demonstrate knowledge of exterior components , their characteristics and applications

	a. identify types of exterior components , and describe their characteristics and applications
	b. identify types of fasteners used to fasten exterior components
	c. identify types of sealants used to seal joints
	d. interpret information about exterior components, fasteners and sealants found on drawings and specifications
D-17.02.02L	demonstrate knowledge of procedures to fasten exterior components
	a. identify tools and equipment used to fasten exterior components , and describe their procedures for use
	b. identify hazards, and describe safe work practices to fasten exterior components
	c. describe procedures to fasten exterior components
	d. describe procedures to seal joints
D-17.02.03L	demonstrate knowledge of regulatory requirements to fasten exterior components and seal joints
	a. identify codes, standards and jurisdictional regulations to fasten exterior components and seal joints
D-17.02.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle fasteners and sealants

Range of Variables (include, but not limited to)

exterior components: awnings, signage

fasteners: anchors, nail-ins, screws, adhesives

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, WHMIS

Task D-18 Installs specialty products

Task Descriptor

Sheet metal workers install specialty products in residential, industrial, commercial and institutional (ICI) locations such as commercial kitchens, food processing plants, pharmaceutical laboratories, medical facilities, manufacturing plants and marine environments. They also design and install stainless or non-stainless architectural products on or inside a variety of buildings.

D-18.01 Installs stainless steel specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-18.01.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-18.01.02P	install components	components are installed according to standards, project specifications and site conditions
D-18.01.03P	select and use fasteners and hangers	fasteners and hangers are selected and used according to application, standards and project specifications
D-18.01.04P	isolate differing materials from each other	differing materials are isolated from each other to avoid galvanic corrosion or cross-contamination
D-18.01.05P	assemble components	components are assembled according to standards, project specifications and site conditions
D-18.01.06P	finish stainless steel specialty products	stainless steel specialty products are finished according to requirements and project specifications

D-18.01.07P apply **sealants and coatings**

sealants and coatings are applied according to **requirements** and **project specifications**

Range of Variables (include, but not limited to)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada

project specifications: engineering, architectural and manufacturers' specifications; penetrations; structural supports; drawings (shop, details, sketches)

finishes: polishing, buffing, pickling, passivating

stainless steel specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, decorative

requirements: sanitary, aesthetic

sealants and coatings: caulking, food grade caulking, silicone, butyl, epoxy, welds, powder coating, paint, epoxy paint

Knowledge

Reference Code	Learning Outcomes and Objectives
-----------------------	---

D-18.01.01L	demonstrate knowledge of stainless steel specialty products , their components, characteristics and applications
-------------	---

a.	identify types of stainless steel specialty products , and describe their characteristics and applications
----	---

b.	interpret information about stainless steel specialty products found on drawings and specifications
----	--

c.	identify types of fasteners used to install stainless steel specialty products , and describe their characteristics and applications
----	---

d.	identify types of sealants and coating used to finish stainless steel specialty products , and describe their characteristics and applications
----	--

D-18.01.02L	demonstrate knowledge of metals, their properties , characteristics and applications
-------------	---

a.	identify types of metals, and describe their properties , characteristics and applications
----	---

b.	describe identification systems for types of stainless steel and their finishes
----	--

D-18.01.03L	demonstrate knowledge of metallurgic principles
-------------	---

a.	describe effects metal working has on metallurgic properties
----	---

b.	identify practices that can create problems when working with stainless steel , and describe procedures used to prevent or correct these problems
----	--

D-18.01.04L	demonstrate knowledge of procedures to install stainless steel specialty products
	a. identify tools and equipment used to install stainless steel specialty products , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install stainless steel specialty products
	c. describe procedures to install stainless steel specialty products
	d. describe procedures used to finish and apply sealants and coating to stainless steel specialty products
D-18.01.05L	demonstrate knowledge of additional training and certification requirements to weld stainless steel specialty products
	a. identify additional training and certification requirements to weld stainless steel specialty products
D-18.01.06L	demonstrate knowledge of regulatory requirements to install stainless steel specialty products
	a. identify codes, standards , and jurisdictional regulations to install stainless steel specialty products
D-18.01.07L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle stainless steel specialty products and their components
	c. identify practices that contribute to net-zero and carbon neutral efforts when welding stainless steel specialty products

Range of Variables (include, but not limited to)

stainless steel specialty products: kitchen, medical, food processing, pharmaceutical, laboratory, decorative

sealants and coatings: caulking, food grade caulking, silicone, butyl, epoxy, welds, powder coating, paint, epoxy paint

properties (of metals): ductility, malleability, elasticity, hardness, composition, physical
identification systems for types of stainless steel and their finishes: numbering, gauging, lettering

effects metal working has on metallurgic properties: stress, contraction, expansion, distortion, work hardening, annealing, galvanic corrosion

practices that can create problems when working with stainless steel: forming, cutting/shearing, punching, drilling, joining, welding, grinding, sanding, polishing/buffing, storage and handling

finishes: polishing, buffing, pickling, passivating

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada

D-18.02 Installs non-stainless steel specialty products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-18.02.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-18.02.02P	install components	components are installed according to standards and project specifications
D-18.02.03P	select and use fasteners and hangers	fasteners and hangers are selected and used according to standards and project specifications
D-18.02.04P	isolate differing materials from each other	differing materials are isolated from each other to avoid galvanic corrosion or cross-contamination
D-18.02.05P	assemble components	components are assembled according to standards and project specifications
D-18.02.06P	apply sealants, coatings and oxidizers	sealants, coatings and oxidizers are applied according to requirements and project specifications

Range of Variables (include, but not limited to)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada

project specifications: engineering, architectural and manufacturers' specifications; penetrations; structural supports; drawings (shop, details, sketches)

sealants, coatings and oxidizers: solders, welding materials, caulking, paint, epoxy paint, fiberglass mat, glues, solvents, primers, polishing compound

requirements: sanitary, aesthetic, increased awareness of PPE and ventilation

Knowledge

Reference Code	Learning Outcomes and Objectives
D-18.02.01L	demonstrate knowledge of non-stainless steel specialty products , their components, characteristics and applications
	a. identify types of non-stainless steel specialty products , and describe their characteristics and applications
	b. interpret information about non-stainless steel specialty products found on drawings and specifications
	c. identify types of fasteners used to install non-stainless steel specialty products , and describe their characteristics and applications
	d. identify types of sealants, coatings and oxidizers used to finish non-stainless steel specialty products , and describe their characteristics and applications
D-18.02.02L	demonstrate knowledge of procedures to install non-stainless steel specialty products
	a. identify tools and equipment used to install non-stainless steel specialty products , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install non-stainless steel specialty products
	c. describe procedures to install non-stainless steel specialty products
	d. describe procedures used to finish and apply sealants, coatings and oxidizers to non-stainless steel specialty products
D-18.02.03L	demonstrate knowledge of regulatory requirements to install non-stainless steel specialty products
	a. identify codes, standards and jurisdictional regulations to install non-stainless steel specialty products
D-18.02.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. identify practices that contribute to environmental protection
	b. describe procedures to dispose of and recycle non-stainless steel specialty products and their components

Range of Variables (include, but not limited to)

non-stainless steel specialty products (may be metal or non-metal): kitchen, manufacturing, medical, food processing, pharmaceutical, laboratory, decorative, underground

sealants, coatings and oxidizers: solders, welding materials, caulking, paint, epoxy paint, fiberglass mat, glues, solvents, primers, polishing compound

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada

D-18.03 Installs marine products

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	no	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-18.03.01P	select and use tools and equipment	tools and equipment are selected and used according to job requirements
D-18.03.02P	install components	components are installed according to standards, project specifications and site conditions
D-18.03.03P	select materials to be used to install marine products	materials to be used to install marine products are selected according to standards and project specifications
D-18.03.04P	select and use fasteners and hangers	fasteners and hangers are selected and used according to standards and project specifications
D-18.03.05P	isolate differing materials from each other	differing materials are isolated from each other to avoid galvanic corrosion or cross-contamination
D-18.03.06P	assemble components	components are assembled according to standards and project specifications
D-18.03.07P	finish marine products	marine products are finished according to requirements and project specifications
D-18.03.08P	apply sealants and coatings	sealants and coatings are applied according to requirements and project specifications

Range of Variables (include, but not limited to)

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada, Transportation Safety Board (TSB)

project specifications: engineering, architectural and manufacturers' specifications; penetrations; structural supports; drawings (shop, details, sketches)

marine products (may be metal or non-metal): kitchen, laboratory, decorative, sandwich panels (wall and ceiling), doors, water-resistant louvers

requirements: sanitary, aesthetic

sealants and coatings: solders, welding materials, caulking, coatings (marine paint, epoxy paint, hot dip, lead paint), fiberglass mat, glues, solvents, primers

Knowledge

Reference Code	Learning Outcomes and Objectives
D-18.03.01L	demonstrate knowledge of marine products , their components, characteristics, applications and operation
	a. identify types of marine products , and describe their characteristics and applications
	b. identify types of fasteners used to install marine products , and describe their characteristics and applications
	c. interpret information about marine products found on drawings and specifications
D-18.03.02L	demonstrate knowledge of procedures to install marine products
	a. identify tools and equipment used to install marine products , and describe their procedures for use
	b. identify hazards, and describe safe work practices to install marine products
	c. describe procedures to install marine products
	d. identify special considerations for installing marine products
	e. describe differences in installing in dry dock versus floating locations
D-18.03.03L	demonstrate knowledge of additional training and certification requirements to weld and install marine products
	a. identify additional training and certification requirements to weld and install marine products
D-18.03.04L	demonstrate knowledge of regulatory requirements to install marine products
	a. identify codes, standards and jurisdictional regulations to install marine products

D-18.03.05L demonstrate knowledge of sustainability and environmental stewardship practices

a. identify practices that contribute to environmental protection

b. describe procedures to dispose of and recycle **marine products**

c. identify practices that contribute to net-zero and carbon neutral efforts when welding **marine products**

Range of Variables (include, but not limited to)

marine products (may be metal or non-metal): kitchen, laboratory, decorative, sandwich panels (wall and ceiling), doors, water-resistant louvers

special considerations for installing marine products: working without levels or squares on non-level or square surfaces, increased awareness of PPE, confined space, ventilation and life safety including flotation devices, working from a single benchmark

standards: AHJ, SMACNA, ASHRAE, NFPA, CSA, ANSI, NBC, CWB, ASTM, Health Canada, Transportation Safety Board (TSB)

Major Work Activity E – Performs maintenance and repair

Task E-19 Performs scheduled maintenance

Task Descriptor

Sheet metal workers perform scheduled maintenance to minimize repair costs, increase longevity and enhance system performance.

E-19.01 Performs maintenance inspections

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
E-19.01.01P	obtain service schedule	service schedule with list of equipment and components to be inspected is obtained according to manufacturers' specifications, and site and environmental conditions
E-19.01.02P	verify inspection checklist	inspection checklist is verified for itemization of equipment and components to be inspected
E-19.01.03P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
E-19.01.04P	perform required tests and readings	tests and readings are performed according to project requirements
E-19.01.05P	conduct sensory inspection	sensory inspection is conducted to identify possible faults
E-19.01.06P	record and report findings on inspection checklist	findings are recorded and reported on inspection checklist
E-19.01.07P	provide record of inspection report to client and keep record on file	record of inspection report is provided to client and kept on file

Range of Variables (include, but not limited to)

tests and readings: amp draws, resistance, voltage, air pressure, filter conditions, vibration, temperature, noise, flow rate

Knowledge

Reference Code	Learning Outcomes and Objectives
E-19.01.01L	demonstrate knowledge of procedures to perform maintenance inspections
	a. identify tools and equipment used to perform maintenance inspections, and describe their procedures for use
	b. identify testing devices used to identify system faults in system components, and describe their procedures for use
	c. identify types of tests and readings
	d. apply information from applicable standards to perform maintenance inspections
	e. identify hazards, and describe safe work practices to perform maintenance inspections
	f. describe procedures to perform maintenance inspections
	g. identify considerations when inspecting system components
	h. describe procedures to perform calculations to determine system performance
E-19.01.02L	demonstrate knowledge of codes and additional training and certification requirements for servicing system components
	a. identify additional training and certification requirements to service system components
	b. identify codes , standards and jurisdictional regulations for servicing system components
E-19.01.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe environmental practices, regulations and limitations for working with refrigerants and hazardous materials
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

testing devices: thermal imaging devices, multimeters, tachometers, belt-tensioning tools, thermometers, stethoscopes, refrigeration gauges, leak detectors, manometers

tests and readings: amp draws, resistance, voltage, air pressure, filter conditions, vibration, temperature, noise, flow rate

considerations: sounds, vibration, odours, heat build-up

codes: CSA B149, Mechanical refrigeration code (CSA B52.23), jurisdictional

E-19.02 Services components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
E-19.02.01P	verify inspection checklist	inspection checklist is verified for recommended servicing
E-19.02.02P	verify normal operating conditions and specific accessories	normal operating conditions and specific accessories are verified according to manufacturers' specifications
E-19.02.03P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
E-19.02.04P	clean and replace filters	filters are cleaned and replaced according to maintenance schedule or site requirements
E-19.02.05P	clean and replace components	components are cleaned by using cleaning methods and replaced according to maintenance schedule
E-19.02.06P	adjust and replace pulleys and belts	pulleys and belts are adjusted for alignment and tension according to manufacturers' specifications, and replaced according to wear, sensory inspection and maintenance schedule
E-19.02.07P	lubricate bearings and motor oil ports	bearings and motor oil ports are lubricated according to manufacturers' specifications and maintenance schedule

Range of Variables (include, but not limited to)

cleaning methods: degreasing, using compressed air, vacuuming, pressure washing, soaking

Knowledge

Reference Code	Learning Outcomes and Objectives
E-19.02.01L	demonstrate knowledge of procedures to service system components
	a. identify tools and equipment used to service system components, and describe their procedures for use
	b. identify hazards, and describe safe work practices to service system components
	c. describe procedures to service system components
	d. identify considerations when servicing system components
	e. describe procedures to perform calculations to determine system performance
	f. apply information from applicable standards to service system components
E-19.02.02L	demonstrate knowledge of codes , standards and additional training and certification requirements to service system components
	a. identify additional training and certification requirements to service system components
	b. identify codes , standards and jurisdictional regulations to service system components
E-19.02.03L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe environmental practices, regulations and limitations for working with refrigerants and hazardous materials
	b. describe procedures to dispose of and recycle materials

Range of Variables (include, but not limited to)

procedures to service system components: performing lock-out/tag-out, changing consumables (filters, pads, trays, bags, seals), cleaning components, lubricating, adjusting for alignment and tension

considerations: sounds, vibration, odours, heat build-up, indoor air quality, drainage

codes: CSA B149, CSA B52.23, jurisdictional

Task E-20 Repairs faulty systems and components

Task Descriptor

Sheet metal workers repair building systems and equipment such as heating, ventilation and air conditioning (HVAC), and conveyance systems to return them to normal operating conditions and specifications.

E-20.01 Diagnoses system faults

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
E-20.01.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
E-20.01.02P	conduct sensory inspections	sensory inspections are conducted to identify system faults
E-20.01.03P	perform tests and readings	tests and readings are performed as indicated by system faults
E-20.01.04P	identify sources of performance issues	sources of performance issues are identified by evaluating information
E-20.01.05P	evaluate performance of system	performance of system is evaluated against design requirements
E-20.01.06P	locate and identify worn, faulty and missing components	worn, faulty and missing components are located and identified
E-20.01.07P	recommend course of action	repair or replacement of components is recommended

Range of Variables (include, but not limited to)

tests and readings: amperage draws, air pressure readings, vibration, temperature, resistance, voltage, gas pressure, humidity, indoor air quality

information: history of work done, deficiency report, maintenance records, client feedback, observations, test results, flow charts, fan curves

Knowledge

Reference Code	Learning Outcomes and Objectives
E-20.01.01L	demonstrate knowledge of system faults
	a. identify symptoms of system faults
E-20.01.02L	demonstrate knowledge of procedures to diagnose system faults
	a. identify tools and equipment used to diagnose system faults, and describe their procedures for use
	b. identify hazards, and describe safe work practices to diagnose system faults
	c. describe procedures to diagnose system faults
	d. identify types of tests and readings required to diagnose system faults
	e. describe procedures to perform calculations to determine system performance
	f. apply information from applicable standards to diagnose system faults

Range of Variables (include, but not limited to)

symptoms of system faults: sounds, vibration, odours, heat build-up, increased amperage draw, mold, decreased airflow

tests and readings: amperage draws, air pressure readings, vibration, temperature, resistance, voltage, gas pressure, humidity, indoor air quality

E-20.02 Repairs worn or faulty components

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Skills

Reference Code	Performance Criteria	Evidence of Attainment
E-20.02.01P	select and use tools and equipment	tools and equipment are selected and used according to project requirements
E-20.02.02P	order components	components are ordered according to project requirements

E-20.02.03P	shut off utility services to appliance	utility services to appliance are shut off according to project requirements and safety procedures
E-20.02.04P	disassemble equipment and components	equipment and components are disassembled in required sequence according to job requirements
E-20.02.05P	replace and modify faulty and obsolete components	faulty and obsolete components are replaced and modified if required
E-20.02.06P	reassemble and tighten components	components are reassembled and tightened according to manufacturers' specifications
E-20.02.07P	perform tests and readings	tests and readings are performed to verify that system is operating according to job requirements
E-20.02.08P	prepare service history	service history is recorded in logbook according to job standards

Range of Variables (include, but not limited to)

components: fan belts, motors, isolators, sheaves, coils, fasteners, ductwork, batteries, controls, bearings, pillow blocks, electrical components

utility services: gas, electrical, water

tests and readings: amperage draws, air pressure readings, filter conditions

Knowledge

Reference Code	Learning Outcomes and Objectives
E-20.02.01L	demonstrate knowledge of procedures to repair system components
	a. identify tools and equipment used to repair system components , and describe their procedures for use
	b. identify hazards, and describe safe work practices to repair system components
	c. describe procedures to repair system components
	d. identify considerations when repairing system components
	e. identify electrical devices , and describe their purpose, characteristics and applications
	f. describe procedures to perform calculations to determine system performance
	g. apply information from applicable standards to repair system components

E-20.02.02L demonstrate knowledge of regulatory requirements to repair system **components**

- a. identify codes, **standards** and jurisdictional regulations to repair system **components**
-

E-20.02.03L demonstrate knowledge of sustainability and environmental stewardship practices

- a. describe repair practices that minimize waste
-
- b. describe procedures to dispose of and recycle materials
-

Range of Variables (include, but not limited to)

procedures to repair system components: lock-out/tag-out, replacing components, calibrating (e.g., tension, speed, motors, temperature, pressure), aligning, adjusting, reassembling, tightening

components: fan belts, motors, isolators, sheaves, coils, fasteners, ductwork, batteries, controls, bearings, pillow blocks, electrical components

considerations: type of replacement components, manufacturers' specifications, location of components, downtime during repair

electrical devices: circuit breakers, disconnects, overload heaters, GFI, fuses, PLC, motors, variable speed drives (VSD), flow switches, thermostats, capacitors

standards: SMACNA, ASHRAE, ANSI, NBC, CSA, Health Canada, TSB

Appendix A - Acronyms

AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AR	augmented reality
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BIM	Building Information Modeling
CAD	computer-aided design
CCUS	carbon capture, utilization and storage
CNC	computer numerical control
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
EAP	employee assistance plan
ERV	energy recovery ventilator
FCAW	flux core arc welding
FRP	fibre-reinforced polyethylene
GFI	ground fault interrupter
GMAW	gas metal arc welding
GTAW	gas tungsten arc welding
HEPA	high efficiency particulate air
HRV	heat recovery ventilator
HVAC	heating, ventilation and air conditioning
ICI	industrial, commercial and institutional
LEED	Leadership in Energy and Environmental Design
MEWP	mobile elevated work platform
MUA	make-up air unit
NBC	National Building Code
NC	numerical control
NFPA	National Fire Protection Association
OBD	opposed blade damper
OFW	oxy-fuel welding
OHS	Occupational Health and Safety
PLC	programmable logic controller
PPE	personal protective equipment
PSI	pre-safety inspection

PVC	polyvinyl chloride
RFI	request for information
RNG	recover natural gas
RTU	roof top unit
SDS	Safety Data Sheet
SMACNA	Sheet Metal and Air Conditioning National Association
SMAW	shielded metal arc welding
TAB	testing, adjusting and balancing
TABB	Testing, Adjusting and Balancing Bureau
TDC	transverse duct connector
TDF	transverse duct flange
TSB	Transportation Safety Board
UHMW	ultra high molecular weight
ULC	Underwriters Laboratories of Canada
VAV	variable air volume
VR	virtual reality
VSD	variable speed drive
WCB	Workers Compensation Board
WETT	Wood Energy Transfer Technology
WHMIS	Workplace Hazardous Materials Information System
ZCB	Zero Carbon Building

Appendix B - Tools and Equipment / Outils et équipement

Personal Protective Equipment (PPE) and Safety Equipment / Équipement de protection individuelle et équipement de sécurité

coveralls	combinaisons de travail
eye protection	protection oculaire
eye wash stations	douches oculaires
face shields	écrans faciaux
fall protection	dispositifs de protection contre les chutes
fire extinguishers	extincteurs
first aid kits	trousses de premiers soins
flotation devices	dispositifs de flottaison
fume exhaust systems	systèmes d'évacuation de la fumée
gloves	gants
hard hats	casques de sécurité
hearing protection	protection auditive
high visibility safety vests	gilets de haute visibilité
hydration stations	postes d'hydratation
leather aprons	tabliers de cuir
reflective vests	gilets à bandes réfléchissantes
respiratory protection	protection des voies respiratoires
safety boots	bottes de sécurité
sun protection	protection contre le soleil
weather protection (clothing, hoarding/warming hut)	la protection contre les intempéries (vêtements, abris temporaires, abris pour se réchauffer)
welding screens	écrans de soudeur
welding helmets	casques de soudeur
welding jackets	sarraus de soudeur

Hand Tools / Outils à main

adjustable wrenches	clés à molette
aviation snips R.H. and L.H. (various)	cisailles aviation pour coupe à droite et à gauche (divers)
banding tools	outils de cerclage
bar folders	plieuses de barre
bar markers	marqueurs pour barres

bulldog snips
caulking guns
C-clamps
center punches
chalk lines
chisels
combination snips
dividers
drift pins
duct pullers/stretchers
files
folders
groove seamers – hand groovers

hacksaws
hammers (raising, setting, ball peen,
riveting, mallets)
hand crimpers
hand dollies
hand notchers
hand seamers/folding pliers
hex keys
hole punches
levels
locking pliers
magnets
marking pens
paint brushes
pipe wrenches
pliers
plumb bobs
prick punches
riveters
rivet sets
scrapers
scratch awls
screwdrivers

cisailles Bulldog
pistolets à calfeutrer
serre-joints en C
pointeaux centreurs
cordeaux à craie
burins
cisailles universelles
compas à pointes sèches
broches d'assemblage
tireurs et tendeurs de conduits
limes
plieuses
agrafeuses rainées – fraises manuelles à
rainer
scies à métaux
marteaux (à rehausser, à restreindre, à
panne ronde, à rivet, et les maillets)
sertisseuses à main
tables à main
encocheuses à main
agrafeuses à main/plieuses manuelles
clés hexagonales
emporte-pièces
niveaux
pince-étaux
aimants
marqueurs
pinceaux
clés à tuyau
pinces
fils à plomb
pointeaux de traçage
riveteuse
bouterolles
grattoirs
pointes à tracer
tournevis

scribers
side cutters
socket sets
soldering coppers
straight edges
taps and dies
trammel points
wire and bolt cutters
wire brushes
wrenches

traçoirs
pinces coupantes de côté
jeux de douilles
fers à souder
règles droites
tarauds et filières
pointes de compas à verge
coupe-fils et coupe-boulons
brosses métalliques
clés

Portable Power Tools and Accessories / Outils mécaniques portatifs et accessoires

air compressors
angle drills
angle grinders
chop saws
circular saws
cordless drills
die grinders
double cutters
drill bits
electric drills
generators
hammer drills
hole saws
impact wrenches
jigsaws
laser leveling tools (line, plumb)

compresseurs d'air
perceuses d'angle
meuleuses d'angle
scies à sectionner
scies circulaires
perceuses sans fil
meuleuses à rectifier les matrices
fraises doubles
forets
perceuses électriques
génératrices
marteaux perforateurs
scies emporte-pièces
clés à chocs
scies sauteuses
outils de nivellement laser (ligne, fil à plomb)

metal cutting shears
nibblers
pneumatic hammers
pneumatic riveters
polishers and buffers
portable band saws
portable plasma cutters
powder-actuated tools

cisailles à découper
grignoteuses
marteaux pneumatiques
riveteuses pneumatiques
polisseuses
scies à ruban portatives
coupeuses au plasma portatives
fixateurs à cartouches

reciprocating saws
rotary hammers
seamers
spray guns
step bits
unishears

scies alternatives
marteaux rotatifs
agrafeuses
pistolets pulvérisateurs
forets étagés
cisailles à métal électrique (pied de cochon)

Shop Tools and Equipment / Outils et équipement d'atelier

abrasive cut-off saws
angle iron rollers
band iron benders
band saws
bar folders
box and pan brakes

scies à tronçonner abrasives
cintreuse de cornières
plieuses de feuillard de fer
scies à ruban
plieuses de barre
plieuses à tablier et à doigts / plieuses à boîtes et à couvercles / plieuse à piano

cheek benders
cleat folders
clinch lock machines
coil line machines
cold cut saws
dimplers
drill indexes
drill presses
foot shears
grinders
hand brakes
hydraulic presses
ironworkers
lever bench shears
magnetic brakes
manual notchers
patterns (e.g., flat templates used for layout)

plieuses de sections
plieuses de clavettes
machines de clinchage
machines à serpentín
scies à froid
emboutisseuses
calibres à forets
perceuses à colonne
cisailles à pédale
meuleuses
plieuses à main
presses hydrauliques
cisailles-poinçonneuses
cisailles d'établi à levier
plieuses magnétiques
encocheuses à main
patrons (p. ex., gabarits plats utilisés pour la disposition)

pin spotters
pipe-threaders, -cutters, -reamers

power brakes

localisateurs de goupilles
filières à tuyaux, coupe-tuyaux, alésoirs à tuyaux
presse-plieuses mécaniques

power notchers
power presses
power punches
power roll formers
power sanders or polishers
power shears
punching shears
rivet presses
riveting guns
roll forming machines
rotary punches
slitters
specialty forming equipment
spiral duct machines

encocheuses mécaniques
presses mécaniques
poinçons mécaniques
machines à profiler mécaniques
ponceuses ou polisseuses mécaniques
cisailles mécaniques
cisailles-poinçonneuses
presses à riveter
pistolets à riveter
machines pour le clinchage de joints
poinçons rotatifs
machines à refendre
équipement de formage spécialisé
machine à conduits d'airs hélicoïdaux

Rotary Machines / Machines rotatives

combination beading and crimping machines
double seaming equipment
easy edgers
ring and circle shears
slip roll formers
turning machines and attachments (such as elbow seaming, burring, beading, wiring, crimping)

machines à border et à sertir
équipement pour agrafage double
machines à border d'utilisation facile
cisailles circulaires à arbres inclinés
cintreuse à glissement
tours et accessoires (comme pour l'agrafage sur bords relevés, l'ébarbage, le roulage de bord, l'enroulement de fil métallique, le sertissage)

Metal Forming Bench Stakes / Enclumettes pour la mise en forme de tôles

anvils
beak horns
bench plates
blow horns
candle moulds
copper smiths
creasing stakes
double seaming
double seaming with heads
hatchets

enclumes
bigornes
tables d'établi
tas
moules à chandelle
chaudronniers sur cuivre
bigornes à crêper
agrafage double
agrafage double avec tête
hachettes

hollow mandrels
offset stakes
solid mandrels
squares

bigornes creuses à mandrin
enclumes en report
mandrins lisses
enclumes à tête carrée

Welding, Brazing, Soldering and Cutting Equipment / Équipement de brasage tendre, de brasage fort et de coupe

air carbon arc equipment (for gouging)

appareil de gougeage à l'arc avec électrode en carbone et jet d'air

butane torches

torches au butane

chill bars/chill plates

barres et plaques de refroidissement

chipping hammers

marteaux burineurs

electric soldering irons

fers à souder électriques

flux core arc welding (FCAW) equipment

équipement de soudage par procédé FCAW

gas metal arc welding (GMAW) equipment

équipement de soudage par procédé GMAW

gas tungsten arc welding (GTAW) equipment

équipement de soudage par procédé GTAW

irons

fers

laser cutting equipment (handheld, CNC)

équipement de découpe au laser (à main, CNC)

laser welding and cleaning equipment

équipement de soudage et de nettoyage laser

oxy-fuel welding (OFW) equipment

équipement de soudage oxygaz

plasma cutting equipment (handheld, CNC)

équipement de découpe au plasma (à main, CNC)

shielded metal arc welding (SMAW) equipment

équipement de soudage par procédé SMAW

soldering coppers

fers à souder

soldering furnaces or pots

fours ou pots à souder

spot welders

appareils de soudage par points

torches (acetylene, oxyacetylene, butane, air, tiger)

chalumeaux (acétylénique, oxyacétylénique, au butane, à l'air, buse de lance-flammes)

water jet cutting equipment

équipement de découpe au jet d'eau

Measuring Tools / Instruments de mesure

angle finders

détecteurs d'angle

angle rules

rapporteurs d'angle

bench rules

règles d'établi

calipers
circumference rulers
compasses
laser levels
laser measures
micrometers
scale rules
scribers
squares
tape measures
transit levels
vernier calipers
wheel gauges

compas d'épaisseur
règles de circonférence
compas
niveaux à laser
mesures au laser
micromètres
règles graduées
traçoirs
équerres
rubans à mesurer
niveaux théodolites
pieds à coulisse
calibres de roue

Shop and Field Layout and Drafting Equipment / Équipement de traçage et de dessin

chalk lines
combination squares
compasses (bow, beam)
dividers
drafting arms
drafting boards
drafting pencils
drafting tables
eraser shields
flexible curves
french curves
framing squares
parallel bars
protractors
scale rules
scratch awls
set squares
stencils
templates
trammel points
triangles
T-squares

cordeaux à craie
équerres combinées
compas (à balustre, à verge)
compas à pointes sèches
bras orientable de planche à dessin
planches à dessin
crayons à dessin
tables à dessin
gabarits à effacer
courbes flexibles
courbes françaises
équerres de charpentier
barres parallèles
rapporteurs d'angle
règles graduées
pointes à tracer
équerres à dessin
pochoirs
gabarits
pointes d'un compas à verge
équerres à dessin
équerres en T

Testing and Inspection Devices / Dispositifs d'essai et d'inspection

ammeters	ampèremètres
anemometers	anémomètres
belt-tensioning tools	tendeurs de courroies
calibrated flow hoods	hottes à flux jaugées
cameras	caméras
CO testers	analyseurs de CO
CO ₂ testers	analyseurs de CO ₂
differential pressure gauges	manomètres différentiels
digital combustion analyzers	analyseurs de combustion numériques
digital manometers	manomètres numériques
digital multimeters	multimètres numériques
digital scopes	oscilloscopes numériques
digital thermometers	thermomètres numériques
duct thermometers	thermomètres pour conduits
gas detection equipment	détecteurs de gaz
hygrometers	hygromètres
inclined manometers	manomètres à tube incliné
leak detectors	détecteurs de fuites
manometers	manomètres
mechanical tachometers	tachymètres mécaniques
micro amp meters	microampèremètres
multimeters	multimètres
O ₂ testers	analyseurs d'O ₂
pitot tubes	tubes de Pitot
pressure gauges	manomètres
pressure testers	vérificateurs de pression
psychrometers	psychromètres
radon detectors	détecteurs de radon
refrigeration gauges	manomètres de réfrigération
smoke testers	fumimètres
stack thermometers	thermomètres de gaz d'échappement
stethoscopes	stéthoscopes
stop watches	chronomètres
strobe tachometers	tachymètres stroboscopiques
tachometers	tachymètres

thermometers
thermal imaging devices
U tube manometers
velometers

thermomètres
appareils d'imagerie thermique
manomètres à tube en U
véloètres

Access Equipment / Équipement d'accès

aerial work platforms (stationary and mobile
elevated work platforms (MEWP))
bosun chairs
ladders
mast climbing lifts
scaffolds
swing stages

plateformes de travail élévatrices
(stationnaires et élévatrices mobiles)
chaises de gabier
échelles
plateformes de travail sur mât
échafaudages
échafaudages suspendus

Hoisting, Rigging and Positioning Equipment / Équipement de hissage, de gréage et de positionnement

cables
chains
chain blocks, chain falls, chain hoists
chokers
come-alongs
foot jacks
forklifts
grip hoists
hooks
hydraulic hoists
johnson / jackson bars
lifting grabs
material lifts
overhead cranes
pallet truck
pry bar
pulleys (gin wheel)
ropes
shackles
slider pads
slings
snatch blocks

câbles
chaînes
palans à chaîne
étrangleurs
palans manuels
vérins mécaniques
chariots élévateurs à fourches
treuils manuels
crochets
palans hydrauliques
leviers sur roues
grapins de levage
monte-charges
ponts roulants
transpalatte
barre de levage (pince-monseigneur)
poules
cordes
manilles
patins de déménagement
élingues
moufle ouvrante

stair climbers
spreader bars
winches

monte-marches
palonniers
treuils

Computer-Assisted Tools and Office Equipment / Outils assistés par ordinateur et matériel de bureau

3D laser scanner
computer hardware
digital cameras
digital devices (smart phones, tablets, laptops)
fax machines
laser measuring tape
numerical control/computer numerical control equipment (NC/CNC) (plasma, laser, water jet, presses/brakes, punches)

printers/scanners
software packages

scanneurs à laser 3D
matériel informatique
caméras numériques
dispositifs numériques (téléphone intelligent, tablette, ordinateur portable)
télécopieurs
télémètre
équipement de commande numérique et de commande numérique par ordinateur (NC/CNC) (à l'arc plasma, au laser, à jet d'eau, presse-plieuses, poinçons)
imprimantes/numériseurs
progiciels

Appendix C - Glossary / Glossaire

annealing	process by which metal is heated to relieve stress, changing the metal's strength and hardness	recuit	procédé consistant à chauffer le métal pour éliminer les tensions internes, changeant ainsi la résistance et la dureté du métal
augmented reality (AR)	provides a digital overlay of instructions, models, and measurements onto the real world, enhancing work and training	réalité augmentée	superposition numérique des directives, des modèles et des mesures sur le monde réel, améliorant le travail et la formation
backer rod	small foam rod or cord used to fill gaps between building materials	tige d'appui	petite tige ou cordon en mousse pour combler les écarts entre les matériaux de construction
blank piece	piece of material cut to size prior to notching or marking	flan	pièce de matériau coupée aux dimensions requises pour l'encochage ou le traçage
brake	manual or power equipment used to bend and form metal; may be CNC or manually controlled	presse-plier	équipement manuel ou mécanique utilisé pour plier et former le métal. Peut être contrôlé par CNC ou manuellement
breeching	the portion of a combustion venting system between an appliance and the chimney or stack used for exhausting fumes and gases	collecteur de fumée	partie d'un réseau d'évacuation à combustion située entre l'appareil et la cheminée ou la tour utilisée pour évacuer la fumée et les gaz
building envelope	a barrier between the interior and exterior environment of the building that serves as an outer shell to protect the indoor environment from elements such as moisture	enveloppe de bâtiment	barrière entre l'intérieur et l'extérieur du bâtiment qui sert de couche externe pour protéger l'intérieur du bâtiment contre les éléments comme l'humidité

Building Information Modeling (BIM)	provides a digital representation of a physical and functional facility that serves as a shared knowledge resource for information throughout its lifecycle	modélisation des données du bâtiment (MDB)	représentation numérique d'un établissement physique et fonctionnel servant de partage de connaissances pour des renseignements à chaque étape de son développement
burglar bars	heavy steel bars installed inside ductwork to prevent access	barres antivol	épaisses barres en acier installées dans les réseaux de conduits pour empêcher l'accès
chill bars/chill plates	used in welding to dissipate heat, preventing excessive heat buildup and potential issues like warpage, overheating, or cracking. They are typically made of copper or other materials with high thermal conductivity	barres et plaques de refroidissement	utilisées lors du soudage pour dissiper la chaleur, aidant à prévenir l'accumulation excessive de chaleur et les problèmes potentiels comme la déformation, la surchauffe et la fissuration. Elles sont habituellement faites de cuivre ou d'autre matériaux à haute conductivité thermique
cladding	a material (metal or composite) that covers another material to provide a skin or a layer; it is intended to control infiltration of weather elements or for aesthetic purposes	placage	matériau (métallique ou en composite) qui en recouvre un autre pour fournir un revêtement ou une couche. Il sert à contrôler l'infiltration d'éléments météorologiques ou à embellir
code CSA B-139	provides minimum requirements for the installation of, alteration to, or addition to oil-burning equipment, components and accessories	code CSA B-139	énonce les exigences minimales visant l'installation, la modification ou l'ajout des appareils de combustion au mazout, de composants et d'accessoires

code CSA B-149	provides safety requirements for the installation of natural gas and propane appliances, equipment, components, and accessories where gas is to be used for fuel purposes	code CSA B-149	énonce les exigences de sécurité visant l'installation des appareils de gaz naturel et de propane, des appareillages, des composants et des accessoires où le gaz est utilisé comme combustible
code CSA B52:23	provides requirements for the design, construction, installation, inspection, and maintenance of mechanical refrigeration systems and volatile direct refrigeration systems	code CSA B52:23	énonce les exigences visant la conception, la construction, l'installation, l'inspection et l'entretien des systèmes de réfrigération mécanique et des systèmes de réfrigération directe fonctionnant avec un composant volatil
coping (architectural)	material used as the capping of a wall	chaperon (architectural)	matériau utilisé comme couronnement d'un mur
crimper	power or manual tool used to allow round or square sheet metal pipes that are the same size to be corrugated to fit together	sertisseuse	outil électrique ou manuel utilisé pour permettre aux tuyaux en tôle ronds ou carrés de la même taille d'être ondulés pour s'insérer l'un dans l'autre
damper	valve or plate that stops or regulates the flow of air or materials	volet	soupape ou plaque qui bloque ou régularise le débit d'air ou les matériaux
duct traverse	series of evenly spaced pressure readings inside of a duct to measure various pressures at points within the duct	point d'échantillonnage du conduit	série de lectures de pression uniformément espacées à l'intérieur du conduit pour mesurer diverses pressions aux points à l'intérieur du conduit

flashing	thin piece of sheet metal or other impervious material installed to prevent the passage of water into a structure from an angle or joint	solin	mince pièce de tôle ou d'un autre matériau imperméable installée pour empêcher l'infiltration d'eau dans une structure par une cornière ou un joint
interference drawings	drawings that show the coordinated layout of all mechanical, electrical, structural and architectural systems and how the placement of different systems may interfere with one another	figures d'interférence	dessins qui montrent la disposition coordonnée de tous les systèmes mécaniques, électriques, structurels et architecturaux et comment le placement de différents systèmes peut interférer les uns avec les autres
isolation	product used between two dissimilar metals to prevent galvanic corrosion (used in roofing, air handling and material handling applications)	matériau isolant	produit utilisé entre deux métaux de nature différente afin d'empêcher l'électrolyse (utilisée dans les applications de toiture, de traitement de l'air et de manipulation de matériaux)
isolator	components that minimize noise, sound and vibration transfer	isolateur	composant qui minimise le bruit, les sons et les vibrations
lagging	protects insulation from damage and provides a barrier around the insulation; it also creates a true even surface for aesthetic purposes	revêtement calorifuge	protège l'isolant des dommages et fournit une barrière autour de l'isolant. Crée aussi une surface droite, plate et égale pour des raisons d'esthétique
parallel line development	method of pattern development based upon lines at an equal distance at all points	développement en traits parallèles	méthode de conception de modèle reposant sur le fait qu'une ligne qui est parallèle à une autre se trouve à une distance égale à tous les points

plasma cutting	process used to cut metal using a plasma torch	coupage au jet de plasma	méthode utilisée pour couper à l'aide d'un chalumeau à plasma
radial line development	method of conical pattern development where all arcs and lines radiate from a common point (apex)	développement de lignes radiales	méthode de conception de modèle conique où tous les points partent d'un sommet commun
seam/lock	any process of connecting two pieces or two ends of metal together	joint/agrafe	toute méthode consistant à joindre deux pièces ou deux bords de métal
shear	equipment or a process of cutting sheet metal	cisailles ou cisaillement	équipement ou méthode de coupage de tôle
stake	equipment used in forming material by hand; usually found in a sheet metal shop	enclume	matériel utilisé pour le formage de matériau à la main; on la trouve habituellement en tôlerie
stand-offs	material or device used to create a gap between two layers of material	pièce d'espacement	matériau ou dispositif utilisé pour créer un espace entre deux couches de matériau
stretch-out	gross stretch-out: overall length of material, including locks and seams; net stretch-out: overall length of material, not including locks and seams	développement	développement brut : longueur totale du matériau, comprenant toutes les agrafes et tous les joints; développement net : longueur totale du matériau, à l'exclusion des agrafes et des joints
strongback	support to keep a welding joint straight and prevent weld distortion	plaque de renfort	appui permettant de garder le joint de soudure droit et d'empêcher la distorsion due à la soudure
thermal insulation	material installed on the outside of duct used to reduce the rate of heat transfer	isolant thermique	matériau installé à l'extérieur de la conduite utilisé pour réduire le taux de transfert de chaleur

triangulation development method of pattern development using right angle triangles and two known points to find a third unknown point

variable air volume air terminal box having capacity for various volumes of air and capable of modulation

virtual reality (VR) uses simulated environments to train, visualize, test various processes and view positioning of mechanical systems

triangulation méthode de conception de modèle à l'aide de triangles à angle droit et de deux points connus pour trouver un troisième point inconnu

débit d'air variable caisson d'air terminal ayant une capacité de plusieurs volumes d'air et capable de modulation

réalité virtuelle à l'aide d'environnements simulés, elle permet de former, de visualiser, de mettre à l'essai plusieurs procédés et de voir le positionnement des systèmes mécaniques