

Sheet Metal Worker

2010

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The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of Sheet Metal Worker.

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. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOA).

The NOAs 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 curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

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TABLE OF CONTENTS

FOREWORD	I
ACKNOWLEDGEMENTS	II
TABLE OF CONTENTS	III
LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES	V
STRUCTURE OF ANALYSIS	VII
DEVELOPMENT AND VALIDATION OF ANALYSIS	IX

ANALYSIS

SAFETY	3
SCOPE OF THE SHEET METAL WORKER TRADE	4
OCCUPATIONAL OBSERVATIONS	6
ESSENTIAL SKILLS SUMMARY	7

BLOCK A	OCCUPATIONAL SKILLS		
	Task 1	Uses and maintains tools and equipment.	9
	Task 2	Organizes work.	16
BLOCK B	FABRICATION		
	Task 3	Performs pattern development.	21
	Task 4	Fabricates sheet metal components for air and material handling systems.	25
	Task 5	Fabricates roofing, sheeting and cladding.	30
	Task 6	Fabricates specialty products.	32

BLOCK C	AIR AND MATERIAL HANDLING SYSTEM INSTALLATION	
Task 7	Prepares installation site.	35
Task 8	Installs chimneys, breeching and venting.	38
Task 9	Installs air handling system components.	40
Task 10	Installs material handling system components.	46
Task 11	Installs thermal insulation, lagging, cladding and flashing.	48
Task 12	Performs testing, adjusting and balancing.	50
BLOCK D	ROOFING, ARCHITECTURAL METAL AND SPECIALTY PRODUCT INSTALLATION	
Task 13	Installs metal roofing and cladding systems.	52
Task 14	Installs exterior components.	56
Task 15	Installs specialty products.	57
BLOCK E	MAINTENANCE AND REPAIR	
Task 16	Performs scheduled maintenance.	59
Task 17	Repairs faulty systems and components.	61
	APPENDICES	
APPENDIX A	TOOLS AND EQUIPMENT	65
APPENDIX B	GLOSSARY	70
APPENDIX C	ACRONYMS	72
APPENDIX D	BLOCK AND TASK WEIGHTING	73
APPENDIX E	PIE CHART	76
APPENDIX F	TASK PROFILE CHART	77

LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES (Red Seal Trades)

TITLE	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2005)	7332
Automotive Painter (2009)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2010)	7271
Concrete Finisher (2006)	7282
Construction Craft Worker (2009)	7611
Construction Electrician (2008)	7241
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician – Consumer Products (1997)	2242
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2009)	7312
Industrial Electrician (2008)	7242
Industrial Mechanic (Millwright) (2009)	7311
Instrumentation and Control Technician (2010)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2006)	7264
Ironworker (Reinforcing) (2006)	7264
Ironworker (Structural/Ornamental) (2006)	7264
Landscape Horticulturist (2010)	2225

* National Occupational Classification

TITLE	NOC Code
Lather (Interior Systems Mechanic) (2007)	7284
Machinist (2010)	7231
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2009)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2010)	7322
Oil Burner Mechanic (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2010)	1472
Plumber (2008)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2009)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2010)	7261
Sprinkler System Installer (2009)	7252
Steamfitter — Pipefitter (2008)	7252
Tilesetter (2004)	7283
Tool and Die Maker (2005)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2010)	7321
Welder (2009)	7265

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Human Resources and Social Development Canada
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Gatineau, Quebec K1A 0J9

These publications can be ordered or downloaded online at: www.red-seal.ca. Links to Essential Skills Profiles for some of these trades are also available on this website.

STRUCTURE OF ANALYSIS

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	the elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from Human Resources and Skills Development Canada. This draft analysis 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.

Draft Review

The National Occupational Analysis (NOA) development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
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 NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on 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 a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis <u>N</u> ot <u>V</u> alidated by a province/territory
ND	trade <u>N</u> ot <u>D</u> esignated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by 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 block 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

ANALYSIS

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE SHEET METAL WORKER TRADE

“Sheet metal worker” is this trade’s official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by sheet metal workers whose occupational title has been identified by provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Sheet Metal Worker	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Tinsmith					✓								

Sheet metal workers design, fabricate, assemble, install and repair sheet metal products. In fabrication work, sheet metal workers lay out and measure pieces to specifications. They use tools such as power shears, press brakes, drill presses and computerized cutting equipment to cut and shape material. They assemble and join the pieces with various techniques such as welding and using mechanical fasteners.

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

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

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

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

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

There may be overlaps with other trades such as ironworkers, boilermakers, refrigeration and air conditioning mechanics, insulators and welders. Experienced sheet metal workers may become specialists in design and layout, estimators, supervisors or business owners.



OCCUPATIONAL OBSERVATIONS

Much of the equipment used by sheet metal workers has remained the same. However, some has become computer-controlled and motorized to minimize human error and improve efficiency.

Workplaces have become safer because of an increase in training and legislated safety practices and procedures. There is a greater awareness of the importance of job safety. For example, practices such as safety committees and weekly safety meetings are well-established.

Clients are more inclined to promote the use of environmentally friendly products and processes in their buildings. Environmental considerations are modifying building methods to reduce energy use and taking advantage of alternate energy sources. For instance, “green roofs” are becoming more common. Leadership in Energy and Environmental Design (LEED) projects are becoming more important, modifying products and methods used in construction. For instance, these standards impact the removal and recycling of construction materials, collection and control of dust and limiting of solvents and other chemicals.

ESSENTIAL SKILLS SUMMARY

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

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

The essential skills profile for the sheet metal worker trade indicates that the most important essential skills are **document use**, **numeracy** and **problem solving**.

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading

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

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 logbook entries, 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. They may explain the fabrication, construction and installation procedures to customers as well.

Numeracy

Numeracy skills are very 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, air flows, capacities and air pressures. 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 Skills

Sheet metal workers solve problems in situations where work may be delayed due to equipment breakdowns and shortages in materials. They may suggest modifications to project designs to correct flaws. They need the ability to think spatially and visualize in three dimensions.

Working with Others

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

Computer Use

Sheet metal workers may use computers and computer-assisted design software in their work. They may also use computers to perform word processing, communicate with others or perform Internet research.

Continuous Learning

Sheet metal workers are required to stay current with new product developments, standards, and changes in installation and production processes.

Trends Computers are being used more for organizing work and communications. There is a greater variety of cordless power tools which have the capability of replacing tools with cords without the hazards and inconveniences. There is more electronic documentation which is less expensive and faster than paper-based documentation. There is a greater awareness of, and regard for, health and safety and improved personal protective equipment (PPE).

Related Components Not applicable.

Tools and Equipment See Appendix A.

Task 1 Uses and maintains tools and equipment.

Context This task describes the maintenance of tools and equipment that are used throughout the analysis to perform tasks of the sheet metal worker trade. It also describes the use of tools and equipment used for personal protection and safety, hoisting and lifting, and work access.

Required Knowledge

- K 1 types of PPE and safety equipment and their operation
- K 2 training requirements for PPE and safety equipment
- K 3 location of PPE and safety equipment
- K 4 OH&S regulations
- K 5 types, operations and limitations of hand tools
- K 6 types, operations and limitations of power tools
- K 7 types, operations and limitations of shop tools and equipment
- K 8 types, operations and limitations of welding/cutting equipment such as spot welding, Shielded Metal Arc Welding (SMAW, also called stick or arc welding), Gas Metal Arc Welding (GMAW, also called MIG welding), Gas Tungsten Arc Welding (GTAW, also called TIG welding), plasma and oxy-fuelled equipment

K 9	materials to be welded such as black iron, stainless steel, aluminium and other alloys
K 10	welding consumable materials such as filler rods, electrodes and inert gas
K 11	welding principles, considerations and manufacturers' operating instructions
K 12	licensing and training requirements for welding/cutting
K 13	ventilation requirements for welding/cutting
K 14	types, operations and limitations of soldering and brazing equipment
K 15	materials to be soldered or brazed such as copper, brass, and galvanized and stainless steel
K 16	soldering/brazing gases such as propane, oxygen and natural gas
K 17	manufacturers' operating instructions for soldering/brazing equipment
K 18	alloys and fluxes
K 19	government regulations such as Transportation of Dangerous Goods (TDG) regulations, Workplace Hazardous Materials Information System (WHMIS) and OH&S
K 20	types of testing devices
K 21	types, operations and limitations of measuring and layout equipment
K 22	imperial and metric systems
K 23	types of ladders such as step ladders and extension ladders
K 24	types of platforms such as scaffolds, hydraulic lifts and manlifts
K 25	training requirements for elevating work platforms such as hydraulic lifts and manlifts
K 26	types, operations and limitations of hoisting and rigging equipment such as cranes, material lifts and chain falls
K 27	rigging equipment components such as shackles, slings and chokers
K 28	hand signals for hoisting
K 29	applications of hoisting and rigging equipment
K 30	training requirements for hoisting and rigging equipment
K 31	geometry and trade-related mathematics

Sub-task**A-1.01 Uses personal protective equipment (PPE) and safety equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.01.01	identify site hazards and regulations requiring the use of PPE and safety equipment
A-1.01.02	select PPE and safety equipment appropriate for individual tasks and situations
A-1.01.03	maintain and store PPE and safety equipment
A-1.01.04	apply local, provincial and national safety regulations such as WHMIS and OH&S
A-1.01.05	identify PPE damage such as excessively worn boots, worn harnesses and cracked safety glasses
A-1.01.06	recognize Canadian Standards Association-approved PPE and applicable safety equipment such as fire extinguishers, welding screens and barricades
A-1.01.07	ensure proper fit of PPE such as respirators, fall arrest harnesses and welding face shields
A-1.01.08	report and replace damaged or faulty equipment

Sub-task**A-1.02 Maintains hand tools.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.02.01	store hand tools to keep organized and avoid damage
A-1.02.02	lubricate hand tools such as wrenches and snips to prevent rusting and corrosion
A-1.02.03	sharpen hand tools such as bulldog snips, drill bits and chisels
A-1.02.04	recognize worn, damaged and defective hand tools, and tag and remove from service if necessary

Sub-task**A-1.03 Maintains portable power tools.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.03.01	recognize hazards of use of portable power tools
A-1.03.02	charge batteries according to manufacturers' specifications to avoid damage to battery
A-1.03.03	lubricate portable power tools such as pneumatic hammers and unishears
A-1.03.04	recognize worn, damaged and defective portable power tools, and tag and remove from service if necessary
A-1.03.05	clean portable power tools for ease of operation and longevity
A-1.03.06	organize and store portable power tools in a clean and dry environment

Sub-task**A-1.04 Maintains shop tools and equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.04.01	lubricate shop tools and equipment such as brakes, lock formers and roll formers to prevent corrosion and to grease drive mechanism
A-1.04.02	clean shop tools and equipment for ease of operation and longevity
A-1.04.03	recognize worn, damaged and defective shop tools and equipment, and tag and lock out power supply until repair is complete
A-1.04.04	recognize hazards of use of shop tools and equipment
A-1.04.05	recognize shop tool and equipment capacities, limitations and operational parameters

Sub-task**A-1.05 Maintains welding/cutting equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.05.01	recognize worn, damaged and defective welding/cutting equipment, and tag and remove from service if necessary
A-1.05.02	recognize hazards of use of welding/cutting equipment
A-1.05.03	replace worn and defective consumable equipment such as tips, cups, nozzles and electrodes
A-1.05.04	clean tips of spot welding equipment to ensure a good contact
A-1.05.05	store welding/cutting equipment and supplies to avoid damage or injury

Sub-task**A-1.06 Maintains soldering/brazing equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.06.01	clean and re-tin soldering equipment
A-1.06.02	check and clean torch tips on brazing equipment
A-1.06.03	recognize worn, damaged and defective soldering/brazing equipment, and tag and remove from service if necessary
A-1.06.04	recognize hazards of use of soldering/brazing equipment
A-1.06.05	store soldering/brazing equipment and supplies to avoid damage or injury

Sub-task**A-1.07 Maintains measuring and layout equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.07.01	lubricate measuring and layout equipment to avoid corrosion
A-1.07.02	store measuring and layout equipment to keep organized and avoid damage
A-1.07.03	sharpen layout equipment such as trammel points, scratch awls and dividers
A-1.07.04	verify accuracy of measuring devices such as squares and scribes

Sub-task**A-1.08 Maintains testing and inspection devices. (NOT COMMON CORE)**

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

Key Competencies

A-1.08.01	store testing and inspection devices to keep organized and avoid damage
A-1.08.02	recognize defective testing and inspection devices and remove from service
A-1.08.03	recognize need for regular calibration of testing and inspection devices
A-1.08.04	check service records prior to use to ensure effective operation

Sub-task**A-1.09 Uses ladders and work platforms.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.09.01	select ladders and work platforms for the job taking into consideration size, site conditions and task being performed
A-1.09.02	inspect ladders and work platforms for damage and missing components, and tag and remove from service if required
A-1.09.03	identify hazards such as power lines and excess loads when erecting ladders and work platforms
A-1.09.04	secure ladders and work platforms
A-1.09.05	erect, level and dismantle scaffolding according to jurisdictional regulations
A-1.09.06	use equipment within operating limitations as indicated on manufacturers' tags and in compliance with OH&S regulations

Sub-task**A-1.10 Uses hoisting and rigging equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.10.01	inspect hoisting and rigging equipment before and after use
A-1.10.02	select rigging equipment such as shackles, spreader bars and chain falls according to task and load size and capacities
A-1.10.03	recognize worn, damaged or defective hoisting and rigging equipment and remove from service
A-1.10.04	lubricate hoisting equipment such as chain falls, pulleys and gin wheels
A-1.10.05	locate centre of gravity of load
A-1.10.06	secure load to rigging using techniques such as choking, and using shackles and lifting lugs
A-1.10.07	communicate with personnel involved in lift using methods such as hand signals and two-way radios

A-1.10.08	store hoisting and rigging equipment in secure, clean and dry environment
A-1.10.09	restrict access to lift area to prevent injury and damage using items such as signs, barricades and danger/caution tape

Task 2	Organizes work.
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Context Well-organized jobs ensure a productive and safe workplace.

Required Knowledge

K 1	WHMIS
K 2	health and safety acts, codes and regulations
K 3	company safety policies and procedures
K 4	construction codes and regulations
K 5	good housekeeping practices
K 6	documentation such as specifications, codes, standards, manuals, work orders and packing slips
K 7	safety documentation such as Material Safety Data Sheets (MSDS) and WHMIS symbols
K 8	site-specific documentation such as permits and signage
K 9	drawings such as plans, specifications, shop drawings and sketches
K 10	symbols on drawings
K 11	verbal and written communication
K 12	trade terminology
K 13	hoisting signals
K 14	sequence of operations
K 15	inventory requirements
K 16	available components and materials
K 17	sheet metal applications such as HVAC systems, material handling systems and roofing systems
K 18	installation methods
K 19	fabrication methods
K 20	intended function of system
K 21	system commissioning procedures
K 22	basic design principles and procedures

Sub-task**A-2.01 Maintains safe work environment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.01.01	use safety manuals and apply procedures
A-2.01.02	recognize, report and correct hazards
A-2.01.03	install temporary safety protection such as barriers to cover hazardous openings, guard rails and signage
A-2.01.04	hold daily or weekly toolbox meetings
A-2.01.05	perform daily work area housekeeping by sweeping, removing debris and storing materials, tools and equipment

Sub-task**A-2.02 Interprets documentation.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.02.01	determine information such as number of parts to make, and material and equipment to be used
A-2.02.02	interpret specifications
A-2.02.03	review maintenance records and safety documentation
A-2.02.04	visualize finished product by analyzing dimensions and drawings
A-2.02.05	use process sheet to determine order of operations
A-2.02.06	locate information in reference materials such as Sheet Metal Air Conditioning National Association (SMACNA), local and national construction codes

Sub-task**A-2.03 Interprets drawings.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.03.01	locate information on drawings such as dimensions, schedules and details
A-2.03.02	use scale readings to interpret sizing of actual dimensions
A-2.03.03	check drawing for dimensioning and conflicting information
A-2.03.04	visualize finished product by analyzing dimensions and drawings
A-2.03.05	compare drawings to specifications

Sub-task**A-2.04 Completes documentation.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.04.01	fill out documents such as time cards, as-builts, work orders, change orders and RFIs (request for information)
A-2.04.02	complete accident and incident reports
A-2.04.03	record maintenance, repairs and recommendations for follow-up action
A-2.04.04	complete safety inspection reports
A-2.04.05	sketch and dimension parts to be assembled

Sub-task**A-2.05 Communicates with others.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.05.01	use communication devices such as computers, two-way radios, cell phones and fax machines
A-2.05.02	coordinate work with other trades
A-2.05.03	communicate with co-workers
A-2.05.04	communicate with other industry people such as manufacturers, suppliers and consultants
A-2.05.05	mentor apprentices
A-2.05.06	explain technical information in layperson's terms

Sub-task**A-2.06 Organizes materials.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.06.01	maintain stock of materials such as consumables, fasteners, sheets and sealants
A-2.06.02	estimate time and material requirements
A-2.06.03	label materials for purposes such as installation, fabrication and shipping
A-2.06.04	store materials for future use or movement
A-2.06.05	manage job site materials according to requirements

Sub-task**A-2.07 Performs basic design and field modifications.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.07.01	use installation site measurements to modify design as required
A-2.07.02	determine duct size and materials from industry codes and standards
A-2.07.03	sketch duct system to facilitate construction and installation
A-2.07.04	design or modify original plans to comply with conditions such as remote locations and limited time frames

Sub-task**A-2.08 Performs inspection.**

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

Key Competencies

A-2.08.01	interpret manufacturers' specifications
A-2.08.02	select and use measuring and testing devices such as test ports, tachometer and manometer
A-2.08.03	check performance accuracy and finish against specifications of systems
A-2.08.04	document findings such as deficiencies
A-2.08.05	recommend solutions to problems

Trends	There are more computerized systems used in fabrication, which can adjust for various conditions and material properties.
Related Components (include, but not limited to)	Material (metal and specialty materials), pop rivets, solid rivets, consumable welding products, strapping, screws, nuts, bolts, washers, gaskets, caulking, insulation, paint, lagging, adhesives, sealants, pins, hardware (such as hinges, quadrants and locks).
Tools and Equipment	See Appendix A.

Task 3 Performs pattern development.

Context	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. Sheet metal workers need to be able to identify which methods to use.
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Required Knowledge

K 1	triangulation method and its applications such as square-to-round, transitions and sweep offsets
K 2	mathematical formulas
K 3	joints such as standing, and slip and drive
K 4	seams such as button lock, Pittsburgh lock and groove seams
K 5	seam and material thickness allowances
K 6	radial line method and its applications such as cones and round reducers
K 7	parallel line method and its applications such as round elbows, tees and take-offs
K 8	simple layout and its applications such as square and round duct, countertops and pans
K 9	basic computer skills

K 10	information to write on piece such as break lines, kink lines, bend up/down and pattern in/out
K 11	company labelling practices

Sub-task

B-3.01 Develops pattern using triangulation method.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.01.01	visualize finished product in three dimensions
B-3.01.02	develop views required for fitting such as plan view and elevation view
B-3.01.03	find true lengths by using the two known points
B-3.01.04	select and use layout tools such as dividers, trammel points and squares
B-3.01.05	lay out flat pattern and allow for transverse joint and longitudinal seam allowances according to specifications
B-3.01.06	connect points to finish pattern
B-3.01.07	mark braking lines and braking diagrams on pattern for future forming

Sub-task

B-3.02 Develops pattern using radial line method.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.02.01	visualize finished product in three dimensions
B-3.02.02	develop views required for fitting such as plan view and elevation view
B-3.02.03	find common apex
B-3.02.04	calculate circumference stretch-out
B-3.02.05	divide stretch-out lengths into equal parts, spaced according to required accuracy and corresponding to developed plan and elevation views
B-3.02.06	transfer points from plan and elevation to pattern
B-3.02.07	add allowances for seams and edges

B-3.02.08	select and use layout tools such as dividers, trammel points and squares
B-3.02.09	connect points to finish pattern
B-3.02.10	mark braking lines and braking diagrams on pattern for future forming

Sub-task

B-3.03 Develops pattern using parallel line method.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.03.01	visualize finished product in three dimensions
B-3.03.02	develop views required for fitting such as plan view and elevation view
B-3.03.03	divide plan and elevation into equal parts
B-3.03.04	calculate and divide stretch-out
B-3.03.05	transfer points from plan and elevation views to the stretch-out in a parallel line
B-3.03.06	add allowances for seams and edges
B-3.03.07	select and use layout tools such as dividers, trammel points and squares
B-3.03.08	connect points to finish pattern
B-3.03.09	mark braking lines and braking diagrams on pattern for future forming

Sub-task

B-3.04 Develops pattern using simple and straight line layout.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.04.01	visualize finished product in three dimensions
B-3.04.02	determine cut size of material to minimize waste
B-3.04.03	mark and notch material to identify seams and bend marks
B-3.04.04	add allowances for seams and edges

B-3.04.05	mark braking lines and braking diagrams on pattern for future forming
B-3.04.06	select and use layout tools such as tape measure and dividers

Sub-task

B-3.05 Develops pattern using computer technology.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.05.01	visualize finished product in three dimensions
B-3.05.02	identify and select required fittings
B-3.05.03	input dimensions required into computer according to brand-specific equipment requirements
B-3.05.04	select and verify all lock and seam information is entered
B-3.05.05	print labels to indicate forming information such as layout of pieces, braking lines and seam allowances

Sub-task

B-3.06 Labels pieces.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-3.06.01	identify fittings according to drawing
B-3.06.02	select and use marking tools
B-3.06.03	transfer information from drawings to fittings to ensure correct assembly and installation onsite

Task 4**Fabricates sheet metal components for air and material handling systems.****Context**

Fabrication of air and material handling systems is the process of producing finished ductwork or fittings from a flat pattern or sheet using various tools.

Required Knowledge

K 1	material such as stainless steel, galvanized steel and aluminium
K 2	thickness of material
K 3	bend allowances and notching
K 4	forming techniques such as bending and rolling
K 5	reinforcing techniques such as cross-braking, beading and angle iron
K 6	types of insulation such as rigid or flexible and acoustic or thermal
K 7	thickness of insulation
K 8	joint and seam allowances
K 9	pin placement
K 10	fittings to assemble such as square-to-round, elbow and offset
K 11	assembly techniques such as welding, spot welding and the use of Pittsburgh locks
K 12	joints such as standing seam, slip and drive, and patented duct connectors
K 13	fasteners such as solid rivets, pop rivets and screws
K 14	types of dampers such as opposed blade, parallel blade and butterfly
K 15	hardware to use for assembly
K 16	flexible connectors
K 17	hangers such as brackets, saddles and channels
K 18	material used for hanger systems such as angle iron, channel and flat bar
K 19	load bearing capacities and specifications
K 20	item to be installed for hanger system such as threaded rods and beam clamps
K 21	equipment supports and bases such as curbs and stands
K 22	types, size and weight of units
K 23	epoxies and sealants

Sub-task**B-4.01 Cuts ductwork, fittings and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.01.01	select and use tools such as snips, shears, grinders, hack saws and cut-off saws
B-4.01.02	verify measurements for seam allowances and duct length
B-4.01.03	create cut list based on drawing to minimize waste
B-4.01.04	cut blanks according to cut list
B-4.01.05	scribe allowances for horizontal and longitudinal seams
B-4.01.06	notch pieces based on seam allowances and pattern
B-4.01.07	mark braking lines and braking diagrams on pieces for future forming

Sub-task**B-4.02 Forms ductwork, fittings and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.02.01	examine braking diagrams to establish order of operations
B-4.02.02	select and use forming tools such as brakes, roll formers, rolls and stakes
B-4.02.03	cross-brake pieces to specifications to strengthen piece and eliminate vibration and noise
B-4.02.04	form longitudinal seams according to braking diagram or scribes
B-4.02.05	form transverse seams according to braking diagram or scribes

Sub-task**B-4.03 Insulates ductwork, fittings and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.03.01	identify insulation thicknesses and types according to specifications
B-4.03.02	select fastening method such as adhesives and pin spotters
B-4.03.03	select and use tools and equipment such as knives, tape measure and straight edge
B-4.03.04	measure and cut insulation according to type and thickness
B-4.03.05	seal cut edges of insulation according to specifications
B-4.03.06	apply insulation using selected fastening method
B-4.03.07	apply perforated metal according to specifications using methods such as pin spotting, welding and using mechanical fasteners

Sub-task**B-4.04 Assembles ductwork, fittings and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.04.01	select and use tools and equipment such as hammers, setting tools and screwdrivers
B-4.04.02	use welding equipment for assembly if required
B-4.04.03	select and use fasteners such as pop rivets and spot welds
B-4.04.04	select and use epoxies and sealants
B-4.04.05	refer to labels and diagrams for order of assembly and orientation of pieces
B-4.04.06	align pieces and fasten according to locks and seams
B-4.04.07	install and bend transverse joints as required

Sub-task**B-4.05 Fabricates dampers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.05.01	determine damper type required according to specifications
B-4.05.02	measure and size damper according to application
B-4.05.03	select hardware required for damper such as quadrant arms, linkages and ball joints according to specifications
B-4.05.04	cut and form damper blades and body
B-4.05.05	assemble blades, hardware and body according to damper type
B-4.05.06	verify damper operation to ensure correct orientation and blade movement
B-4.05.07	select and use tools and equipment such as drills, snips and screwdrivers

Sub-task**B-4.06 Fabricates flexible connections.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.06.01	identify material required for application according to specifications
B-4.06.02	measure and size flexible connections
B-4.06.03	notch and form flexible connections
B-4.06.04	fasten overlapping sections using methods such as staples and glue
B-4.06.05	apply transverse seams if necessary
B-4.06.06	select and use tools and equipment such as drills, snips and staplers

Sub-task**B-4.07 Fabricates hanger systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.07.01	select hangers for size and run of air or material handling systems according to specifications and industry standards
B-4.07.02	select and use tools and equipment such as tape measure, welding equipment, drills, snips, abrasive cut-off saws and hack saws
B-4.07.03	select and use epoxies and sealants
B-4.07.04	determine fastening system according to site structure and weight of the air or material handling systems
B-4.07.05	determine measurements for hangers accounting for thickness of insulation and specified height of air or material handling systems
B-4.07.06	determine required number of hangers for specified length of air or material handling systems and spacing of hangers according to codes and specifications
B-4.07.07	perform basic layout for hanger systems
B-4.07.08	assemble components for hanger systems

Sub-task**B-4.08 Fabricates supports and bases.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-4.08.01	determine size and weight of equipment and materials to be supported according to specifications
B-4.08.02	determine type and size of material for supports and bases according to specifications such as for isolation, insulation and seismic restraints
B-4.08.03	select and use tools and equipment such as welding equipment, chop saws, cut-off saws and band saws
B-4.08.04	determine location of supports and bases according to plans and specifications for required installation such as pitched roof and concrete floor

B-4.08.05	pre-drill holes for mounting support as required
B-4.08.06	perform basic layout for supports and bases
B-4.08.07	assemble components of supports and bases according to specifications and plans

Task 5

Fabricates roofing, sheeting and cladding.

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

Required Knowledge

K 1	types of seams such as standing and lap
K 2	types of materials such as copper, galvanized steel , pre-finished material, composite materials and aluminium
K 3	types of roofing, sheeting and cladding
K 4	bend allowances
K 5	flashing such as roof jack, coping and fascia
K 6	joints such as S-joints, lap joints and standing joints
K 7	sealants such as caulking and solder

Sub-task

B-5.01 Determines seams.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.01.01	interpret seam information in specifications and plans
B-5.01.02	select seam type according to strength, aesthetics and specifications
B-5.01.03	match type of seam according to type of material being used

Sub-task**B-5.02 Cuts metal for flashing, roofing, sheeting and cladding.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.02.01	select and use tools and equipment such as tape measure, snips and shears
B-5.02.02	calculate and measure material, taking into account factors such as expansion, contraction, seams and bend allowances
B-5.02.03	calculate size of area to be covered to determine material required and to minimize waste
B-5.02.04	shear material to gross blank size (stretch-out)
B-5.02.05	notch material according to selected seams
B-5.02.06	mark brake lines and diagrams

Sub-task**B-5.03 Forms flashing, roofing, sheeting and cladding.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-5.03.01	select and use tools and equipment such as brakes, rolls and stakes
B-5.03.02	plan and follow order of operations for forming material
B-5.03.03	bend or roll material according to brake lines and diagrams

Task 6**Fabricates specialty products.****Context**

This is the process of producing finished specialty products from designs. Specialty products may include kitchen equipment, medical facility products, food processing equipment, pharmaceutical laboratory products, decorative accessories and plastic products.

Required Knowledge

K 1	types of materials such as stainless steel, copper, plastic, composite materials and aluminium
K 2	bend and seam allowances
K 3	types of finishes such as brushed, mirrored and dull
K 4	specialty products such as canopies, sinks and polyvinyl chloride (PVC) fittings
K 5	specialty product applications such as food preparation, corrosive environments and medical environments
K 6	pattern development and basic specialty product design
K 7	thickness of material
K 8	forming techniques such as bending, rolling and heat forming
K 9	assembly techniques such as welding, spot welding and gluing
K 10	fasteners such as solid rivets, pop rivets, bolts and screws

Sub-task**B-6.01 Cuts material for specialty products.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.01.01	select materials according to specifications
B-6.01.02	select and use tools and equipment for cutting specific material such as plastic, PVC-coated and stainless steel
B-6.01.03	calculate and measure material, taking into account factors such as expansion, contraction, seams and bend allowances
B-6.01.04	shear or saw material according to manufacturers' specifications

B-6.01.05	notch material according to selected seams
B-6.01.06	mark brake lines and diagrams

Sub-task

B-6.02 Forms specialty products.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.02.01	select and use tools and equipment for forming specific material such as plastic, PVC-coated and stainless steel
B-6.02.02	use specialized procedures for forming specialty products such as pre-heating material for bending and annealing to relieve stress
B-6.02.03	plan and follow order of operations for forming materials
B-6.02.04	bend or roll material according to brake lines and diagrams

Sub-task

B-6.03 Assembles specialty products.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.03.01	select and use tools and equipment such as welding equipment, soldering irons and drills
B-6.03.02	select and use fasteners according to material used
B-6.03.03	fasten product components together according to plans and specifications

Sub-task**B-6.04 Finishes specialty products.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.04.01	select and use tools and equipment such as buffers, grinders, files and chemical compounds
B-6.04.02	perform quality control for conditions such as sharp edges and overall appearance
B-6.04.03	select and use sealants according to specifications

BLOCK C

AIR AND MATERIAL HANDLING SYSTEM INSTALLATION

Trends

There is a strong push by industry and governments towards installing energy efficient equipment and practicing green construction methods. Cable hangers are now being used by sheet metal workers to reduce installation time of materials.

Related Components (include, but not limited to)

Chimney, breeching, venting, louvers, grilles, diffusers, registers, fire dampers, splitter dampers, backdraft dampers, motorized dampers, volume dampers, smoke dampers, filter racks, duct heaters, coils, furnaces, rooftop units, air conditioners, exhaust fans, humidifiers, unit heaters, heat recovery ventilators, energy recovery ventilators, mixing boxes, variable air volume boxes, filter banks, drain pans, burglar bars, air valves, air lock, scrubbers, silencers, flexible duct, test ports, access doors, temporary caps, acoustic plenums, acoustic insulation, thermal insulation, lagging, cladding, hoppers, hoods, bins, cyclones, bag houses, conveyor skirting, hangers, braces, mounting brackets, threaded rod, wire hanger, channel, round rod, beam clamps, concrete shields, nails, pins, screws, rivets, tape, glue, nuts, bolts.

Tools and Equipment

See Appendix A.

Task 7

Prepares installation site.

Context

Sheet metal workers need to confirm field measurements and prepare site prior to installation of equipment to ensure safe, smooth and efficient installation. Measurements need to be made ahead of time to allow time for construction of ductwork and equipment.

Required Knowledge

- K 1 code, regulations and manufacturers' specifications for requirements such as clearances, weight and spacing
- K 2 building materials
- K 3 hazardous materials such as asbestos, mould and noxious gases
- K 4 material to be recycled or reclaimed

K 5	dimension and weight of units and materials
K 6	orientation and location of units and materials
K 7	plans and specifications
K 8	updated documentation
K 9	hangers, braces and brackets and their installation methods
K 10	supports and bases and their installation methods

Sub-task

C-7.01 Performs onsite measurements.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.01.01	select and use tools and equipment such as laser level, tape measure and scale ruler
C-7.01.02	verify work area dimension and compare to plans and specifications
C-7.01.03	identify obstructions and problems to be resolved
C-7.01.04	locate penetrations and openings, and measure to fit
C-7.01.05	determine positions of hangers, braces and brackets according to codes, regulations and specifications

Sub-task

C-7.02 Performs demolitions for renovations.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.02.01	isolate demolition area with required barricades
C-7.02.02	select and use tools and equipment such as grinders, hammers and saws
C-7.02.03	identify materials and equipment to be removed according to plans and demolition drawings
C-7.02.04	prepare removal plan for material and equipment

C-7.02.05	dismantle and remove materials and equipment
C-7.02.06	recycle or dispose of waste materials and equipment

Sub-task

C-7.03 Cuts penetrations.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.03.01	identify materials to be cut
C-7.03.02	identify obstructions such as electrical and structural members for safety and architectural reasons
C-7.03.03	select and use tools and equipment such as hole saw, snips and reciprocating saw

Sub-task

C-7.04 Installs supports and bases.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.04.01	select and use tools and equipment such as tape measure, hammer drill and drills
C-7.04.02	verify that shop drawings are approved and reflect equipment onsite or to be installed
C-7.04.03	determine anchor positions using shop drawings and specifications
C-7.04.04	select and use anchors and fasteners to support load
C-7.04.05	install isolators to isolate system from vibration
C-7.04.06	install seismic restraints as required according to specifications, local codes and regulations

Sub-task**C-7.05 Installs hangers, braces and brackets.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-7.05.01	select and use tools and equipment such as tape measure, hammer drill and chop saw
C-7.05.02	verify that shop drawings are approved and reflect materials and equipment onsite or to be installed
C-7.05.03	determine anchor positions using shop drawings and specifications
C-7.05.04	select materials to be used according to specifications
C-7.05.05	measure and cut material to fabricate hangers, braces and brackets
C-7.05.06	secure anchors and fasteners to support load according to specifications
C-7.05.07	install seismic restraint as required according to specifications, local codes and regulations

Task 8**Installs chimneys, breeching and venting.****Context**

Chimneys are used to vent gases, smoke and other products of combustion. Breeching and venting connect one or more appliances 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.

Required Knowledge

K 1	code and manufacturers' specifications for requirements such as clearances, weight, spacing and seismic upgrading
K 2	building materials
K 3	construction codes and regulations
K 4	sealants
K 5	sheet metal materials used for chimneys, breeching and venting
K 6	appliances such as furnaces, stoves and incinerators
K 7	mechanical equipment and components such as boilers, piping and pressure vessels

K 8	thermal expansion and contraction of material
K 9	the effect of environmental conditions on material and installation
K 10	high efficiency furnace venting

Sub-task

C-8.01 Installs chimney, breeching and venting primary components.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-8.01.01	select and use tools and equipment such as drills, saws and levels
C-8.01.02	select chimney, breeching and venting components according to codes and specifications
C-8.01.03	assemble and fasten sections according to specifications and manufacturers' instructions
C-8.01.04	install clean-out for removal of debris
C-8.01.05	seal chimney, breeching and venting joints according to specifications

Sub-task

C-8.02 Connects chimney, breeching and venting to appliance.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-8.02.01	select and use tools and equipment such as snips, drills and tape measure
C-8.02.02	identify type of appliance and materials to be used
C-8.02.03	identify type of expansion joint required for appliance and according to specifications
C-8.02.04	install and secure expansion joint between the appliance and the chimney to allow for expansion and contraction
C-8.02.05	seal chimney, breeching and venting joints according to specifications

Task 9

Installs air handling system components.

Context

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 and fire prevention.

Required Knowledge

K 1	air handlers such as furnaces, fans, rooftop units, built-up systems and air conditioners
K 2	the effect of environmental conditions on material and installation
K 3	types of dampers and their applications such as volume, smoke, motorized and backdraft
K 4	construction codes and regulations
K 5	duct systems
K 6	code and manufacturers' specifications for requirements such as clearances, weight and spacing
K 7	fire damper sleeves
K 8	types and applications of registers, grilles, diffusers and louvers
K 9	HVAC systems
K 10	types of coils such as electric, hydronic and direct expansion
K 11	refrigeration principles
K 12	heat recovery ventilator applications
K 13	types of filters such as viscous impingement, pleated and high efficiency particulate air (HEPA)
K 14	accessories such as humidifiers, silencers, air valves, variable air volume boxes, mixing boxes, filter banks, drain pans, burglar bars, access doors, flexible duct, acoustic plenums and unit heaters
K 15	energy recovery ventilators

Sub-task**C-9.01 Installs air handlers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.01.01	select and use tools and equipment such as impact drill, snips and hammers
C-9.01.02	align air handler with ductwork or with building lines
C-9.01.03	assemble air handler components according to manufacturers' specifications
C-9.01.04	determine requirements to secure air handler
C-9.01.05	secure air handler to base/structure
C-9.01.06	install isolators as specified or required
C-9.01.07	install flexible connections as specified or required
C-9.01.08	remove or verify that shipping brackets are removed

Sub-task**C-9.02 Installs heat recovery ventilators (HRVs).**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.02.01	select and use tools and equipment such as impact drill, snips and screwdrivers
C-9.02.02	align HRV with ductwork or with building lines
C-9.02.03	assemble HRV components according to manufacturers' specifications
C-9.02.04	determine requirements to secure HRV
C-9.02.05	secure HRV to base/structure
C-9.02.06	install isolators as specified or required
C-9.02.07	install flexible connections as specified or required
C-9.02.08	remove or verify that shipping brackets are removed
C-9.02.09	connect condensate lines

Sub-task**C-9.03 Installs sheet metal ducts and fittings.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.03.01	select and use tools and equipment such as grinders, hammers, snips and screwdrivers
C-9.03.02	assemble ductwork, fittings and components according to labelling and tagging
C-9.03.03	complete transverse joints according to specifications and industry standards such as Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) and American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
C-9.03.04	secure ducts to support system according to specifications and industry standards
C-9.03.05	align ductwork with building lines to ensure uniformity and aesthetics
C-9.03.06	select fittings and components
C-9.03.07	install seismic restraints according to specifications, local codes and regulations

Sub-task**C-9.04 Installs dampers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.04.01	select and use tools and equipment such as snips, hammers and cordless drills
C-9.04.02	select dampers according to requirements such as size and use
C-9.04.03	determine damper positions according to air direction and shaft access
C-9.04.04	prepare ductwork by using processes such as installing hat-channel and slotting ductwork to receive dampers

C-9.04.05	prepare sectional dampers using methods such as bolting sections together and adding stiffeners to damper frames and brackets to damper blades to allow blades to move in unison, as required
C-9.04.06	secure dampers and control mechanisms using fasteners such as screws, rivets and bolts
C-9.04.07	mark or slot shafts to identify blade direction
C-9.04.08	identify that dampers are true or square
C-9.04.09	cycle dampers to ensure free movement of parts
C-9.04.10	set dampers as required for application

Sub-task

C-9.05 **Installs fire dampers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.05.01	select and use tools and equipment such as hammers, hacksaws and cordless drills
C-9.05.02	select fire dampers according to requirement such as size and use
C-9.05.03	prepare sleeves to receive fire dampers
C-9.05.04	prepare sectional fire dampers using methods such as bolting sections together and adding stiffeners to the fire damper frames, as required
C-9.05.05	secure fire dampers using fasteners and angles ensuring tight fit to wall and around fire damper sleeves
C-9.05.06	identify that fire dampers are true or square
C-9.05.07	apply fire stop caulking on external angle for smoke wall protection
C-9.05.08	test fire dampers to ensure free movement of parts
C-9.05.09	install access door on ductwork for easy access to perform tests and visual inspections and to reset fire dampers
C-9.05.10	install breakaway joints according to jurisdictional codes

Sub-task**C-9.06 Installs registers, grilles, diffusers and louvers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.06.01	select and use tools and equipment such as drills, screwdrivers, levels and snips
C-9.06.02	select registers, grilles, diffusers and louvers according to requirements or specifications
C-9.06.03	connect registers, grilles, diffusers and louvers to ductwork using methods such as fastening and placing in ceiling grid, taking into account directional considerations
C-9.06.04	align registers, grilles, diffusers and louvers with building line for aesthetic reasons
C-9.06.05	assemble register, grille, diffuser and louver components when required
C-9.06.06	install access doors according to requirements or specifications

Sub-task**C-9.07 Installs terminal boxes.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.07.01	select and use tools and equipment such as cordless drills, snips, screwdrivers and hammers
C-9.07.02	determine terminal boxes position according to air flow direction marked on box, and access to connections and shafts
C-9.07.03	install access doors on ductwork for testing and cleaning purposes according to specifications, plans and documents
C-9.07.04	secure and seal terminal boxes to ductwork, plenums or units using mechanical fasteners such as S-cleats, drive cleats and screwed joints
C-9.07.05	determine duct straight length requirements prior to connection to main ductwork for optimal operation according to manufacturers' specifications

Sub-task**C-9.08 Installs coils.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.08.01	select and use tools and equipment such as cordless drills, snips, screwdrivers and hammers
C-9.08.02	determine coil position according to air flow direction marked on coil, access to connections and easy removal
C-9.08.03	install access doors on ductwork for testing and cleaning purposes according to specifications, plans and documents
C-9.08.04	secure and seal coils to ductwork, plenums or units using methods such as installing channels and using mechanical fasteners

Sub-task**C-9.09 Installs system component accessories.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-9.09.01	select and use tools and equipment such as screwdrivers, drills and hammers
C-9.09.02	determine installation requirements for component accessories such as air balancing test ports, security bars, humidifiers, spark arrestors, air filtration systems and access doors according to specifications, plans and drawings
C-9.09.03	determine location of accessories according to factors such as accessibility, specifications and manufacturers' recommendations
C-9.09.04	secure accessories using mechanical fasteners

Task 10**Installs material handling system components.**

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

Required Knowledge

K 1	types of fans such as vane axial, centrifugal and backward inclined
K 2	types of material handling systems such as gravity, pneumatic and mechanical
K 3	system design principles and air flow
K 4	construction codes and regulations
K 5	material handling systems
K 6	collection devices such as hoppers, hoods and bins
K 7	separating devices such as cyclones, bag houses and scrubbers
K 8	the effect of environmental conditions on material and installation
K 9	installation techniques

Sub-task**C-10.01 Installs pneumatic and gravity material handling system components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-10.01.01	select and use tools and equipment such as grinders, hammers and screwdrivers
C-10.01.02	assemble ductwork, fittings and components according to labelling, tagging, plans and specifications
C-10.01.03	complete joints using methods such as welding and bolting according to specifications
C-10.01.04	secure ducts and components to support system according to specifications
C-10.01.05	select and install fittings and components to ensure a smooth passage of materials through systems minimizing angle and direction changes

Sub-task**C-10.02 Installs mechanical material handling system components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-10.02.01	select and use tools and equipment such as welding equipment, impact drills and grinders
C-10.02.02	assemble chutes and slides, fittings and components according to labelling, tagging, plans and specifications
C-10.02.03	complete joints using methods such as welding and bolting according to specifications
C-10.02.04	secure chutes, slides and components to support or hanging systems according to specifications
C-10.02.05	select and install fittings and components to ensure a smooth passage of materials through systems minimizing angle and direction changes

Sub-task**C-10.03 Installs collection and separating devices.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-10.03.01	select and use tools and equipment such as drills, hammers and wrenches
C-10.03.02	determine location of device according to specifications or requirements
C-10.03.03	assemble components of device according to requirements
C-10.03.04	secure and connect devices and components using methods such as using mechanical fasteners, welding and installing brackets

Task 11**Installs thermal insulation, lagging, cladding and flashing.**

Context Sheet metal workers may install components for air and material handling systems to address safety concerns, to limit operating costs, to increase the efficiency of equipment through the conservation of energy, and to protect insulation and ductwork from damage due to environmental exposure.

Required Knowledge

K 1	types of insulation such as thermal and fire-rated and their application
K 2	types of cladding material such as aluminium, stainless steel and galvanised steel
K 3	types of lagging material such as aluminium, stainless steel and canvas
K 4	types of flashings such as cap flashing, curb and step flashing
K 5	building materials and types of weatherproofing materials
K 6	cladding components such as end caps, straps and preformed elbows
K 7	cladding requirements
K 8	the effect of environmental conditions on material and installation
K 9	types of materials for sealing such as oil-based, solvent-based, water-based, tapes and caulking
K 8	measurement and layout techniques
K 9	securing techniques
K 10	installation techniques

Sub-task**C-11.01 Applies thermal insulation to components.**

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

Key Competencies

C-11.01.01	select and use tools and equipment such as knives, end cutters and pin spotters
C-11.01.02	identify location to be insulated according to specifications and codes
C-11.01.03	lay out and cut insulation pieces

C-11.01.04	secure insulation by applying fasteners and components such as pins, z-bars and glue, and finish with insulation washers
C-11.01.05	complete vapour barrier according to specifications

Sub-task

C-11.02 Applies lagging and cladding to components.

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

Key Competencies

C-11.02.01	select and use tools and equipment such as snips, grinders, banders, tape measure and trammel points
C-11.02.02	select material according to plans, specifications and documents
C-11.02.03	measure, lay out and cut material to fit
C-11.02.04	overlap seams to shed moisture
C-11.02.05	secure and seal material using methods such as banding, and applying screws, sealants and adhesives

Sub-task

C-11.03 Applies flashing to components.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.03.01	select and use tools and equipment such as drills, snips and folding pliers
C-11.03.02	select material according to plans, specifications, documents or requirements
C-11.03.03	measure and modify flashing to fit onsite conditions
C-11.03.04	overlap seams to shed moisture
C-11.03.05	secure and seal material using fasteners such as screws, sealants and adhesives

Task 12**Performs testing, adjusting and balancing.**

Context Sheet metal workers perform testing, adjusting and balancing to ensure that the system operates at its specified performance level.

Required Knowledge

K 1	types of leak tests such as smoke, dye, pressure, fluid, visual and audible
K 2	test procedures
K 3	charts for leak tests
K 4	air balancing instruments and techniques
K 5	HVAC and material handling systems
K 6	damper locations
K 7	thermal overload
K 8	pressure requirements
K 9	litres per second (L/S) and cubic feet per minute (CFM) measurements
K 10	documentation requirements
K 11	sealing methods
K 12	fan law calculations
K 13	pulley alignment and adjustment
K 14	belt length calculation and sizing

Sub-task**C-12.01 Performs leak tests. (NOT COMMON CORE)**

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

Key Competencies

C-12.01.01	select and use tools and equipment such as testing equipment, snips and drills
C-12.01.02	cap all branches by means such as end caps, polyethylene and duct tape
C-12.01.03	pressurize ductwork by attaching blower to duct
C-12.01.04	identify and mark leaking areas

C-12.01.05	reseal leaking areas and retest
C-12.01.06	document test results

Sub-task

C-12.02 Performs air balancing.

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

Key Competencies

C-12.02.01	select and use tools and equipment such as velometers and drills
C-12.02.02	lay out and create test ports by drilling holes in ductwork and systems
C-12.02.03	establish grid marks
C-12.02.04	take air flow measurements in pre-determined grids
C-12.02.05	perform calculations to determine air flow and compare to design specifications
C-12.02.06	adjust components as required
C-12.02.07	retest air flow measurements
C-12.02.08	document results

BLOCK D

ROOFING, ARCHITECTURAL METAL AND SPECIALTY PRODUCT INSTALLATION

Trends	Pre-engineered wall paneling systems are becoming a popular building construction option. The pre-finished insulated panels permit maintenance-free, quick and efficient installation for feature walls or exterior shells. There is an increase in the use of sheet metal products such as copper roofs in the residential, institutional, historical and commercial sectors.
Related Components (include, but not limited to)	Flashing, coping, gutters, downspouts, conductors, scuppers, fasteners, sealants, sheet and batten, closures, fascia, awnings, canopies, finials, insulation, waterproof membranes, isolation membranes, pre-formed and roll-formed decking, sheeting and roofing products, lagging, cladding, kitchen hoods, backsplashes, countertops, laboratory components, medical facility products, food processing products, guards, signage, brackets, cleaning compounds, abrasives.
Tools and Equipment	See Appendix A.

Task 13 Installs metal roofing and cladding systems.

Context	Sheet metal workers install metal roofing and cladding products to provide low maintenance, longevity of the building and protection from the elements. Metal roofs and cladding can also add to the aesthetics of the building.
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Required Knowledge

K 1	types of roof structures such as pitched, tapered, domes and spires
K 2	roof construction features such as hips, ridges and valleys
K 3	access doors and roof hatches
K 4	roof and wall materials and characteristics
K 5	final appearance of roof and wall

K 6	types of insulation such as fibreglass, styrofoam and fibreboard
K 7	types of waterproof membranes such as mastic and plastic
K 8	isolation materials such as wood blocks, plastic, felt paper, rubber and mineral surface
K 9	air and vapour barriers
K 10	manufacturers' recommended installation methods for metal roofing and cladding systems
K 11	types of roof and wall panels such as standing seam, batten and snap lock
K 12	fasteners such as concealed and exposed clips, screws, washer nails and cleats
K 13	thermal expansion and contraction of material
K 14	the effect of environmental conditions on material and installation
K 15	roofing components such as expansion joints, flashings and gutters
K 16	sealants such as caulking, solder and mastic
K 17	manufacturers' recommendations for application of sealants
K 18	locations requiring sealing
K 19	types of decking such as metal pan and Q-decking
K 20	material to be applied on decking such as roofing, concrete, wood and insulation

Sub-task

D-13.01 Lays out roof and walls.

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

Key Competencies

D-13.01.01	select and use tools such as transits, laser levels and chalk lines
D-13.01.02	check the building for things such as penetrations, status and square
D-13.01.03	establish reference lines
D-13.01.04	confirm site measurements referencing plans, specifications and documents
D-13.01.05	determine orientation of seams and joints
D-13.01.06	determine desired overall appearance
D-13.01.07	prepare sheeting for installation procedures such as pre-drilling and hoisting

Sub-task**D-13.02 Installs insulation, isolation material and building envelope.
(NOT COMMON CORE)**

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

Key Competencies

D-13.02.01	select and use tools and equipment such as screwdrivers, paint brushes and hammer-staplers
D-13.02.02	apply building envelope such as felt paper, ice and water shield, and self-adhesive membrane to the building
D-13.02.03	select and use fasteners such as pin bolts, screws and powder-actuated fasteners
D-13.02.04	determine paneling system requirements
D-13.02.05	install panel mounting system such as z-bars, j-bars, clips and/or cleats
D-13.02.06	apply and fasten insulation to structure
D-13.02.07	apply isolation material such as neoprene, caulking and wood

Sub-task**D-13.03 Installs roofing and cladding system components.**

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

Key Competencies

D-13.03.01	select and use fasteners such as screws, nails and bolts
D-13.03.02	select and use tools and equipment such as drills, seamers and laser levels
D-13.03.03	determine starting point to achieve finished appearance
D-13.03.04	install required flashing
D-13.03.05	cut, fit and fasten panels to the structure or mounting system following reference lines
D-13.03.06	install expansion joints
D-13.03.07	install finish flashing and drainage according to specifications

Sub-task**D-13.04 Seals exposed joints.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-13.04.01	select and use tools and equipment such as caulking guns and soldering irons
D-13.04.02	select sealant such as caulking, solder and mastic
D-13.04.03	apply sealant according to manufacturers' specifications
D-13.04.04	apply joint or seam caps to secure seal and ensure watershed

Sub-task**D-13.05 Installs decking.**

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

Key Competencies

D-13.05.01	select and use tools and equipment such as welding equipment, abrasive cut-off saws and hand crimpers
D-13.05.02	determine material required such as metal pan and Q-decking
D-13.05.03	cut and fit decking
D-13.05.04	fasten decking using welding equipment, screws and dimple tools
D-13.05.05	frame out non-structural openings
D-13.05.06	finish exposed welds to prevent corrosion

Task 14

Installs exterior components.

Context Sheet metal workers install metal exterior components such as awnings, and signage for functional and aesthetic reasons.

Required Knowledge

K 1	types of exterior surfaces such as concrete, metal, stone, wood and composite
K 2	surface preparation such as cleaning, filling voids, grouting mortar lines and scoring surface for adherence
K 3	cleaning compounds and abrasives
K 4	exterior components such as awnings, finials, signage, decorative fascia and canopies
K 5	fasteners such as anchors, nail-ins, screws and adhesives
K 6	compatibility of fasteners and components
K 7	final appearance of components

Sub-task

D-14.01 Prepares surface.

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

Key Competencies

D-14.01.01	select and use tools and equipment such as grinders, putty knives and hammer drills
D-14.01.02	check alignment of the exterior surface for aesthetic purposes and for ease of installation
D-14.01.03	identify fastening points
D-14.01.04	determine fastening system
D-14.01.05	clean installation area using scrapers, grinders, wire brushes and chemicals such as degreasers and acids
D-14.01.06	score surface for adherence
D-14.01.07	apply waterproofing membrane or flashing to ensure watertight construction

Sub-task**D-14.02 Fastens exterior components.**

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

Key Competencies

D-14.02.01	select and use tools and equipment such as drills, screwdrivers and hammers
D-14.02.02	select components to suit application
D-14.02.03	modify components as required
D-14.02.04	install fasteners such as anchors, nail-ins, screws and adhesives
D-14.02.05	seal joints to weatherproof the building by soldering or caulking

Task 15 Installs specialty products.

Context Sheet metal workers install these products in locations such as commercial kitchens, food processing plants, pharmaceutical laboratories, medical facilities and manufacturing plants.

Required Knowledge

K 1	kitchen preparation products such as sinks, hoods, backsplashes and countertops
K 2	pharmaceutical laboratory products such as tanks, conveyors and laboratory components
K 3	food processing products such as flumes, guards and chutes
K 4	medical facility products such as laundry chutes, counters and cupboards
K 5	codes and regulations
K 6	food grade caulking, solders and welding materials
K 7	non-stainless steel metals such as aluminium and copper
K 8	plastic products such as laboratory exhaust systems and sneeze shields
K 9	fasteners such as screws, pop rivets and bolts

Sub-task**D-15.01 Installs stainless steel specialty products.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.01.01	select and use tools and equipment such as welding equipment, grinders and snips
D-15.01.02	install components according to codes, regulations and specifications
D-15.01.03	select and use fasteners and hangers for application
D-15.01.04	isolate differing materials from each other to avoid electrolysis
D-15.01.05	assemble components according to plan
D-15.01.06	finish specialty product using sealants and coating such as food grade caulking, solders, welding materials and epoxy coating
D-15.01.07	finish products according to requirements such as sanitary and aesthetic

Sub-task**D-15.02 Installs non-stainless steel products.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	NV	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.02.01	select and use tools and equipment such as welding equipment, grinders and snips
D-15.02.02	install components according to codes, regulations and specifications
D-15.02.03	select and use fasteners and hangers for application
D-15.02.04	isolate differing materials from each other to avoid electrolysis
D-15.02.05	assemble components according to plan
D-15.02.06	finish specialty product using sealants and coating such as solders, welding materials and epoxy coatings
D-15.02.07	finish products according to requirements such as sanitary and aesthetic

BLOCK E

MAINTENANCE AND REPAIR

Trends	There is an increase in the use of electronic equipment controls and sensors. This has increased the need for more training in electronic diagnosis. There is an emphasis to improve energy efficiency of buildings and their operating systems.
Related Components (include, but not limited to)	Ductwork, furnaces, air conditioners, rooftop units, makeup air units, fans, dampers, belts, pulleys, bearings, blower wheels, electronic and mechanical controls, filters, vents, humidifiers, scrubbers, lubricants, roofs, walls.
Tools and Equipment	See Appendix A.

Task 16 Performs scheduled maintenance.

Context	Sheet metal workers perform scheduled maintenance to minimize repair costs, increase longevity and enhance system performance.
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Required Knowledge

K 1	components such as belts, pulleys, bearings, fan blades, filters and motors
K 2	normal operation and appearance of components
K 3	frequency of scheduled maintenance
K 4	sequence of equipment operation

Sub-task**E-16.01 Performs maintenance inspection.**

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

Key Competencies

E-16.01.01	obtain service schedule with a list of equipment and components to be inspected
E-16.01.02	refer to inspection checklist for itemisation of equipment components to be inspected
E-16.01.03	select and use tools and equipment such as multimeters, air testing equipment and screwdrivers
E-16.01.04	perform required tests, surveys or readings such as amp draws, air readings and filter conditions
E-16.01.05	conduct sensory inspection to identify possible faults
E-16.01.06	record and report all findings on inspection checklist
E-16.01.07	keep record of inspection report on file

Sub-task**E-16.02 Services components.**

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

Key Competencies

E-16.02.01	refer to inspection checklist for parts
E-16.02.02	refer to manufacturers' specifications for normal operating conditions and specific accessories
E-16.02.03	select and use tools and equipment such as grease guns, Allen keys and adjustable wrenches
E-16.02.04	clean or replace filters
E-16.02.05	clean components through methods such as de-greasing, using compressed air and vacuuming
E-16.02.06	adjust pulleys and belts for required tension and alignment

E-16.02.07	lubricate bearings
E-16.02.08	re-check pressures

Task 17 **Repairs faulty systems and components.**

Context Sheet metal workers repair building systems and equipment such as ventilation, conveyance, and wall systems to return them to normal operating conditions and specifications.

Required Knowledge

K 1	normal operation and appearance of components
K 2	diagnostic methods such as sensory inspections and use of testing devices
K 3	sequence for removing and replacing components such as ductwork, material handling components, filters, belts and pulleys
K 4	patching methods such as welding, riveting and bonding

Sub-task

E-17.01 **Diagnoses system faults.**

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

Key Competencies

E-17.01.01	obtain information such as history of work done, maintenance record and client feedback
E-17.01.02	select and use tools and equipment such as multimeters, air testing equipment and screwdrivers
E-17.01.03	perform required tests, surveys or readings such as amp draws, air readings and filter conditions
E-17.01.04	conduct sensory inspections
E-17.01.05	identify worn, faulty or missing components
E-17.01.06	record and report findings

Sub-task**E-17.02 Repairs worn, faulty or obsolete components.**

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

Key Competencies

E-17.02.01	select and use tools and equipment such as wrenches, hammers, drills and grinders
E-17.02.02	measure and fabricate sheet metal components
E-17.02.03	order components such as fan belts, motors and isolators
E-17.02.04	disassemble equipment and components in required sequence
E-17.02.05	replace or modify faulty or obsolete components
E-17.02.06	reassemble and tighten components
E-17.02.07	perform tests, surveys or readings such as amp draws, air readings and filter conditions to verify that system is operating according to specifications

APPENDICES

Hand Tools

adjustable wrench	locking pliers
Allen hex keys	mallet
aviation snips R.H. and L.H.	marking pen
ball peen hammer	paint brush
banding tools	pipe wrench
bulldog snips	pliers
bumping hammer	plumb bob
caulking gun	pop riveter
C-clamp	prick punch
center punch	rivet set
chalk line	riveting hammer
chipping hammer	scraper
chisels	scratch awl
combination snip	screwdriver
divider	scriber
drift pin	setting hammer
duct puller/stretcher	side cutters
files	socket set
groove seamer – hand groover	soldering coppers
hacksaw	straight edge
hand crimpers	tap and die
hand dolly	trowels
hand notcher	wire and bolt cutters
hand seamer/folding pliers	wire brushes
hole punch	wrenches
levels	

Portable Power Tools and Accessories

air compressor	drill bits
angle drill	electric drill
angle grinder	generator
chop saw	hammer drill
circular saw	hole saw
cordless drill	impact wrench
die grinder	jigsaw
double cutter	nibbler

Portable Power Tools and Accessories (continued)

pneumatic hammer	power washer
pneumatic riveter	reciprocating saw
polisher and buffer	seamer
portable band saw	spray gun
portable plasma cutter	unishear
powder-actuated tool	

Shop Tools and Equipment

abrasive cut-off saw	notcher
angle iron roller	pattern
band iron bender	pin spotter
band saw	pipe-threader, cutter, reamer
bar folder	Pittsburgh machine
box and pan brake	power brake
button lock machine	power notcher
cleat folder	power press
cleat machine	power punch
cold cut saw	power roll former
cut to length line	power sander or polisher
dimpler	power shear
drill index	rivet press
drill press	riveting gun
foot shear	rotary punch
grinder	slitter
hand brake	snap-lock machine
hydraulic press	spiral duct machine
ironworker	Transverse Duct Connector/Transverse
lever bench shear	Duct Flange (TDC/TDF) machine
magnetic brake	

Rotary Machines

combination bending and crimping machine	slip roll former
double seaming equipment	turning machines and attachments (such as elbow seaming, burring, beading, wiring, crimping)
easy edger	van stone machine
ring and circle shears	

Metal Forming Bench Stakes

anvil	creasing stake
beak horn	double seaming
bench plate	double seaming with heads
blow horn	hatchet
candle mould	hollow mandrel
common square	solid mandrel
copper smith	square

Welding, Brazing, Soldering and Cutting Equipment

AC power unit	shielded metal arc welding (SMAW)
AC/DC power unit	equipment
butane torch	soldering furnace or pot
electric soldering iron	soldering coppers
MIG welding equipment (GMAW)	spot welder
oxy-fuelled welding equipment	TIG welding equipment (GTAW)
	tiger torch

Layout and Drafting Equipment

beam compass	framing square
circumference rule	parallel bar
combination square	protractor
compass	scale ruler
divider	set square/triangle
drafting arm	stencil
drafting pencil	template
drafting table	trammel points
eraser shield	T-square

Measuring Tools

angle finder	micrometer
angle rule	tape measure
bench rule	transit level
caliper	vernier caliper
laser level	

Ladders, Platforms, and Hoisting and Rigging Equipment

cable	manlift
chain falls	material lift
chain hoist	overhead crane
chokers	rope
come-along	scaffolds
fork lift	scissor lift
gin wheel (pulley)	shackles
grip hoist	slings
hydraulic hoist	swing stage
ladders	

Testing Equipment

ammeter	micro amp meter
amprobe	millivolt meter
anemometer	monoxor (CO tester)
calibrated flow hood	multimeter
CO ² tester	O ² tester
digital combustion analyzer	ohmmeter
digital manometer	pitot tube
digital multimeter	pressure gauge
digital scope	psychrometer
digital thermometer	smoke tester
duct thermometer	stack thermometer
grommet or plug	stop watch
high pressure duct tester	strobe tachometer
hygrometer	tachometer
inclined manometer	U tube manometer
magnehelic pressure gauge	velometer
mechanical tachometer	

Computer Assisted Tools

computer hardware	plasma cutter
digital camera	printer/scanner
fax machine	software packages
hand held personal computer	water jet
laser cutter	
numerical control/computer	
numerical control equipment	
(NC/CNC)	

Personal Protective Equipment and Safety Equipment

coveralls	hearing protection
eye protection	leather apron
eye wash station	reflective vest
face shield	respiratory protection
fall arrest equipment	safety boots
fire extinguisher	welding goggles
first aid kit	welding helmet
fume exhaust system	welding jacket
gloves	welding screen
hard hat	

acoustic insulation	material installed internally to reduce or transfer the intensity of sound
annealing	process by which metal is heated to relieve stress, changing the metal's strength and hardness
aviation snips	tool used to cut thin sheet metal
blank piece	piece of material cut to size prior to notching or marking
brake	manual or power equipment used to bend and form metal
breeching	horizontal portion of a combustion venting system used for exhausting fumes and gases
building envelope	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
building insulation	material installed on buildings for comfort and energy efficiency
burglar bars	heavy steel bars installed to prevent access
cladding	material that covers another material to provide a skin or a layer; it is intended to control infiltration of weather elements or for aesthetic purposes
coping (architectural)	material used as the capping of a wall
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
damper	valve or plate that stops or regulates the flow of air or materials
electrolysis	galvanic reaction between dissimilar metals that occurs in the presence of an electrolyte, such as water; also known as electrolytic corrosion
flashing	thin continuous piece of sheet metal or other imperious material installed to prevent the passage of water into a structure from an angle or joint, and to seal around duct penetrations

flue	duct pipe for conveying exhaust gas from a fireplace, furnace, hot water heater or boiler to the outside
isolation	product used between two dissimilar metals to prevent electrolysis
isolator	components that minimize noise, sound and vibration
lagging	provides weatherproof construction for protecting the insulation from water and damage; it also creates a finished surface for aesthetic purposes
parallel line development	method of pattern development based upon the fact that a line that is parallel to another line is at an equal distance at all points
plasma cutting	process used to cut metal of different thicknesses using a plasma torch
radial line development	method of conical pattern development where all points radiate from a common apex
sealant	substance, such as sealing wax, used to seal a surface to prevent passage of a liquid or gas
seam/lock	any process of connecting two pieces or two ends of metal/materials together
shear	equipment or a process of cutting sheet metal
soldering	process that uses low-melting point metal alloys to join metallic surfaces without melting them
stake	equipment used in forming material by hand; usually found in a sheet metal shop
stretch-out	overall length of material including all locks and seams
thermal insulation	material used to reduce the rate of heat transfer
triangulation development	method of pattern development using right angle triangles and two known points to find a third unknown point

ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
CAD	Computer Aided Drafting
CFM	cubic feet per minute
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
FCAW	Flux Core Arc Welding
GMAW	Gas Metal Arc Welding (MIG)
GTAW	Gas Tungsten Arc Welding (TIG)
HEPA	high efficiency particulate air
HRV	heat recovery ventilator
HVAC	heating, ventilation and air conditioning
LEED	Leadership in Energy and Environmental Design
L/S	Litres per Second
MSDS	Material Safety Data Sheet
NBC	National Building Code
OH&S	Occupational Health and Safety
PPE	Personal protective equipment
PVC	polyvinyl chloride
RFI	request for information
RPM	revolutions per minute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMAW	Shielded Metal Arc Welding (stick)
TDC	transverse duct connectors
TDF	transverse duct flange
TDG	Transportation of Dangerous Goods
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D

BLOCK AND TASK WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	30	24	NV	15	25	20	20	17	21	25	NV	NV	NV	22%

Task 1 Uses and maintains tools and equipment.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	60	NV	40	80	60	60	40	60	60	NV	NV	NV	57%

Task 2 Organizes work.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	40	NV	60	20	40	40	60	40	40	NV	NV	NV	43%

BLOCK B FABRICATION

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	50	29	NV	38	20	32	35	33	27	30	NV	NV	NV	33%

Task 3 Performs pattern development.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	45	45	NV	40	20	40	35	50	31	30	NV	NV	NV	37%

Task 4 Fabricates sheet metal components for air and material handling systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	40	40	NV	27	30	45	45	30	39	40	NV	NV	NV	37%

Task 5 Fabricates roofing, sheeting and cladding.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	5	5	NV	14	30	10	5	10	12	15	NV	NV	NV	12%

Task 6 Fabricates specialty products.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	10	10	NV	19	20	5	15	10	18	15	NV	NV	NV	14%

BLOCK C AIR AND MATERIAL HANDLING SYSTEM INSTALLATION

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	15	34	NV	26	20	38	40	25	21	30	NV	NV	NV	28%

Task 7 Prepares installation site.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	30	20	NV	18	15	30	15	15	16	25	NV	NV	NV	20%

Task 8 Installs chimneys, breeching and venting.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	5	10	NV	12	30	10	10	8	21	15	NV	NV	NV	13%

Task 9 Installs air handling system components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	50	35	NV	23	30	40	40	39	23	30	NV	NV	NV	35%

Task 10 Installs material handling system components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	10	25	NV	20	10	5	25	15	19	15	NV	NV	NV	16%

Task 11 Installs thermal insulation, lagging, cladding and flashing.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	5	10	NV	12	5	5	5	10	10	10	NV	NV	NV	8%

Task 12 Performs testing, adjusting and balancing.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	0	0	NV	15	10	10	5	13	11	5	NV	NV	NV	8%

BLOCK D ROOFING, ARCHITECTURAL METAL AND SPECIALTY PRODUCT INSTALLATION

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	5	10	NV	11	25	7	2	10	14	10	NV	NV	NV	10%

Task 13 Installs metal roofing and cladding systems.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	10	25	NV	39	60	70	25	50	24	35	NV	NV	NV	38%

Task 14 Installs exterior components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	0	50	NV	35	20	5	25	25	35	30	NV	NV	NV	25%

Task 15 Installs specialty products.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	90	25	NV	26	20	25	50	25	41	35	NV	NV	NV	37%

BLOCK E MAINTENANCE AND REPAIR

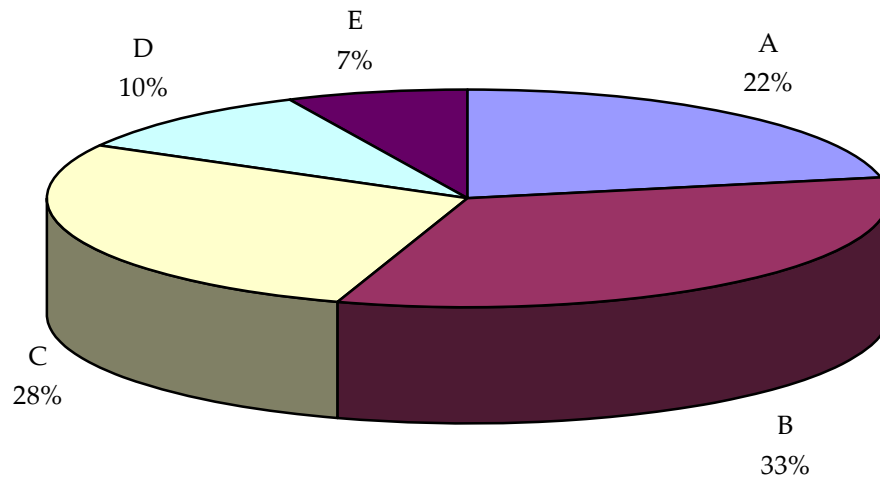
	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	National Average
%	0	3	NV	10	10	3	3	15	17	5	NV	NV	NV	7%

Task 16 Performs scheduled maintenance.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	0	0	NV	48	60	5	50	40	44	70	NV	NV	NV	40%

Task 17 Repairs faulty systems and components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>	
%	0	100	NV	52	40	95	50	60	56	30	NV	NV	NV	60%



TITLES OF BLOCKS

BLOCK A	Occupational Skills	BLOCK D	Roofing, Architectural Metal and Specialty Product Installation
BLOCK B	Fabrication	BLOCK E	Maintenance and Repair
BLOCK C	Air and Material Handling System Installation		

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART – Sheet Metal Worker

BLOCKS	TASKS	SUB-TASKS				
A - OCCUPATIONAL SKILLS	1. Uses and maintains tools and equipment.	1.01 Uses personal protective equipment (PPE) and safety equipment.	1.02 Maintains hand tools.	1.03 Maintains portable power tools.	1.04 Maintains shop tools and equipment.	1.05 Maintains welding/cutting equipment.
		1.06 Maintains soldering/brazing equipment.	1.07 Maintains measuring and layout equipment.	1.08 Maintains testing and inspection devices. (NOT COMMON CORE)	1.09 Uses ladders and work platforms.	1.10 Uses hoisting and rigging equipment.
		2.01 Maintains safe work environment.	2.02 Interprets documentation.	2.03 Interprets drawings.	2.04 Completes documentation.	2.05 Communicates with others.
		2.06 Organizes materials.	2.07 Performs basic design and field modifications.	2.08 Performs inspection.		
	3. Performs pattern development.	3.01 Develops pattern using triangulation method.	3.02 Develops pattern using radial line method.	3.03 Develops pattern using parallel line method.	3.04 Develops pattern using simple and straight line layout.	3.05 Develops pattern using computer technology.
		3.06 Labels pieces.				
B - FABRICATION	4. Fabricates sheet metal components for air and material handling systems.	4.01 Cuts ductwork, fittings and components.	4.02 Forms ductwork, fittings and components.	4.03 Insulates ductwork, fittings and components.	4.04 Assembles ductwork, fittings and components.	4.05 Fabricates dampers.

BLOCKS	TASKS	SUB-TASKS				
C - AIR AND MATERIAL HANDLING SYSTEM INSTALLATION		4.06 Fabricates flexible connections.	4.07 Fabricates hanger systems.	4.08 Fabricates supports and bases.		
	5. Fabricates roofing, sheeting and cladding.	5.01 Determines seams.	5.02 Cuts metal for flashing, roofing, sheeting and cladding.	5.03 Forms flashing, roofing, sheeting and cladding.		
	6. Fabricates specialty products.	6.01 Cuts material for specialty products.	6.02 Forms specialty products.	6.03 Assembles specialty products.	6.04 Finishes specialty products.	
	7. Prepares installation site.	7.01 Performs onsite measurements.	7.02 Performs demolitions for renovations.	7.03 Cuts penetrations.	7.04 Installs supports and bases.	7.05 Installs hangers, braces and brackets.
	8. Installs chimneys, breeching and venting.	8.01 Installs chimney, breeching and venting primary components.	8.02 Connects chimney, breeching and venting to appliance.			
	9. Installs air handling system components.	9.01 Installs air handlers.	9.02 Installs heat recovery ventilators (HRVs).	9.03 Installs sheet metal ducts and fittings.	9.04 Installs dampers.	9.05 Installs fire dampers.
		9.06 Installs registers, grilles, diffusers and louvers.	9.07 Installs terminal boxes.	9.08 Installs coils.	9.09 Installs system component accessories.	
	10. Installs material handling system components.	10.01 Installs pneumatic and gravity material handling system components.	10.02 Installs mechanical material handling system components.	10.03 Installs collection and separating devices.		

BLOCKS	TASKS	SUB-TASKS				
D - ROOFING, ARCHITECTURAL METAL AND SPECIALTY PRODUCT INSTALLATION	11. Installs thermal insulation, lagging, cladding and flashing.	11.01 Applies thermal insulation to components.	11.02 Applies lagging and cladding to components.	11.03 Applies flashing to components.		
	12. Performs testing, adjusting and balancing.	12.01 Performs leak tests. (NOT COMMON CORE)	12.02 Performs air balancing.			
	13. Installs metal roofing and cladding systems.	13.01 Lays out roof and walls.	13.02 Installs insulation, isolation material and building envelope. (NOT COMMON CORE)	13.03 Installs roofing and cladding system components.	13.04 Seals exposed joints.	13.05 Installs decking.
	14. Installs exterior components.	14.01 Prepares surface.	14.02 Fastens exterior components.			
	15. Installs specialty products.	15.01 Installs stainless steel specialty products.	15.02 Installs non-stainless steel products.			
E - MAINTENANCE AND REPAIR	16. Performs scheduled maintenance.	16.01 Performs maintenance inspection.	16.02 Services components.			
	17. Repairs faulty systems and components.	17.01 Diagnoses system faults.	17.02 Repairs worn, faulty or obsolete components.			