PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Metal Fabricator (Fitter)

INTERPROVINCIAL STANDARD
CANADA
NORME INTERPROVINCIALE

red-seal.ca
sceau-rouge.ca

Employment and Social Development Canada
Emploi et Développement social Canada

Canada

PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Metal Fabricator (Fitter)

Title: Metal Fabricator (Fitter)

This publication is available for download at canada.ca/publicentre-ESDC. It is also available upon request in multiple formats by contacting 1 800 O-Canada (1-800-622-6232). By teletypewriter (TTY), call 1-800-926-9105.

PDF
Cat. No.: Em15-3/32-2021E-PDF
ISBN/ISSN: 978-0-660-40842-2

Foreword

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

Background

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

Standards have the following objectives:

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

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

Trades and Apprenticeship Division
Apprenticeship and Sectoral Initiatives Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV, 6th Floor
Gatineau, Quebec K1A 0J9

Acknowledgements

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

Special thanks are offered to Adam Noseworthy of New Brunswick, who provided expert advice in the initial review.

This standard was prepared by the Apprenticeship and Sectoral Initiatives Directorate of ESDC. The coordinating, facilitating and processing of this standard were undertaken by employees of the standards development team of the Trades and Apprenticeship Division and of New Brunswick, the host jurisdiction for this trade.

Structure of the Occupational Standard

This standard contains the following sections:

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

Description of the Metal Fabricator (Fitter) trade: an overview of the trade's duties, work environment, job requirements, similar occupations and career progression

Trends in the Metal Fabricator (Fitter) trade: some of the trends identified by industry as being the most important for workers in this trade

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

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

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

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

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

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard

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

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

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

Task Descriptor: a general description of the task

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

Skills:

Performance Criteria: description of the activities that are done as the sub-task is performed

Evidence of Attainment: proof that the activities of the sub-task meet the expected performance of a tradesperson who has reached journeyperson level

Range of Variables: elements and examples (not all inclusive) that provide a more in-depth description of a term used in the performance criteria and evidence of attainment

Knowledge:

Learning Outcomes: describes what should be learned relating to a sub-task while participating in technical or in-school training

Learning Objectives: topics to be covered during technical or in-school training in order to meet the learning outcomes for the sub-task

Range of Variables: elements and examples (not all inclusive) that provide a more in-depth description of a term used in the learning outcomes and learning objectives

Appendix A – Acronyms: a list of acronyms used in the standard with their full name

Appendix B – Tools and Equipment / Outils et équipement: a bilingual non-exhaustive list of tools and equipment used in this trade

Appendix C – Glossary / Glossaire: bilingual definitions or explanations of selected technical terms used in the standard

Methodology

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

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

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

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

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

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

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

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

Definitions for Validation and Weighting

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

Provincial/Territorial Abbreviations

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

Description of the Metal Fabricator (Fitter) Trade

"Metal Fabricator (Fitter)" is this trade's official Red Seal occupational title approved by the CCDA. This standard covers tasks performed by metal fabricators (fitters).

Metal fabricators (fitters) make and repair metal parts used in the construction of buildings, bridges, tanks, towers, boilers, pressure vessels and other structures and products. They develop templates, patterns, jigs and fixtures. They lay out, cut and fabricate structural steel, plate, and miscellaneous ferrous and non-ferrous metals for use in a wide variety of manufacturing and construction industries. They also assemble and fit metal sections and plates together to form complete units or sub-units such as frames, plates, girders and chutes that are used later in the assembly process.

Metal fabricators (fitters) must have the ability to interpret fabrication drawings and specifications. They select materials to accomplish their work. Metal fabricators (fitters) use tools and equipment such as plate rolls, press brakes, saws, iron worker, plate shears, plasma cutters, oxy-fuel cutting torches, grinders and drills to bend, cut, punch, drill or form metal components. They may also use computer numerical controlled (CNC) equipment. They fasten components together by using methods such as welding and bolting. They also use material handling and rigging, hoisting and lifting equipment to move materials and completed assemblies.

Skills important to metal fabricators (fitters) include the ability to visualize in three-dimensions, good coordination, mechanical aptitude, manual dexterity and the ability to perform work-related mathematical calculations.

There are risks associated with this trade such as working in close quarters, at heights, and with power tools, welding equipment, elevated work platforms, access equipment, and heavy materials.

Metal fabricators (fitters) usually work indoors in fabricating shops or factories. Some may also work outdoors fitting and fastening sub-assemblies. They may be employed by welding or ironworking companies, or by manufacturers of structural steel, boilers, heavy machinery and transportation equipment. They can also find employment in other sectors including maintenance, shipbuilding, fishing, agricultural equipment, railways, aviation, mining and the oil and gas industry.

This standard recognizes similarities or overlaps with the work of welders, sheet metal workers, ironworkers, steamfitter/pipefitters, industrial mechanics (millwrights) and boilermakers. Metal fabricators (fitters) often hold one or more welding qualifications.

With experience, metal fabricators (fitters) may act as mentors and trainers to apprentices in the trade. They may advance to positions such as lead hand, supervisor, quality assurance/quality control inspector, or contract manager, or set up their own shops.

Trends in the Metal Fabricator (Fitter) Trade

Tools and Equipment

Improving new technologies introduced to the workplace include water jet and laser cutting. This equipment provides more detailed, accurate cuts on the parts used by metal fabricators (fitters). As the high cost of this equipment comes down, more shops are willing to invest in this technology. However, specialized shops often provide these services to other fabrication shops.

The use of CNC equipment is becoming more prevalent and has found its way into nearly all types of equipment found in a fabrication shop. The use of CNC equipment and computer-assisted design (CAD) software increases the efficiency and accuracy of the fabrication process.

Health and Safety

To reduce accidents and promote awareness, safety regulations are becoming more stringent, resulting in more safety training and certification.

Environmental

Environmental concerns and awareness have increased.

Products/Materials

Familiarity with the range of alloys available is becoming more important in this trade. Alloys are being used more often because of factors such as mechanical properties, durability, cost effectiveness and weight.

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 application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile.

Reading

Metal fabricators (fitters) 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

Metal fabricators (fitters) locate and interpret information in several types of documents such as labels, signs, forms, lists, tables, technical drawings and specifications. They interpret fabrication drawings to determine how ferrous and non-ferrous materials should be cut and assembled by integrating plan views, elevation and section drawings as well as synthesizing information from other prints about adjacent components of the fabrication. Metal fabricators (fitters) also prepare documents such as sketches and forms.

Writing

Writing skills are used by metal fabricators (fitters) to write short texts. Examples of written work include logbook entries, quality assurance reports and production problem reports.

Oral Communication

Metal fabricators (fitters) discuss equipment maintenance and repair with suppliers, and specifications and plans with co-workers, supervisors and general contractors. They may mentor, supervise and direct the work of apprentices. Because of constant noise, metal fabricators (fitters) may also communicate through hand signals, gestures and sometimes notes.

Numeracy

Numeracy skills are very important in the everyday work of metal fabricators (fitters). Mathematical skills are used in taking measurements, doing material layout, using formulas, preparing cut lists and preparing jigs according to specifications in fabrication drawings.

Thinking

Metal fabricator (fitters) may suggest modifications to project designs to correct flaws, for example when fabrication drawing specifications do not take into account the space needed for welds. They need the ability to think spatially and visualize in three dimensions. On the job they are required to problem solve on a regular basis, such as trouble shooting equipment problems and making repairs.

Working with Others

Metal fabricators (fitters) generally work independently to fabricate and fit metal structures following fabrication drawing specifications, though working as a team may be essential to complete large projects. Metal fabricators (fitters) co-ordinate work with supervisors, co-workers, quality control staff and with workers from other trades such as millwrights or welders.

Digital Technology

Metal fabricators (fitters) may input parameters for CNC equipment such as press brakes or cutting tables. They may also use computer technology during pattern and template development. They may need to have a basic knowledge of CAD software to prepare layouts and interpret plans and drawings.

Continuous Learning

Metal fabricators (fitters) have a need to engage in ongoing learning to acquire information about health and safety, new products, metal fabrication procedures, metal properties and quality assurance standards. They must maintain skills and certification according to industry and jurisdictional regulatory authorities. New learning is acquired as part of regular work activities, by participating in industry specific training sessions, reading trade journals and talking to other metal fabricators (fitters).

Roles and Opportunities for Skilled Trades in a Sustainable Future

Climate change affects all of us. Trades play a large role in implementing solutions and adjusting to changes in the world.

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

For example:

- Construction tradespeople need to consider the materials they are using, building methods, and improvements to mechanical and electrical installations. There are important changes to codes and standards to help meet the climate change goals and commitments set for 2030 and 2050. Retrofits and new construction of low-energy buildings provide enormous opportunities for workers in this sector. Concepts, such as energy efficiency and regarding buildings as systems are foundational.

- Automotive and mechanical trades are seeing a shift towards the electrification of vehicles and equipment. As a result, new skills and knowledge will be required for tradespeople working in this sector. There are mandates for sales of new light-duty zero-emission vehicles (ZEV) in Canada, with the goal of achieving 100% ZEV sales by 2035. Due to this mandate, the demand for these vehicles is growing quickly among consumers and fleets. With this escalating demand, the need for skilled workers to maintain and repair these vehicles is also increasing.

- In industrial and resource sectors, there is pressure to move towards increased electrification of industrial processes. Many industrial and commercial facilities are also being upgraded to improve energy efficiency in areas such as lighting systems, and new production processes and technologies. There are also opportunities in carbon capture, utilization and storage (CCUS), as well as the production and export of low-carbon hydrogen.

- Trades in the service sector may also need to be aware of responsible sourcing, as well as efficient use of products and materials. New ways of working better are always a part of the job.

There are fast-moving changes in guidelines, codes, regulations and specifications. Many are being implemented for the purpose of energy efficiency and climate change. Those that affect specific trades may be mentioned within the standard. Examples of these guidelines and legislation include:

- The National Energy Code of Canada for Buildings (NECB).

- The Canadian Net-Zero Emissions Accountability Act (CNZEAA).

- programs that encourage sustainable building design and construction such as Leadership in Energy and Environmental Design (LEED) and the Zero Carbon Building (ZCB) standards.

- the Montreal Protocol for phasing out R22 refrigerants.

- energy efficiency programs such as ENERGY STAR.

- principles of the United Nations Declaration for the Rights of Indigenous Peoples pertaining to energy sector development.

Apprentices and tradespeople need to increase their climate literacy and reinforce their own understanding of energy issues and environmental practices. It is important for them to understand why these changes are happening and their effect on trades' work. While individual tradespeople and apprentices may not be able to choose certain elements like; the architectural design of buildings, building material selection, regulatory requirements, use of electric vehicles and technologies, they must understand the impact of using these elements in their work. Impacts include using environmentally friendly products and following requirements related to the disposal and recycling of materials.

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

All in all, it's about doing the work better and building a better world.

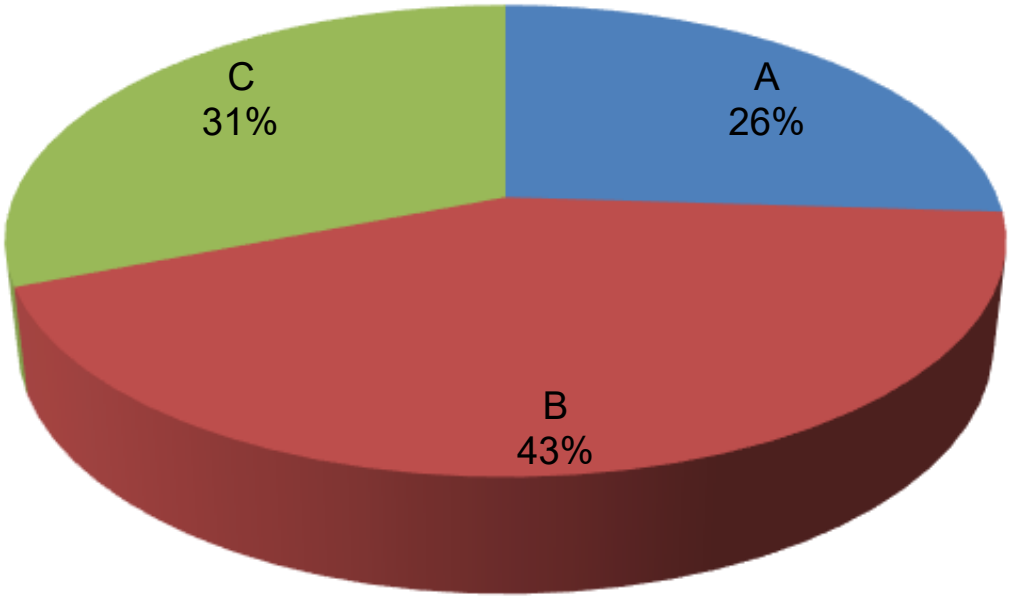
Industry Expected Performance

All tasks must be performed according to the applicable jurisdictional codes and standards. All health and safety standards must be respected and observed. Work should be performed efficiently and to a high quality without material waste or environmental damage. All requirements of employers, engineers, designers, manufacturers, clients and quality control policies must be met. At a journeyperson level of performance, all tasks must be done with minimal direction and supervision. As a journeyperson progresses in their career there is an expectation they continue to upgrade their skills and knowledge to maintain pace with industry and promote continuous learning in their trade through mentoring of apprentices.

Language Requirements

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

Pie Chart
of Red Seal Examination Weightings



MWA A	Performs common occupational skills	26%
MWA B	Fabricates components	43%
MWA C	Assembles components	31%

This pie chart represents a breakdown of the interprovincial Red Seal examination. Percentages are based on the collective input from workers from the trade from across Canada. The Task Matrix on the next pages indicates the breakdown of tasks and sub-tasks within each Major Work Activity and the breakdown of questions assigned to the Tasks. The Interprovincial examination for this trade has 130 questions.

Metal Fabricator (Fitter)

Task Matrix

A – Performs common occupational skills — 26%

Task A-1 Performs safety-related functions 17%	A-1.01 Maintains safe work environment	A-1.02 Uses personal protective equipment (PPE) and safety equipment	
Task A-2 Uses and maintains tools and equipment 19%	A-2.01 Uses hand, power, layout and measuring tools and equipment	A-2.02 Uses stationary machinery	A-2.03 Maintains cutting and welding equipment
	A-2.04 Uses access equipment		
Task A-3 Organizes work 17%	A-3.01 Interprets plans, drawings and specifications	A-3.02 Organizes project tasks	
Task A-4 Performs quality assurance throughout fabrication and assembly process 20%	A-4.01 Performs visual inspections	A-4.02 Verifies measurements, welds and layout	A-4.03 Tracks materials and parts for traceability
Task A-5 Handles materials 18%	A-5.01 Organizes material	A-5.02 Determines weights	A-5.03 Applies rigging practices
	A-5.04 Operates material handling equipment		
Task A-6 Uses communication and mentoring techniques 9%	A-6.01 Uses communication techniques	A-6.02 Uses mentoring techniques	

B – Fabricates components

43%

Task B-7 **Performs layout** **41%**	**B-7.01 Performs pattern development**	**B-7.02 Calculates material allowances for various processes**	**B-7.03 Determines dimensions**
	B-7.04 Transfers dimensions	**B-7.05 Makes templates**	
Task B-8 **Cuts materials** **31%**	**B-8.01 Cuts material using plasma cutting equipment**	**B-8.02 Cuts material using oxy-fuel cutting equipment**	**B-8.03 Cuts material using shears**
	B-8.04 Cuts material using saws	**B-8.05 Cuts material using ironworkers**	**B-8.06 Cuts material using computer numerically controlled (CNC) equipment**
	B-8.07 Drills holes	**B-8.08 Cuts threads**	**B-8.09 Prepares joints**
Task B-9 **Forms materials** **28%**	**B-9.01 Forms materials using plate rollers**	**B-9.02 Forms material using shape rollers**	**B-9.03 Forms material using conventional and computer numerically controlled (CNC) press brakes**
	B-9.04 Forms materials using benders	**B-9.05 Applies heat for forming**	

C – Assembles components

31%

Task C-10 **Fits and fastens sub-components and components** **48%**	**C-10.01 Assembles jigs**	**C-10.02 Determines sequence for assembly**	**C-10.03 Assembles sub-components and components**
	C-10.04 Sets fabricated components in place	**C-10.05 Joins components on-site**	
Task C-11 **Performs welding activities** **31%**	**C-11.01 Applies heat prior to tack welding**	**C-11.02 Performs tack welding**	**C-11.03 Minimizes welding distortions**
	C-11.04 Applies welding processes	**C-11.05 Corrects welding distortions**	
Task C-12 **Completes project** **21%**	**C-12.01 Identifies type of finish**	**C-12.02 Prepares material for finishing**	

Harmonization of Apprenticeship Training

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

1. Trade name

The official Red Seal name for this trade is Metal Fabricator (Fitter).

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for this trade is 3 (three).

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for this trade is 5400.

4. Sequencing Topics and Related Sub-tasks

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

Level 1	Level 2	Level 3
		Welding Activities
	Handles Materials	
Safety-Related Functions A-1.01 Maintains safe work environment A-1.02 Uses personal protective equipment (PPE) and safety equipment		
Tools and Equipment A-2.01 Uses hand, power, layout and measuring tools and equipment A-2.02 Uses stationary machinery A-2.03 Maintains cutting and welding equipment A-2.04 Uses access equipment	**Tools and Equipment** A-2.03 Maintains cutting and welding equipment	
Organizes Work A-3.01 Interprets plans, drawings and specifications	**Organizes Work** A-3.01 Interprets plans, drawings and specifications	**Organizes Work** A-3.01 Interprets plans, drawings and specifications A-3.02 Organizes project tasks

Level 1	Level 2	Level 3
Quality Assurance Throughout Fabrication and Assembly Process A-4.01 Performs visual inspections	**Quality Assurance Throughout Fabrication and Assembly Process** A-4.02 Verifies measurements, welds and layout A-4.03 Tracks material and parts for traceability	**Quality Assurance Throughout Fabrication and Assembly Process** A-4.02 Verifies measurements, welds and layout A-4.03 Tracks material and parts for traceability
Handles Materials A-5.02 Determines weights A-5.03 Applies rigging practices A-5.04 Operates material handling equipment		**Handles Materials** A-5.01 Organizes material
Communication Techniques A-6.01 Uses communication techniques		**Mentoring Techniques** A-6.02 Uses mentoring techniques
Layout B-7.01 Performs pattern development B-7.02 Calculates material allowances for various processes B-7.03 Determines dimensions	**Layout** B-7.01 Performs pattern development B-7.02 Calculates material allowances for various processes B-7.03 Determines dimensions B-7.04 Transfers dimensions B-7.05 Makes templates	**Layout** B-7.01 Performs pattern development B-7.02 Calculates material allowances for various processes B-7.03 Determines dimensions B-7.04 Transfers dimensions B-7.05 Makes templates
Materials Cutting B-8.01 Cuts material using plasma cutting equipment B-8.02 Cuts material using oxy-fuel cutting equipment B-8.03 Cuts material using shears B-8.04 Cuts material using saws B-8.05 Cuts material using ironworkers B-8.06 Cuts material using computer numerically controlled (CNC) equipment B-8.07 Drills holes B-8.08 Cuts threads B-8.09 Prepares joints	**Materials Cutting** B-8.01 Cuts material using plasma cutting equipment B-8.02 Cuts material using oxy-fuel cutting equipment B-8.03 Cuts material using shears B-8.04 Cuts material using saws B-8.05 Cuts material using ironworkers B-8.07 Drills holes B-8.08 Cuts threads B-8.09 Prepares joints	**Materials Cutting** B-8.01 Cuts material using plasma cutting equipment B-8.02 Cuts material using oxy-fuel cutting equipment B-8.03 Cuts material using shears B-8.04 Cuts material using saws B-8.05 Cuts material using ironworkers B-8.06 Cuts material using computer numerically controlled (CNC) equipment B-8.07 Drills holes B-8.08 Cuts threads B-8.09 Prepares joints
Forms Material B-9.05 Applies heat for forming	**Forms Material** B-9.01 Forms materials using plate rollers B-9.02 Forms material using shape rollers B-9.03 Forms material using conventional and computer numerically controlled (CNC) press brakes B-9.04 Forms materials using benders B-9.05 Applies heat for forming	**Forms Material** B-9.01 Forms materials using plate rollers B-9.02 Forms material using shape rollers B-9.03 Forms material using conventional and computer numerically controlled (CNC) press brakes B-9.04 Forms materials using benders
Sub-components and components C-10.01 Assembles jigs C-10.02 Determines sequence for assembly C-10.03 Assembles sub-components and components C-10.04 Sets fabricated components in place C-10.05 Joins components on-site	**Sub-components and components** C-10.02 Determines sequence for assembly C-10.03 Assembles sub-components and components C-10.04 Sets fabricated components in place C-10.05 Joins components on-site	**Sub-components and components** C-10.02 Determines sequence for assembly C-10.03 Assembles sub-components and components C-10.04 Sets fabricated components in place C-10.05 Joins components on-site

Level 1	Level 2	Level 3
Welding Activities C-11.01 Applies heat prior to tack welding C-11.02 Performs tack welding C-11.03 Minimizes welding distortions	**Welding Activities** C-11.01 Applies heat prior to tack welding C-11.03 Minimizes welding distortions C-11.04 Applies welding processes C-11.05 Corrects welding distortions	**Project Completion** C-12.01 Identifies type of finish C-12.02 Prepares material for finishing

Major Work Activity A

Performs common occupational skills

Task A-1 Performs safety-related functions

Task Descriptor

Metal fabricators (fitters) encounter many hazards in their work environment. These hazards are controlled by administrative and engineering controls, training, the use of personal protective equipment (PPE) and safety equipment, and maintaining a safe work environment.

A-1.01 Maintains safe work environment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-1.01.01P	identify potential injury and property damage from ***hazards***	potential injury and property damage from ***hazards*** are identified
A-1.01.02P	report ***hazards***	***hazards*** are reported according to company policies and procedures, and Occupational Health and Safety (OH&S) requirements
A-1.01.03P	attend site orientation and safety training	site orientation and safety training are attended according to company policies and procedures
A-1.01.04P	handle and store ***hazardous materials*** in designated areas	***hazardous materials*** are handled and stored in designated areas according to company policies and procedures, Workplace Hazardous Materials Information System (WHMIS) and Safety Data Sheets (SDS)
A-1.01.05P	install temporary ***safety protection***	temporary ***safety protection*** is installed according to site conditions
A-1.01.06P	perform ***housekeeping*** tasks	***housekeeping*** tasks are performed according to company policies and procedures, environmental conditions, and ***workplace safety and health regulations*** to prevent tripping hazards, falling objects, slips or falls

A-1.01.07P	ensure clear line of path when moving material	clear line of path is ensured when moving material
A-1.01.08P	identify and remove damaged tools and equipment from service	damaged tools and equipment are identified and removed from service according to company policies and procedures, and manufacturers' specifications
A-1.01.09P	ensure stationary machines' range of motion is unobstructed	stationary machines' range of motion is unobstructed
A-1.01.10P	ensure guards and shielding are in place	guards and shielding are in place according to manufacturers' specifications
A-1.01.11P	locate on-site ***safety locations***	on-site ***safety locations*** are located
A-1.01.12P	tag-out and lock-out defective equipment	defective equipment is tagged out and locked out according to jurisdictional regulations, manufacturers' specifications, and company policies and procedures

Range of Variables

hazards include: heights, confined spaces, moving machinery, overhead wires, toxic fumes, hazardous substances, crushing hazards, pinch points

hazardous materials include: acids, compressed gases, chemicals, paints, fuels

safety protection includes: barriers, lock-outs, engineering and administrative controls

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

workplace safety and health regulations include: WHMIS, jurisdictional OH&S

safety locations include: first aid stations, eye wash stations, muster points (assembly area), location of fire extinguishers

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-1.01.01L	demonstrate knowledge of maintaining safe work environments	identify terminology associated with safe work environments
		identify ***hazards*** and describe safe work practices
		describe company safety policies and procedures associated with maintaining safe work environments
		describe workers' rights and responsibilities associated with maintaining safe work environments
		identify emergency shut down devices
		describe ***housekeeping*** tasks performed to maintain safe work environments
		describe tag-out and lock-out procedures
		describe emergency procedures and evacuation plans

		identify ***safety protection*** used to maintain safe work environments, and describe their procedures for use
		describe procedures used to handle, store, transport and dispose of ***hazardous materials***
		describe ergonomically correct procedures to lift and move materials
A-1.01.02L	demonstrate knowledge of regulatory requirements pertaining to safety	identify and interpret ***workplace safety and health regulations***
A-1.01.03L	demonstrate knowledge of ***training requirements*** for specific PPE, safety equipment and safety procedures	describe ***training requirements*** for specific PPE, safety equipment and safety procedures

Range of Variables

hazards include: heights, confined spaces, moving machinery, overhead wires, toxic fumes, hazardous substances, crushing hazards, pinch points
housekeeping includes: sweeping, removing debris, storing materials and tools and equipment
safety protection includes: barriers, lock-outs, engineering and administrative controls
hazardous materials include: acids, compressed gases, chemicals, paints, fuels
workplace safety and health regulations include: WHMIS, jurisdictional OH&S
training requirements include: first aid, confined space, fall arrest, site orientation

A-1.02 Uses personal protective equipment (PPE) and safety equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-1.02.01P	select and use PPE and safety equipment	PPE and safety equipment are selected and used according to hazard, company policies and procedures, and manufacturers' specifications
A-1.02.02P	store and maintain PPE and safety equipment	PPE and safety equipment are stored and maintained according to manufacturers' specifications
A-1.02.03P	identify and remove from service unsafe, worn, damaged, expired and defective PPE and safety equipment	unsafe, worn, damaged, expired and defective PPE and safety equipment are identified and removed from service according to manufacturers' specifications
A-1.02.04P	adjust PPE	PPE is adjusted to ensure proper fit according to safety standards

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-1.02.01L	demonstrate knowledge of PPE and safety equipment	identify terminology associated with PPE and safety equipment
		describe workers' rights and responsibilities associated with PPE and safety equipment
		identify types of PPE and safety equipment, and describe their characteristics, applications, limitations and operation
A-1.02.02L	demonstrate knowledge of procedures to use PPE and safety equipment	identify PPE and safety equipment, and describe their procedures for use
A-1.02.03L	demonstrate knowledge of ***training requirements*** for specific PPE, safety equipment and safety procedures	describe ***training requirements*** for specific PPE, safety equipment and safety procedures

Range of Variables

training requirements include: first aid, confined space, fall arrest, site orientation

Task A-2 Uses and maintains tools and equipment

Task Descriptor

Metal fabricators (fitters) must use and maintain tools and equipment in order to safely and effectively perform the duties of their trade.

A-2.01 Uses hand, power, layout and measuring tools and equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.01.01P	identify safe work procedures prior to using hand tools and equipment	safe work procedures for hand tools and equipment are identified
A-2.01.02P	sharpen ***striking tools*** and remove mushroomed heads from tools	***striking tools*** are sharpened and mushroomed heads are removed from tools
A-2.01.03P	identify and sharpen dull and damaged cutting edges on drill bits	dull and damaged cutting edges on drill bits are identified and sharpened

A-2.01.04P	place and store tools, equipment and consumables in designated area	tools, equipment and consumables are placed and stored in designated area to minimize risk of damage or loss
A-2.01.05P	identify worn, damaged and defective tools and equipment and take corrective action	worn, damaged and defective tools and equipment are identified and corrective action is taken
A-2.01.06P	check and top up fluids in hydraulic tools	fluids in hydraulic tools are checked and topped up
A-2.01.07P	lubricate pneumatic tools and ensure air supply is dry and clean	pneumatic tools are lubricated and air supply is dry and clean
A-2.01.08P	clean tools and equipment after use	tools and equipment are cleaned after use according to manufacturers' recommendations
A-2.01.09P	check cords and switches on electric tools for damage	cords and switches on electric tools are checked for damage
A-2.01.10P	check accuracy and calibrate layout and measuring tools	layout and measuring tools are checked for accuracy and calibrated

Range of Variables

striking tools include: chipping hammers, chisels, center punches

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.01.01L	demonstrate knowledge of hand, power, layout and measuring tools and equipment, their characteristics, applications, limitations, maintenance and operation	identify terminology associated with hand, power, layout and measuring tools and equipment
		identify types of hand, power, layout and measuring tools and equipment and describe their characteristics, applications, limitations, maintenance and operation
		describe rpm rating of power tools and attachments
		describe storage requirements and uses for ***consumables***
		identify hazards and safe work practices when operating and maintaining hand, power, layout and measuring tools and equipment

Range of Variables

consumables include: abrasive cutting discs, grinding discs

A-2.02 Uses stationary machinery

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.02.01P	identify safe work procedures prior to using stationary machinery	safe work procedures for stationary equipment are identified
A-2.02.02P	remove ***debris***	***debris*** is removed to keep work surface functional and safe
A-2.02.03P	lubricate stationary machinery	stationary machinery is lubricated to ensure smooth operation and function
A-2.02.04P	check and top up coolant reservoir on drill presses and saws	coolant reservoir on drill presses and saws is checked and topped up
A-2.02.05P	inspect cutting dies and blades for ***damages***	cutting dies and blades are inspected for ***damages*** to ensure safe operation and quality product
A-2.02.06P	inspect forming dies for damage and debris	forming dies are inspected for damage and debris
A-2.02.07P	identify worn, damaged and defective parts in stationary machinery and take ***corrective action***	worn, damaged and defective parts in stationary machinery are identified and ***corrective action*** is taken
A-2.02.08P	tag out and lock out defective stationary machinery prior to maintenance	defective stationary machinery is tagged out and locked out prior to maintenance
A-2.02.09P	ensure stationary machinery's range of motion is unobstructed	stationary machinery's range of motion is unobstructed
A-2.02.10P	adjust tool rests on pedestal grinders and other rotating equipment	tool rests on pedestal grinders and other rotating equipment are adjusted to ensure safe operation
A-2.02.11P	ensure guards and shielding are in place	guards and shielding are in place according to manufacturers' specifications
A-2.02.12P	inspect and replace filters in stationary machinery	filters in stationary machinery are inspected and replaced according to jurisdictional requirements

Range of Variables

debris includes: steel shavings, off-cuts
damages include: chips, nicks, missing teeth
corrective action includes: replacement, reconditioning

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.02.01L	demonstrate knowledge of stationary machinery, their components, characteristics, applications, limitations, maintenance and operation	identify terminology associated with stationary machinery and their components
		identify types of stationary machinery and their components, and describe their characteristics, applications, limitations, maintenance and operation
		identify location of lubrication points
		identify ***types of lubricants***
		identify types of coolants
		identify hazards and safe work practices when operating and maintaining stationary machinery and their components

Range of Variables

types of lubricants include: grease, gear oil

A-2.03 Maintains cutting and welding equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.03.01P	identify safe work procedures prior to using cutting and welding equipment	safe work procedures for cutting and welding equipment are identified
A-2.03.02P	identify, and repair or replace damaged gas lines	damaged gas lines are identified, and repaired or replaced
A-2.03.03P	identify ***problems*** with equipment	***problems*** with equipment are identified
A-2.03.04P	clean and store equipment	equipment is cleaned and stored according to manufacturers' recommendations
A-2.03.05P	clean or replace ***consumables***	***consumables*** are cleaned or replaced
A-2.03.06P	identify worn, damaged and defective equipment and take ***corrective action***	worn, damaged and defective equipment is identified and ***corrective action*** is taken

A-2.03.07P	clean or replace damaged ***lenses*** in equipment	damaged ***lenses*** in equipment are cleaned or replaced
A-2.03.08P	identify ***hazards*** and tag out and lock out equipment	***hazards*** are identified and equipment is tagged out and locked out

Range of Variables

problems include: inconsistent operation, poor quality of cut and welds
consumables include: tips, diffusers, electrodes, nozzles
corrective action includes: replacement, reconditioning
lenses include: welding helmets, cutting shields
hazards include: fire watch, air quality, combustibles, ultraviolet protection

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.03.01L	demonstrate knowledge of cutting and welding equipment, their ***components***, characteristics, applications, limitations and maintenance	identify terminology associated with cutting and welding equipment and their ***components***
		identify types of cutting and welding equipment and their ***components***, and describe their characteristics, applications, limitations and maintenance
		identify possible ***problems*** with cutting and welding equipment
		identify ***hazards*** and safe work practices when maintaining cutting and welding equipment

Range of Variables

components include: regulators, tips, hoses
problems include: inconsistent operation, poor quality of cut and welds
hazards include: fire watch, air quality, combustibles, ultraviolet protection

A-2.04 Uses access equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-2.04.01P	select and use access equipment	access equipment is selected and used according to job requirements, manufacturers' specifications, and jurisdictional and OH&S requirements
A-2.04.02P	verify scaffolding and footing of ladders is secure, level and stable	scaffolding and footing of ladders are secure, level and stable
A-2.04.03P	inspect access equipment for operation and compliance	access equipment is inspected for operation and compliance
A-2.04.04P	identify unsafe, worn, damaged and defective access equipment and take ***corrective action***	unsafe, worn, damaged and defective access equipment is identified and ***corrective action*** is taken
A-2.04.05P	plan travel route and account for operational range of mobile access equipment	travel route is planned and operational range of mobile access equipment is accounted for
A-2.04.06P	cordon off work area	work area is cordoned off
A-2.04.07P	perform ***routine maintenance***	***routine maintenance*** is performed
A-2.04.08P	secure and store access equipment in designated area	access equipment is secured and stored in designated area according to company policies and procedures

Range of Variables

corrective action includes: replacement, reconditioning
routine maintenance includes: fluid top-ups, re-fuelling

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-2.04.01L	demonstrate knowledge of access equipment, characteristics, applications, limitations, operation and maintenance	identify terminology associated with access equipment
		identify types of access equipment, and describe their characteristics, applications, limitations, operation and maintenance
		identify hazards and safe work practices when operating and maintaining access equipment

Task A-3 Organizes work

Task Descriptor

In order to organize their work, metal fabricators (fitters) must be able to use documents and drawings, recognize hazards at the work site and plan their project tasks.

A-3.01 Interprets plans, drawings and specifications

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-3.01.01P	identify piece marks	piece marks are identified by referring to bill
A-3.01.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to ***job requirements*** and manufacturers' recommendations
A-3.01.03P	review ***drawing*** and identify discrepancies or lack of information	***drawing*** is reviewed for discrepancies or lack of information
A-3.01.04P	interpret ***types of lines***	***types of lines*** are interpreted
A-3.01.05P	interpret ***welding symbols*** and general notes	***welding symbols*** and general notes are interpreted
A-3.01.06P	visualize ***drawing*** in three dimensions	***drawing*** is visualized in three dimensions to plan steps of build and understand scope of work
A-3.01.07P	generate cut lists and part lists	cut lists and part lists are generated
A-3.01.08P	convert between imperial and metric measurements	imperial and metric measurements are converted
A-3.01.09P	locate section and detail views	section and detail views are located

Range of Variables

tools and equipment include: calculators, computers, drafting equipment
job requirements include: work space, materials, supplies
drawings include: detail, shop, fabrication, CAD
types of lines include: broken, hidden, centre, section, object, extension, dimension, cutting plane
welding symbols include: reference line, arrow side/other side, reading sequence, joint profile

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-3.01.01L	demonstrate knowledge of plans, ***drawings*** and ***specifications***, their characteristics, applications and limitations	identify terminology associated with plans, ***drawings*** and ***specifications***
		identify types of plans, ***drawings*** and ***specifications***, and describe their characteristics, applications and limitations
		identify ***types of lines*** and describe their characteristics, applications and limitations
		describe ***principles of orthographic and isometric projection***
A-3.01.02L	demonstrate knowledge of interpreting plans, ***drawings*** and ***specifications***	interpret plans, ***drawings*** and ***specifications***
		identify piece marks, and describe their characteristics, applications and limitations
		describe company method of assigning piece marks
		describe procedures to convert between imperial and metric systems

Range of Variables

drawings include: detail, shop, fabrication, CAD
specifications include: tolerances, material types
types of lines include: broken, hidden, centre, section, object, extension, dimension, cutting plane
principles of orthographic and isometric projection include: views, projection method, auxiliary, section

A-3.02 Organizes project tasks

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-3.02.01P	determine required equipment, material and personnel to complete job	required equipment, material and personnel to complete job are determined
A-3.02.02P	determine fabrication sequence	fabrication sequence is determined according to availability of resources

A-3.02.03P	schedule jobs and tasks	jobs and tasks are scheduled according to availability of resources, shop space, and access to site
A-3.02.04P	determine safety requirements	safety requirements are determined
A-3.02.05P	coordinate tasks with coworkers and other trades	tasks with coworkers and other trades are coordinated
A-3.02.06P	set up work area	work area is set up according to ***job requirements***
A-3.02.07P	manage changing conditions	changing conditions are managed

Range of Variables

job requirements include: materials, supplies, site orientation

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-3.02.01L	demonstrate knowledge of organizing project tasks	describe procedures to organize project tasks
		describe procedures to determine time required to complete project tasks
		describe possible ***finished project restrictions***

Range of Variables

finished project restrictions include: ability to remove project from fabrication shop, crane limitations, transportation considerations

Task A-4 Performs quality assurance throughout fabrication and assembly process

Task Descriptor

Metal fabricators (fitters) inspect, document, track materials for traceability and verify critical measurements to ensure quality. Quality assurance is important in this trade in order to produce products within tolerances, save time and money, ensure the protection of others' property and avoid liability issues.

A-4.01 Performs visual inspections

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-4.01.01P	verify minimum quality requirements	minimum quality requirements are verified based on project specifications
A-4.01.02P	check ***ferrous and non-ferrous materials*** for deformities and dimensional inaccuracy	***ferrous and non-ferrous materials*** are checked for deformities and dimensional inaccuracy
A-4.01.03P	check ***ferrous and non-ferrous material*** for ***shipping damages***	***ferrous and non-ferrous material*** is checked for ***shipping damages***
A-4.01.04P	check completed assembly for ***factors***	completed assembly is checked for ***factors***
A-4.01.05P	check completed assembly for ***obvious omissions***	completed assembly is checked for ***obvious omissions***
A-4.01.06P	check completed assembly for ***surface imperfections***	completed assembly is checked for ***surface imperfections***
A-4.01.07P	check completed assembly for ***weld defects***	completed assembly is checked for ***weld defects***
A-4.01.08P	identify ***fabrication defects*** and implement corrective measures	***fabrication defects*** are identified and corrective measures are implemented

Range of Variables

ferrous and non-ferrous materials include: carbon steel, stainless steel, aluminium
shipping damages include: twists, deformities, scratches
factors include: piece count, approximate dimensions, relevant codes
obvious omissions include: missed welds and parts
surface imperfections include: welding spatter, gouges, sharp edges
weld defects include: porosity, undercut, crater cracks, weld size, location
fabrication defects include: distortion, improper fit-up, improper piece alignment

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-4.01.01L	demonstrate knowledge of performing visual inspections	describe procedures to perform visual inspections
		identify types of ***factors***, ***obvious omissions***, ***surface imperfections***, ***weld defects*** and ***fabrication defects*** found on completed assemblies during visual inspections
		identify types of ***ferrous and non-ferrous materials*** and describe their characteristics, applications, limitations and operation

Range of Variables

factors include: piece count, approximate dimensions, relevant codes
obvious omissions include: missed welds and parts
surface imperfections include: welding spatter, gouges, sharp edges
weld defects include: porosity, undercut, crater cracks, weld size, location
fabrication defects include: distortion, improper fit-up, improper piece alignment
ferrous and non-ferrous materials include: carbon steel, stainless steel, aluminium

A-4.02 Verifies measurements, welds and layout

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-4.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to job requirement and manufacturers' specifications
A-4.02.02P	verify required tolerances	required tolerances are verified

A-4.02.03P	check dimensions of goods received against bill of lading	dimensions of goods received are checked against bill of lading
A-4.02.04P	check raw material size, length and thickness	size, length and thickness of raw material is checked
A-4.02.05P	check ***dimensions*** of ***components and sub-components***	***dimensions*** of ***components and sub-components*** are checked
A-4.02.06P	check dimensions of hole patterns	dimensions of hole patterns are checked
A-4.02.07P	check dimensional accuracy of ***fabricated assemblies***	dimensional accuracy of ***fabricated assemblies*** is checked using triangulation and other methods
A-4.02.08P	check weld size and location	weld size and location are checked
A-4.02.09P	confirm layout and fit-up	layout and fit-up are confirmed using jigs and templates

Range of Variables

tools and equipment include: measuring tapes, lasers, fillet gauges, levels, squares, protractors, dividers

dimensions include: angles, orientation, slopes

components and sub-components include: stiffeners, gussets, clips

fabricated assemblies include: jigs, square frames, trusses, stairs

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-4.02.01L	demonstrate knowledge of verifying measurements, welds and layouts	describe procedures used to verify measurements, welds and layouts
		identify types of ***tools and equipment*** used to verify measurements, welds and layouts and describe their characteristics, applications, limitations and operation
		identify ***types of measurements*** to be verified
		identify ***causes of changes in dimensions***
		identify ***types of references***
		identify ***conditions to check for***

Range of Variables

tools and equipment include: measuring tapes, lasers, fillet gauges, levels, squares, protractors, dividers

types of measurements include: raw material, on-going dimensional checks, final product measurements

causes of changes in dimensions include: heating, cooling

types of references include: tangent lines, centre lines, work points, working bevels

conditions to check for include: changes in dimensions, distortion, squareness, discolouration

A-4.03 Tracks materials and parts for traceability

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-4.03.01P	obtain and record part and job number from drawings	part and job number are obtained and recorded from drawings
A-4.03.02P	keep mill certification for future reference	mill certification is kept for future reference
A-4.03.03P	transfer ***information*** from parent piece to cut-off and crop pieces	***information*** is transferred from parent piece to cut-off and crop pieces
A-4.03.04P	select and use ***marking devices***	***marking devices*** are used according to ***finishing requirements***
A-4.03.05P	verify and complete ***documentation***	***documentation*** is verified and completed according to company policies

Range of Variables

information includes: heat numbers, size of material
marking devices includes: roller pens, crayon markers, stamps, tags, barcodes
finishing requirements include: painting, galvanizing
documentation includes: weld maps, welder's identification, welder qualification, quality assurance records, mill certifications, heat numbers, as-built drawings

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-4.03.01L	demonstrate knowledge of tracking materials and parts for traceability	describe procedures to track materials and parts for traceability
		identify types of ***marking devices*** used to track materials and parts, and describe their characteristics, applications, limitations and operation
		describe importance and ***reasons for marking material and parts***
		describe importance of keeping ***documentation*** up to date

Range of Variables

marking devices includes: roller pens, crayon markers, stamps, tags, barcodes
reasons for marking material and parts include: traceability, identification for fabrication and erection
documentation includes: weld maps, welder's identification, welder qualification, quality assurance records, mill certifications, heat numbers, as-built drawings

Task A-5 Handles materials

Task Descriptor

Metal fabricators (fitters) need to identify the material required and determine weight, shape and size before it is transferred. They transfer the loads using rigging, hoisting and lifting equipment, and other material handling equipment such as forklifts, conveyor rollers, dollies and carts.
Lifts are planned to ensure that the proper rigging practices and safety factors are taken into account. Rigging equipment is used so that loads can be hoisted in a safe and secure manner.

A-5.01 Organizes material

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-5.01.01P	identify and select ***material***	***material*** is identified and selected according to ***documents***
A-5.01.02P	identify and select ***profile***	***profile*** is identified and selected according to job requirement
A-5.01.03P	determine quantities required	quantities required are determined according to job requirement
A-5.01.04P	check availability of ***material*** and notify responsible individual of out of stock situations	availability of ***material*** is checked and responsible individual is notified of out of stock situations
A-5.01.05P	locate and verify ***components and sub-assemblies***	***components and sub-assemblies*** are located and verified
A-5.01.06P	group ***material***	***material*** is grouped according to ***factors***
A-5.01.07P	sequence ***materials***	***materials*** are sequenced according to job priority
A-5.01.08P	store and protect ***vulnerable materials***	***vulnerable materials*** are stored and protected

Range of Variables

materials include: stainless steel, aluminium, copper, mild steel, alloy steel
documents include: drawings, reference manuals, suppliers' catalogues
profiles include: beams, piping, tubing, channel, flat stocks, angle iron
components and sub-assemblies include: cut-to-size pieces, flanges, elbows, pre-cut parts, pre-fabricated and welded
factors include: alloys, profiles, sizes, weights, grades
vulnerable materials include: stainless steel, aluminium

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-5.01.01L	demonstrate knowledge of organizing ***materials***	describe procedures used to organize ***materials***
		identify types of ***materials***, ***components and sub-assemblies***, and describe their characteristics, applications and limitations
		determine suitable storage for dissimilar products and ***vulnerable materials***

Range of Variables

materials include: stainless steel, aluminium, copper, mild steel, alloy steel
components and sub-assemblies include: cut-to-size pieces, flanges, elbows, pre-cut parts, pre-fabricated and welded
vulnerable materials include: stainless steel, aluminium

A-5.02 Determines weights

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-5.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to job requirement and manufacturers' specifications
A-5.02.02P	consult ***documents*** for weight	***documents*** are consulted for weight
A-5.02.03P	identify types of ***material*** to determine weight	types of ***material*** is identified to determine weight
A-5.02.04P	calculate volume and weight	volume and weight are calculated

Range of Variables

tools and equipment include: gauges (sheet, plate), load indicators, calipers, measuring tapes
documents include: drawings, reference manuals, suppliers' catalogues
materials include: stainless steel, aluminium, copper, mild steel, alloy steel

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-5.02.01L	demonstrate knowledge of determining weight of ***materials***	describe procedures to determine weight of ***materials***
		identify types of ***tools and equipment*** used to determine weight of ***materials***, and describe their characteristics, applications, limitations and operation
		identify types of ***documents*** used to identify weight of ***materials***
		calculate volume and weight of ***materials***
		describe procedures used to convert between imperial and metric systems

Range of Variables

materials include: stainless steel, aluminium, copper, mild steel, alloy steel
tools and equipment include: gauges (sheet, plate), load indicators, calipers, measuring tapes
documents include: drawings, reference manuals, suppliers' catalogues

A-5.03 Applies rigging practices

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-5.03.01P	select and use ***rigging equipment and components***	***rigging equipment and components*** are selected and used according to ***requirements***
A-5.03.02P	identify worn, damaged and defective ***rigging equipment and components*** and take ***corrective action***	worn, damaged and defective ***rigging equipment and components*** are identified and ***corrective action*** is taken
A-5.03.03P	visualize lifting operation and identify ***potential issues***	lifting operation is visualized to determine lifting points, travel path and ***potential issues*** are identified
A-5.03.04P	select lay down area and prepare blocking to suit load	lay down area is selected and blocking is prepared to suit load

A-5.03.05P	determine centre of gravity	centre of gravity is determined to balance load
A-5.03.06P	interpret load chart	load chart is interpreted
A-5.03.07P	attach rigging to predetermined lifting points	rigging is attached to predetermined lifting points
A-5.03.08P	perform test lift and make adjustments	test lift is performed to confirm load stability, lifting points and rigging and adjustments are made
A-5.03.09P	maintain control of lift	control of lift is maintained using tag lines
A-5.03.10P	develop critical lift plan	critical lift plan is developed

Range of Variables

rigging equipment and components include: slings, chains, chokers, softeners, plate clamps, wire ropes, tag lines, chainfalls, come-a-longs

requirements include: weight, manoeuvrability, space

corrective action includes: replacement, reconditioning

potential issues include: weak points, potential hazards in load, shock loading

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-5.03.01L	demonstrate knowledge of ***rigging equipment and components***, their characteristics, applications, limitations and operation	define terminology associated with ***rigging equipment and components***
		identify types of ***rigging equipment and components***, and describe their characteristics, applications, limitations and operation
A-5.03.02L	demonstrate knowledge of applying rigging practices and procedures	describe practices and procedures used to rig materials
		describe lifting capacity and load ratings
		identify types of ***rigging methods*** and describe their characteristics, applications, limitations and operation
		identify safe lifting angles, and describe their characteristics, applications, limitations and operation
		explain how to determine centre of gravity of load
		describe proper loading and unloading procedures
		describe ***potential issues*** encountered during lift
		calculate working load limits (WLL) for rigging

		describe ***communications*** required for safe lift
A-5.03.03L	demonstrate knowledge of regulatory and certification requirements pertaining to rigging and use of ***rigging equipment and components***	identify and interpret jurisdictional regulations, standards and certification requirements pertaining to rigging and use of ***rigging equipment and components***

Range of Variables

rigging equipment and components include: slings, chains, chokers, softeners, plate clamps, wire ropes, tag lines, chainfalls, come-a-longs

rigging methods include: knots, chokers, basket hitches

potential issues include: weak points, potential hazards in load, shock loading

communications include: hand signals, radio communications

A-5.04 Operates material handling equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-5.04.01P	inspect and confirm safe operation of ***material handling equipment***	***material handling equipment*** is inspected and safe operation is confirmed
A-5.04.02P	interpret load chart	load chart is interpreted
A-5.04.03P	adjust ***material handling equipment*** and secure load	***material handling equipment*** is adjusted and load is secured
A-5.04.04P	plan lift and path of travel and confirm laydown area	lift and path of travel are planned to minimize lift time and hazards, and laydown area is confirmed
A-5.04.05P	select and use ***material handling equipment***	***material handling equipment*** is selected and used according to job requirement and availability
A-5.04.06P	monitor load during transfer	load is monitored during transfer
A-5.04.07P	ensure hoisted load does not travel over personnel	hoisted load does not travel over personnel
A-5.04.08P	place load in pre-selected area	load is placed in pre-selected area according to orientation required

Range of Variables

material handling equipment includes: forklifts, telehandlers, chain falls, come-a-longs, carts, conveyor rollers, cranes (shop, jib, overhead, gantry), hand truck

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-5.04.01L	demonstrate knowledge of ***material handling equipment***, their characteristics, applications and limitations	define terminology associated with ***material handling equipment***
		identify types of ***material handling equipment***, and describe their characteristics, applications and limitations
A-5.04.02L	demonstrate knowledge of operating ***material handling equipment***	describe procedures to operate ***material handling equipment***
		describe ***laydown area requirements*** for receiving materials
		describe WLL characteristics and applications
		describe refuelling procedures
		identify lifting device capacity
		describe characteristics and applications of log books for ***material handling equipment***
		identify hand signals, and describe their applications
		identify emergency stop devices, and describe their characteristics and applications
A-5.04.03L	demonstrate knowledge of regulatory and certification requirements for ***material handling equipment***	identify and interpret certification and regulatory requirements pertaining to operation of ***material handling equipment***

Range of Variables

material handling equipment includes: forklifts, telehandlers, chain falls, come-a-longs, carts, conveyor rollers, cranes (shop, jib, overhead, gantry), hand truck

laydown area requirements include: space availability, level and dry surface, dunnage, workflow coordination, equipment lanes

Task A-6 Uses communication and mentoring techniques

Task Descriptor

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

A-6.01 Uses communication techniques

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-6.01.01P	demonstrate communication practices with individuals or in a group	instructions and messages are interpreted by all parties involved in communication
A-6.01.02P	listen using ***active listening*** practices	***active listening*** practices are utilized
A-6.01.03P	speak clearly using correct industry terminology to ensure understanding	understanding of message is confirmed by both parties
A-6.01.04P	receive and respond to instructions	response to instructions indicates understanding
A-6.01.05P	receive and respond to feedback on work completed or performed	response to feedback indicates understanding and corrective measures are taken
A-6.01.06P	explain and provide feedback	explanation and feedback is provided and task is carried out as directed
A-6.01.07P	use questions to improve communication	questions enhance understanding, on-the-job training and goal setting
A-6.01.08P	participate in safety and information meetings	meetings are attended, information is relayed to workforce, and is applied
A-6.01.09P	send and receive ***electronic messages***	***electronic messages*** are sent and received using professionalism, plain language and clear expressions according to company policies and procedures

Range of Variables

active listening includes: hearing, interpreting, reflecting, responding, paraphrasing
electronic messages include: email, text messages, virtual meeting platforms

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-6.01.01L	demonstrate knowledge of trade terminology	define terminology used in trade
A-6.01.02L	demonstrate knowledge of effective communication practices	describe importance of using effective verbal and non-verbal communication with ***people in the workplace***
		identify ***sources of information*** to effectively communicate
		identify communication and ***learning styles***
		describe effective listening and speaking skills
		describe how to receive and give instructions effectively
		identify ***personal responsibilities and attitudes*** that contribute to on-the-job success
		identify value of equity, diversity and inclusion in workplace
		identify communication that constitutes bullying, ***harassment*** and ***discrimination***
		identify communication styles appropriate to different systems and applications of ***electronic messages***

Range of Variables

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

sources of information include: jurisdictional regulations and requirements, codes, occupational health and safety requirements, prints, drawings, specifications, company and client documentation

learning styles include: seeing it, hearing it, trying it

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

harassment as defined by the Canadian and jurisdictional Human Rights Commissions

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

electronic messages include: email, text messages, virtual meeting platforms

A-6.02 Uses mentoring techniques

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
A-6.02.01P	identify and communicate learning objective and point of lesson	apprentice or learner can explain objective and point of lesson
A-6.02.02P	link lesson to other lessons and project	lesson order and unplanned learning opportunities are defined
A-6.02.03P	demonstrates performance of a skill to an apprentice or learner	***steps required to demonstrate a skill*** are performed
A-6.02.04P	set up conditions required for apprentice or learner to practice a skill	***practice conditions*** are set up so that skill can be practiced safely by apprentice or learner
A-6.02.05P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice or learner improves with practice to a point where skill can be done with little supervision
A-6.02.06P	give supportive and corrective feedback	apprentice or learner adopts best practice after having been given supportive or corrective feedback
A-6.02.07P	support apprentices or learners in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-6.02.08P	support anti-***harassment*** and anti-***discrimination*** practices in workplace	workplace is ***harassment***- and ***discrimination***-free
A-6.02.09P	assess apprentice or learner suitability to trade during probationary period	apprentice or learner is given constructive feedback that helps them identify their own strengths and weaknesses and suitability for trade

Range of Variables

steps required to demonstrate a skill include: understanding the who, what, where, when, why, and how, explaining, showing, giving encouragement, following up to ensure skill is performed correctly

practice conditions means: guided, limited independence, full independence

harassment as defined by the Canadian and jurisdictional Human Rights Commissions

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

	Knowledge	
	Learning Outcomes	**Learning Objectives**
A-6.02.01L	demonstrate knowledge of strategies for learning skills in workplace	describe importance of individual experience
		describe shared responsibilities for workplace learning
		determine one's own learning preferences and explain how these relate to learning new skills
		describe importance of different types of skills in workplace
		describe importance of ***essential skills*** in workplace
		identify different ***learning styles***
		identify different ***learning needs*** and strategies to meet them
		identify ***strategies to assist in learning a skill***
A-6.02.02L	demonstrate knowledge of strategies for ***teaching*** workplace ***skills***	identify different roles played by a workplace mentor
		describe ***teaching skills***
		explain importance of identifying point of a lesson
		identify how to choose a good time to present a lesson
		explain importance of linking lessons
		identify context for learning skills
		describe considerations in setting up opportunities for skill practice
		explain importance of providing feedback
		identify techniques for giving effective feedback
		describe a skills assessment
		identify methods of assessing progress
		explain how to adjust a lesson to different situations

Range of Variables

essential skills are: reading, document use, writing, oral communication, numeracy, thinking, working with others, digital technology, continuous learning

learning styles include: seeing it, hearing it, trying it

learning needs include: learning disabilities, learning preferences, language proficiency

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

teaching skills include: identifying the point of the lesson, linking the lesson, demonstrating the skill, providing practice, giving feedback, assessing skills and progress

Major Work Activity B
Fabricates components

Task B-7 Performs layout

Task Descriptor
Metal fabricators (fitters) lay out materials before any fabrication procedure such as cutting, drilling, bending and welding. It is important that the layout be done accurately to limit waste, and ensure proper fit and accuracy.

B-7.01 Performs pattern development

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-7.01.01P	generate pattern/template from detailed drawing	pattern/template is generated from detailed drawing
B-7.01.02P	visualize finished product in three dimensions	finished product is visualized in three dimensions
B-7.01.03P	visualize flat pattern required	flat pattern required is visualized to build finished product
B-7.01.04P	determine ***layout method***	***layout method*** is determined according to design requirements
B-7.01.05P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to job requirements
B-7.01.06P	establish working point and axis to determine starting point	working point and axis are established to determine starting point
B-7.01.07P	develop ***views required for fitting***	***views required for fitting*** are developed
B-7.01.08P	consider ***factors*** to maximize efficiency and quality	***factors*** to maximize efficiency and quality are considered

Range of Variables

layout methods include: radial line development, parallel line development, triangulation
tools and equipment include: squares, trammel points, compasses, measuring tapes, drafting equipment, CAD software
views required for fitting include: plan view, elevation view, section view, orientation view, 3-dimensional view
factors include: size, material usage, seam location

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-7.01.01L	demonstrate knowledge of performing pattern development	describe procedures to perform pattern development
		identify ***layout methods***, and describe their characteristics, applications and limitations
		identify ***tools and equipment*** used for pattern development and describe their characteristics, applications, limitations and operation
		describe characteristics and applications of CAD produced layouts
		identify shapes and patterns, and describe their characteristics and applications
		describe pattern development techniques
		describe ***factors*** considered for maximum efficiency and quality

Range of Variables

layout methods include: radial line development, parallel line development, triangulation
tools and equipment include: squares, trammel points, compasses, measuring tapes, drafting equipment, CAD software
factors include: size, material usage, seam location

B-7.02 Calculates material allowances for various processes

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-7.02.01P	determine total material required	total material required is determined by considering ***factors***
B-7.02.02P	perform mathematical calculations and use formulas	mathematical calculations are performed and formulas are used to determine ***requirements***
B-7.02.03P	determine bend radius	bend radius is determined according to ***factors***
B-7.02.04P	account for excess material	excess material is accounted for to allow for rolling to and flat spot removal

Range of Variables

factors (to determine total material) include: bend and weld allowances, kerf, job requirements
requirements include: stretch-out length, true length, angular measurements, bend deductions
factors (to determine bend radius) include: charts, reference materials, available equipment

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-7.02.01L	demonstrate knowledge of calculating material allowances for various processes	identify ***mathematics*** applicable to trade
		describe procedures used to convert between imperial and metric systems
		identify bending, rolling and cutting allowances, and describe their characteristics and applications

Range of Variables

mathematics include: conversions, fractions, geometric formulas, trigonometric functions

B-7.03 Determines dimensions

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-7.03.01P	extract required information from drawings to calculate material dimensions	required information from drawings is extracted to calculate material dimensions
B-7.03.02P	select and use appropriate mathematical formula	appropriate mathematical formula is selected and used
B-7.03.03P	perform ***geometric calculations*** to calculate material dimensions	***geometric calculations*** are performed to calculate material dimensions
B-7.03.04P	calculate arc measurements from angular dimensions to determine true length of arc	arc measurements are calculated from angular dimensions to determine true length of arc
B-7.03.05P	select and use ***layout and measuring tools***	***layout and measuring tools*** are selected and used

Range of Variables

geometric calculations include: Pythagorean theorem, diameter of circles, areas
layout and measuring tools include: protractors, stair gauges, dividers, levels (builder's, laser)

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-7.03.01L	demonstrate knowledge of determining dimensions	describe procedures to determine dimensions
		identify ***layout and measuring tools*** used for pattern development and describe their characteristics, applications, limitations and operation
		identify ***mathematics*** applicable to trade
		identify ***geometric calculations*** performed to calculate material dimensions
		describe procedures used to convert between imperial and metric systems

Range of Variables

layout and measuring tools include: protractors, stair gauges, dividers, levels (builder's, laser)
mathematics include: conversions, fractions, geometric formulas, trigonometric functions
geometric calculations include: Pythagorean theorem, diameter of circles, areas

B-7.04 Transfers dimensions

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-7.04.01P	establish ***work point*** and mark surfaces on components	***work point*** is established and surfaces on components are marked according to layout and drawings
B-7.04.02P	locate transferred marks	transferred marks are located using ***layout and measuring tools***
B-7.04.03P	locate ***work points*** to determine location and orientation of components	***work points*** are located to determine location and orientation of components according to drawings
B-7.04.04P	lay out incline and slope using rise and run, and angular dimensions	incline and slope are laid out using rise and run, and angular dimensions
B-7.04.05P	transfer top dead centre from one end of a cylinder to other end	top dead centre is transferred from one end of a cylinder to other end using ***tools***

Range of Variables

work points include: centre lines, quarter marks

layout and measuring tools include: bevel squares, measuring tapes, plumb bobs, soapstone, combination square

tools include: square, levels (builder's, laser), straight edge

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-7.04.01L	demonstrate knowledge of transferring dimensions	describe procedures to transfer dimensions
		identify ***layout and measuring tools*** used to transfer dimensions and describe their characteristics, applications, limitations and operation
		identify angular dimensions, running dimensions and incremental dimensions, and describe their characteristics and applications
		identify ***mathematics*** applicable to trade
		identify ***work points***, and describe their characteristics and applications

Range of Variables

layout and measuring tools include: bevel squares, measuring tapes, plumb bobs, soapstone, combination square
mathematics include: conversions, fractions, geometric formulas, trigonometric functions
work points include: centre lines, quarter marks

B-7.05 Makes templates

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-7.05.01P	develop ***templates***	***templates*** are developed using manual drafting techniques and CAD software
B-7.05.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to ***material*** used to construct templates
B-7.05.03P	mark ***template*** with ***information***	***template*** is marked with ***information***

Range of Variables

templates include: hole-punching, wrap-arounds, cutting, arc (sweeps)
tools and equipment include: scissors, tin snips, drafting equipment, CAD software
materials include: cardboard, metal, wood
information includes: part numbers, layout information material required for identification

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-7.05.01L	demonstrate knowledge of ***templates***, their characteristics, applications and limitations	identify types of ***templates***, and describe their characteristics, applications and limitations
		identify template ***materials***, and describe their characteristics, applications and limitations
		identify drawing specifications and describe their applications
		describe angular dimensions, running dimensions and incremental dimensions, and their characteristics, applications and limitations

B-7.05.02L	demonstrate knowledge of making ***templates***	describe procedures to make ***templates***
		identify ***tools and equipment*** used to make ***templates***, and describe their characteristics, applications and procedures for use

Range of Variables

templates include: hole-punching, wrap-arounds, cutting, arc (sweeps)
materials include: cardboard, metal, wood
tools and equipment include: scissors, tin snips, drafting equipment, CAD software

Task B-8 Cuts materials

Task Descriptor

Metal fabricators (fitters) cut materials according to the layouts and specifications. Accurate cuts are important to the final assembly. Journeypersons must master the use of several pieces of heavy duty and sophisticated cutting equipment to perform these tasks. Joint preparation is done in advance of the welding process. Safety practices are critical.

B-8.01 Cuts material using plasma cutting equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.01.01P	verify type and thickness of material that can be cut	type and thickness of material that can be cut is verified according to equipment capacity
B-8.01.02P	set up plasma cutting equipment	plasma cutting equipment is set up according to machine capacity and manufacturers' specifications
B-8.01.03P	operate plasma cutting equipment	plasma cutting equipment is operated according to manufacturers' specifications
B-8.01.04P	ensure straight or profiled edge	straight or profiled edge is ensured using ***methods***

Range of Variables

methods include: free-hand, guided cutting

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.01.01L	demonstrate knowledge of plasma cutting equipment, their characteristics, applications, limitations and operation	identify ***types of plasma cutting equipment***, and describe their characteristics, applications, limitations and operation
		identify pressure settings and describe their characteristics, applications and limitations
		identify hazards and safe work practices while using manual plasma cutting equipment
B-8.01.02L	demonstrate knowledge of cutting material using plasma cutting equipment	describe procedures to cut material using plasma cutting equipment
		describe cutting processes for different materials
		describe ***methods*** used to ensure straight or profiled edge

Range of Variables

types of plasma cutting equipment include: manual, automated
methods include: free-hand, guided cutting

B-8.02 Cuts material using oxy-fuel cutting equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.02.01P	verify type and thickness of material that can be cut	type and thickness of material that can be cut is verified according to equipment capacity
B-8.02.02P	set up and take down oxy-fuel cutting equipment	oxy-fuel cutting equipment is set up and taken down
B-8.02.03P	select and adjust gas pressure and tip sizes	gas pressure and tip sizes are selected and adjusted according to material thickness
B-8.02.04P	adjust flame to neutral	flame is adjusted to neutral

B-8.02.05P	ensure straight or profiled edge	straight or profiled edge is ensured using ***methods***
B-8.02.06P	minimize distortion of material	distortion of material is minimized by anticipating effects of longitudinal, angular and transverse distortion as a result of heat input

Range of Variables

methods include: free-hand, guided or automated cutting

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.02.01L	demonstrate knowledge of oxy-fuel cutting equipment, their components, consumables, characteristics, applications, limitations and operation	identify types of oxy-fuel cutting equipment, their components and consumables, and describe their characteristics, applications, limitations and operation
		describe procedures to start up and shut down oxy-fuel cutting equipment
		identify safety features of oxy-fuel cutting equipment, and describe their characteristics, applications and limitations
		identify various gases and describe their properties
		identify pressure settings, and describe their characteristics, applications and limitations
		identify hazards and safe work practices while using oxy-fuel cutting equipment
B-8.02.02L	demonstrate knowledge of cutting material using oxy-fuel cutting equipment	describe procedures to cut material using oxy-fuel cutting equipment
		describe cutting processes for different materials
		describe ***methods*** used to ensure straight or profiled edge

Range of Variables

methods include: free-hand, guided or automated cutting

B-8.03 Cuts material using shears

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.03.01P	ensure ***safety features*** are in place	***safety features*** are in place according to manufacturers' specifications
B-8.03.02P	verify type and thickness of material that can be sheared	type and thickness of material that can be sheared is verified according to equipment capacity
B-8.03.03P	adjust rake angle and blade clearance settings	rake angle and blade clearance settings are adjusted according to manufacturers' specifications and material characteristics
B-8.03.04P	adjust back gauges	back gauges are adjusted to position material
B-8.03.05P	operate shears	shears are operated using automated or manual controls

Range of Variables

safety features include: guards, dead man pedal

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.03.01L	demonstrate knowledge of shears, their characteristics, applications, limitations and operation	identify ***types of shears*** and describe their characteristics, applications, limitations and operation
		describe shear cut-off minimums to reduce bow, twist and camber
		identify ***safety features*** and describe their characteristics, applications, limitations and operation
		identify hazards and safe work practices while using shears
B-8.03.02L	demonstrate knowledge of cutting material using shears	describe procedures to cut material using shears
		describe cutting processes for different materials

Range of Variables

types of shears include: mechanical, hydraulic
safety features include: guards, dead man pedal

B-8.04 Cuts material using saws

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.04.01P	ensure ***safety features*** are in place	***safety features*** are in place according to manufacturers' specifications
B-8.04.02P	verify type and thickness of material that can be cut	type and thickness of material that can be cut is verified according to equipment capacity
B-8.04.03P	select blade types, styles and tooth pitches	blade types, styles and tooth pitches are selected according to grade, shape and dimensions of material to be cut
B-8.04.04P	determine speed and feed rate of cut	speed and feed rate of cut are determined according to ***factors***
B-8.04.05P	select and use coolants	coolants are selected and used to prolong blade life and improve quality of cut
B-8.04.06P	use jigs, gauges and backstops during cutting operations with multiple cuts	jigs, gauges and backstops are used during cutting operations with multiple cuts

Range of Variables

safety features include: guards, emergency stop buttons, capacity limits
factors include: blade type, hardness and thickness of material

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.04.01L	demonstrate knowledge of saws, their ***characteristics***, applications, limitations and operation	identify ***types of saws***, and describe their ***characteristics***, applications, limitations and operation
		identify ***safety features*** and describe their characteristics, applications, limitations and operation
		identify hazards and safe work practices while using saws
B-8.04.02L	demonstrate knowledge of cutting material using saws	describe procedures to cut material using saws
		describe cutting processes for different materials
		identify ***factors*** to determine speed and feed rate of cut

Range of Variables

characteristics include: blade types, tooth pitch, blade thickness
types of saws include: band, abrasive, cold
safety features include: guards, emergency stop buttons, capacity limits
factors include: blade type, hardness and thickness of material

B-8.05 Cuts material using ironworkers

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.05.01P	ensure ***safety features*** are in place	***safety features*** are in place according to manufacturers' specifications
B-8.05.02P	verify type and thickness of materials that can be processed	type and thickness of materials that can be processed are verified according to equipment capacity
B-8.05.03P	set up ironworker equipment	ironworker equipment is set up according to ***functions*** to be performed
B-8.05.04P	use jigs, gauges and backstops during processing operations for repeatability	jigs, gauges and backstops are used during processing operations for repeatability

Range of Variables

safety features include: guards, emergency stop buttons
functions include: punching, shearing, notching, forming

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.05.01L	demonstrate knowledge of ironworkers their characteristics, applications, limitations and operation	identify ***types of ironworkers***, and describe their characteristics, applications, limitations and operation
		identify stations on ironworkers and describe their ***functions***
		identify ***safety features*** and describe their characteristics, applications, limitations and operation
		identify hazards and safe work practices while using ironworkers

B-8.05.02L	demonstrate knowledge of cutting material using ironworkers	describe procedures to cut material using ironworkers
		describe cutting processes for different materials

Range of Variables

types of ironworkers include: hydraulic, mechanical, pneumatic
functions include: punching, shearing, notching, forming
safety features include: guards, emergency stop buttons

B-8.06 Cuts material using computer numerically controlled (CNC) equipment

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.06.01P	ensure ***safety features*** are in place	***safety features*** are in place according to manufacturers' specifications
B-8.06.02P	verify type and thickness of material that can be processed	type and thickness of material that can be processed is verified according to equipment capacity
B-8.06.03P	adjust settings of ***CNC equipment consumables***	settings of ***CNC equipment consumables*** are adjusted according to material being cut
B-8.06.04P	select ***gas type*** to be used for cutting different materials with cutting equipment	***gas type*** to be used for cutting different materials with cutting equipment is selected
B-8.06.05P	select cut pattern	cut pattern is selected according to job requirements
B-8.06.06P	nest cut patterns	patterns are nested to minimize material waste

Range of Variables

safety features include: guards, emergency stop buttons, ventilation, water table
CNC equipment include: plasma, oxy-fuel, laser and water jet cutters
consumables include: tips, electrodes, nozzles
gas types include: nitrogen, hydrogen, oxygen

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.06.01L	demonstrate knowledge of ***CNC equipment***, their ***consumables***, characteristics, applications, limitations and operation	identify types of ***CNC equipment*** and their ***consumables***, and describe their characteristics, applications, limitations and operation
		identify ***gas types*** and describe their properties
		identify ***safety features*** and describe their characteristics, applications, limitations and operation
		identify ***hazards*** and safe work practices while using ***CNC equipment***
B-8.06.02L	demonstrate knowledge of cutting material using ***CNC equipment***	describe procedures to cut material using ***CNC equipment***

Range of Variables

CNC equipment include: plasma, oxy-fuel, laser and water jet cutters
consumables include: tips, electrodes, nozzles
gas types include: nitrogen, hydrogen, oxygen
safety features include: guards, emergency stop buttons, ventilation, water table
hazards include: pinch points, noise, ultraviolet light, fumes

B-8.07 Drills holes

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.07.01P	select and use ***drilling equipment***	***drilling equipment*** is selected and used according to job requirements
B-8.07.02P	set up drills	drills are set up to account for ***factors***
B-8.07.03P	use ***clamping devices***	***clamping devices*** are used to ensure positioning and avoid slippage of material
B-8.07.04P	select and use ***cutting fluids***	***cutting fluids*** are selected and used to cool cutting surface and remove drill shavings

Range of Variables

drilling equipment include: hand, magnetic based, radial drills
factors include: speed and feed rates of cutters, hole dimensions, type of material
clamping devices include: vices, jigs, hold-downs
cutting fluids include: oils, water

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.07.01L	demonstrate knowledge of holes, their characteristics, applications and limitations	identify ***types of holes***, and describe their characteristics, applications and limitations
B-8.07.02L	demonstrate knowledge of ***drilling equipment***, their characteristics, applications, limitations and operation	identify types of ***drilling equipment***, and describe their characteristics, applications, limitations and operation
		identify ***types of drill bits***, and describe their characteristics, applications, limitations and operation
B-8.07.03L	demonstrate knowledge of drilling holes	describe procedures to drill holes using ***drilling equipment***
		describe procedures used to convert between imperial and metric systems
		identify ***clamping devices*** used to secure material
		identify types of ***cutting fluids*** used to cool cutting surfaces, and describe their characteristics, applications, limitations and operation

Range of Variables

types of holes include: blind holes, pilot holes
drilling equipment include: hand, magnetic based, radial drills
types of drill bits include: twist, core
clamping devices include: vices, jigs, hold-downs
cutting fluids include: oils, water

B-8.08 Cuts threads

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.08.01P	select and use ***threading tools and equipment***	***threading tools and equipment*** are selected and used
B-8.08.02P	select speed and feed rates	speed and feed rates are selected according to manufacturers' specifications and job requirements
B-8.08.03P	use clamping devices	clamping devices are used to ensure positioning and avoid slippage of material
B-8.08.04P	select and use ***cutting fluids***	***cutting fluids*** are selected and used to cool cutting surface and remove debris

Range of Variables

threading tools and equipment include: taps, dies, pipe threaders
cutting fluids include: oils, water

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.08.01L	demonstrate knowledge of threads, their characteristics, applications, limitations and operation	identify ***thread profiles***, and describe their characteristics, applications and limitations
		identify internal and external threads, and describe their characteristics, applications, limitations and operation
		identify left- and right-handed threads, and describe their characteristics, applications, limitations and operation
B-8.08.02L	demonstrate knowledge of procedures to cut threads	describe procedures to cut threads
		identify ***threading tools and equipment*** used to cut threads and describe their characteristics, applications, limitations and operation
		identify types of ***cutting fluids*** used to cool cutting surfaces, and describe their characteristics, applications, limitations and operation

Range of Variables

thread profiles include: National Pipe Thread (NPT), National Coarse (NC), National Fine (NF), metric
threading tools and equipment include: taps, dies, pipe threaders
cutting fluids include: oils, water

B-8.09 Prepares joints

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-8.09.01P	select and use ***equipment for edge bevelling and grooving***	***equipment for edge bevelling and grooving*** are selected and used
B-8.09.02P	maintain dimensional consistency throughout joint length	dimensional consistency is maintained throughout joint length according to job specifications
B-8.09.03P	clean joints and remove ***contaminants***	joints are cleaned and ***contaminants*** are removed to prevent weld defects

Range of Variables

equipment for edge bevelling and grooving include: oxy-fuel cutting equipment, plasma cutters, nibblers
contaminants include: slag, oil

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-8.09.01L	demonstrate knowledge of joints, their characteristics, applications and limitations	identify ***types of joints***, and describe their characteristics, applications and limitations
		describe welding requirements of joint preparation
B-8.09.02L	demonstrate knowledge of preparing joints	describe procedures to prepare joints
		identify ***equipment for edge bevelling and grooving***, and describe their characteristics, applications, limitations and operation
		describe procedures to clean joints and remove ***contaminants***

Range of Variables

types of joints include: bevels, U-groove, V-groove
equipment for edge bevelling and grooving include: oxy-fuel cutting equipment, plasma cutters, nibblers
contaminants include: slag, oil

Task B-9 Forms materials

Task Descriptor

Metal fabricators (fitters) use specialized equipment such as press brakes, plate rollers, shape rollers and benders to form materials into specified shapes. They may apply heat to facilitate the forming of these materials.

B-9.01 Forms material using plate rollers

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-9.01.01P	pre-form material ends	material ends are pre-formed to account for limitations of rollers
B-9.01.02P	adjust plate rollers	plate rollers are adjusted according to radius during forming
B-9.01.03P	monitor material	material is monitored by using sweep template to ensure amount of roll is consistent with job specifications

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-9.01.01L	demonstrate knowledge of materials, their applications, ***metallurgy and characteristics***	identify types of materials and describe their applications, ***metallurgy and characteristics***
		identify minimum bend radius for various materials
B-9.01.02L	demonstrate knowledge of plate rollers, their characteristics, applications, limitations and operation	identify ***types of plate rollers***, and describe their characteristics, applications, limitations and operation

B-9.01.03L	demonstrate knowledge of forming material using plate rollers	describe procedures to form material using plate rollers
		identify ***hazards*** and safe work practices while using plate rollers

Range of Variables

metallurgy and characteristics include: workability, grain direction, elasticity
types of plate rollers include: pyramid rollers, initial pinch rollers, 4 rolls
hazards include: pinch points, noise

B-9.02 Forms material using shape rollers

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

Skills

	Performance Criteria	Evidence of Attainment
B-9.02.01P	select and change dies	dies are selected and changed according to material shape
B-9.02.02P	adjust shape rollers	shape rollers are adjusted according to radius during forming
B-9.02.03P	monitor material	material is monitored by using sweep template to ensure amount of roll is consistent with job specifications

Knowledge

	Learning Outcomes	Learning Objectives
B-9.02.01L	demonstrate knowledge of materials, their applications, ***metallurgy and characteristics***	identify types of materials and describe their applications, ***metallurgy and characteristics***
		identify minimum bend radius for various materials
B-9.02.02L	demonstrate knowledge of shape rollers, their characteristics, applications, limitations and operation	identify ***types of shape rollers***, and describe their characteristics, applications, limitations and operation
		describe procedures to set up and adjust shape rollers
		describe use of sweeps and templates
B-9.02.03L	demonstrate knowledge of forming material using shape rollers	describe procedures to form material using shape rollers
		identify considerations and describe procedures used to lay out structural shapes

	identify ***hazards*** and safe work practices while using shape rollers
	explain ***effects*** associated with shape rolling

Range of Variables

metallurgy and characteristics include: workability, grain direction, elasticity
types of shape rollers include: angle rollers, tubing rollers
hazards include: pinch points, noise
effects include: mechanical, dimensional

B-9.03 Forms material using conventional and computer numerically controlled (CNC) press brakes

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

Skills

	Performance Criteria	Evidence of Attainment
B-9.03.01P	select and use dies	dies are selected and used according to ***job specifications***
B-9.03.02P	determine bend sequence	bend sequence is determined according to equipment clearance and profile of desired shape
B-9.03.03P	set up back stops	back stops are set up according to required dimensions to aid in forming repeated bends
B-9.03.04P	monitor bends for irregularities during forming and adjust equipment settings to compensate	bends are monitored for irregularities during forming and equipment settings are adjusted to compensate
B-9.03.05P	select and use templates	templates are selected and used to verify bend profile

Range of Variables

job specifications include: bend radius, desired shape

Knowledge

	Learning Outcomes	Learning Objectives
B-9.03.01L	demonstrate knowledge of materials, their applications, ***metallurgy and characteristics***	identify types of materials and describe their applications, ***metallurgy and characteristics***
		identify minimum bend radius for various materials

B-9.03.02L	demonstrate knowledge of conventional and CNC press brakes, their characteristics, applications, limitations and operation	identify ***types of press brakes***, and describe their characteristics, applications, limitations and operation
		describe procedures to set up and adjust press brakes
B-9.03.03L	demonstrate knowledge of forming material using conventional and CNC press brakes	describe procedures to form material using conventional and CNC press brakes
		identify ***hazards*** and safe work practices while using press brakes
		explain ***effects*** associated with braking

Range of Variables

metallurgy and characteristics include: workability, grain direction, elasticity
types of press brakes include: hydraulic, mechanical, CNC
hazards include: pinch points, noise
effects include: mechanical, dimensional

B-9.04 Forms materials using benders

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-9.04.01P	select, change and set up dies	dies are selected, changed and set up according to material shape
B-9.04.02P	adjust benders	benders are adjusted according to radius during forming
B-9.04.03P	monitor material	material is monitored by using measuring and layout tools to ensure bend is consistent with job specifications

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-9.04.01L	demonstrate knowledge of materials, their applications, ***metallurgy and characteristics***	identify types of materials and describe their applications, ***metallurgy and characteristics***
		identify minimum bend radius for various materials

B-9.04.02L	demonstrate knowledge of benders, their characteristics, applications, limitations and operation	identify ***types of benders***, and describe their characteristics, applications, limitations and operation
B-9.04.03L	demonstrate knowledge of forming material using benders	describe procedures to form material using benders
		identify ***hazards*** and safe work practices while using benders

Range of Variables

metallurgy and characteristics include: workability, grain direction, elasticity
types of benders include: manual, pipe, mandrel
hazards include: pinch points, noise

B-9.05 Applies heat for forming

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
B-9.05.01P	use jigs for manual forming	jigs for manual forming are used to ensure consistency of end product
B-9.05.02P	select and use ***heating equipment***	***heating equipment*** is selected and used according to material size, type and shape
B-9.05.03P	measure temperature of heated material	temperature of heated material is measured considering ***factors***
B-9.05.04P	determine location of heat application	location of heat application is determined according to ***job specifications***
B-9.05.05P	correct distortions in distorted metals	distortions in distorted metals are corrected through use of heat

Range of Variables

heating equipment includes: induction heaters, oxy-fuel torches, ovens
factors include: structural integrity, optimal temperature
job specifications include: bend location, desired shape

	Knowledge	
	Learning Outcomes	**Learning Objectives**
B-9.05.01L	demonstrate knowledge of ***heating equipment***, their characteristics, applications, limitations and operation	identify types of ***heating equipment***, and describe their characteristics, applications, limitations and operation
		identify ***hazards*** and safe work practices while using ***heating equipment***
B-9.05.02L	demonstrate knowledge of applying heat for forming materials	describe procedures to apply heat for forming materials
		describe heating requirements for forming various materials
		identify ***indicators of temperature***
		identify minimum bend radius for various materials

Range of Variables

heating equipment includes: induction heaters, oxy-fuel torches, ovens
hazards include: pinch points, noise, fire
indicators of temperature include: colour of heated materials, digital heat sensors

Major Work Activity C
Assembles components

Task C-10 Fits and fastens sub-components and components

Task Descriptor
After fabricating sub-components of a product, metal fabricators (fitters) must assemble them to create a component. They must follow sequential steps to do the job while staying within tolerances and specifications. While the bulk of these operations are done within the fabrication shop, occasionally, field assembly work may be done on the work site.

C-10.01 Assembles jigs

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-10.01.01P	select materials for jig	materials for jig are selected based on ***factors***
C-10.01.02P	select and use tools and equipment	tools and equipment are selected and used according to product being built
C-10.01.03P	establish necessary axes, planes and work points	necessary axes, planes and work points are established according to product being built
C-10.01.04P	lay out ***jig location***	***jig location*** is laid out according to fabrication drawing
C-10.01.05P	fasten stops and hold-downs to jig	stops and hold-downs are fastened to jig for accuracy and for ease of removal of fabricated product
C-10.01.06P	mark jigs for future use with ***information***	jigs are marked with ***information*** for future use

Range of Variables
factors include: cost, availability, accuracy, quantity requirements of finished products
jig location includes: plate, shop horses, floor surface
information includes: part numbers, material required, work orders

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-10.01.01L	demonstrate knowledge of jigs, their characteristics, applications and limitations	identify jigs and describe their characteristics, applications and limitations
		describe ***factors*** considered when choosing materials for jigs
		describe ***information*** used to mark jigs for future use
C-10.01.02L	demonstrate knowledge of assembling jigs	describe procedures to assemble jigs
		identify tools and equipment used for assembling jigs, and describe their characteristics, applications, limitations and operation

Range of Variables

factors include: cost, availability, accuracy, quantity requirements of finished products
information includes: part numbers, material required, work orders

C-10.02 Determines sequence for assembly

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-10.02.01P	refer to documents and drawings for ***detailed information***	documents and drawings are referred to for ***detailed information***
C-10.02.02P	visualize finished components prior to assembly	finished components are visualized prior to assembly
C-10.02.03P	define steps in process	steps in process are defined for efficiency and accuracy to prevent re-work while considering ***aspects***
C-10.02.04P	coordinate assembly in conjunction with ***other workers***	assembly is coordinated in conjunction with ***other workers***

Range of Variables

detailed information includes: size of product, types of material
aspects include: availability of equipment, size of product, location of work site
other workers include: co-workers, other trades

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-10.02.01L	demonstrate knowledge of determining sequence of assembly	describe procedures to determine sequence of assembly
		describe ***aspects*** to be considered while determining sequence of assembly
		describe relevance of starting point
		describe importance of coordinating assembly with ***other workers***

Range of Variables

aspects include: availability of equipment, size of product, location of work site
other workers include: co-workers, other trades

C-10.03 Assembles sub-components and components

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-10.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to type of assembly and space limitations for assembly
C-10.03.02P	attach sub-components and components	sub-components and components are attached using ***joining methods*** and ***fastening devices***
C-10.03.03P	verify component is torqued	component is torqued according to manufacturers' and client specifications
C-10.03.04P	verify component placement	component is placed according to drawings

Range of Variables

tools and equipment include: impact wrenches, torque wrenches, bolt tension measuring devices
joining methods include: bolting, welding
fastening devices include: pins, rivets, bolts, clips

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-10.03.01L	demonstrate knowledge of assembling components and sub-components	describe procedures and ***joining methods*** to assemble components and sub-components
		identify ***tools and equipment*** used for assembling components and sub-components, and describe their characteristics, applications, limitations and operation
		describe ***assembly constraints***
		describe site accessibility and layout requirements to be considered when assembling components and sub-components
		identify types of ***fastening devices***, and describe their specifications and applications
		identify dimensional tolerances

Range of Variables

joining methods include: bolting, welding
tools and equipment include: impact wrenches, torque wrenches, bolt tension measuring devices
assembly constraints include: building size, equipment limits
fastening devices include: pins, rivets, bolts, clips

C-10.04 Sets fabricated components in place

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-10.04.01P	verify location of installation	location of installation is verified according to erection drawings
C-10.04.02P	plan for ***possible installation difficulties*** and adapt to shifting work site needs	***possible installation difficulties*** are anticipated and installation is adapted to shifting work site needs

C-10.04.03P	secure work area	work area is secured to ensure area is clear of personnel and obstructions
C-10.04.04P	fit, place and adjust component	component is fit, placed and adjusted ensuring it is level, plumb, at the correct elevation and orientated according to drawings

Range of Variables

possible installation difficulties include: access to work area, equipment available

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-10.04.01L	demonstrate knowledge of setting fabricated components in place	describe procedures to set fabricated components in place
		describe ***possible installation difficulties*** and how to adapt

Range of Variables

possible installation difficulties include: access to work area, equipment available

C-10.05 Joins components on site

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-10.05.01P	determine ***joining methods***	***joining methods*** are determined from drawings
C-10.05.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to type of assembly
C-10.05.03P	attach components together	components are attached together according to procedures and manufacturers' specifications

Range of Variables

joining methods include: bolting, welding

tools and equipment include: wrenches, impact wrenches, torque wrenches, bolt tension measuring devices

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-10.05.01L	demonstrate knowledge of joining components on site	describe procedures to join components on site
		identify ***tools and equipment*** used for joining components on site, and describe their characteristics, applications, limitations and operation
		identify ***joining methods***
		identify types of ***fastening devices***, and describe their specifications and applications

Range of Variables

tools and equipment include: wrenches, impact wrenches, torque wrenches, bolt tension measuring devices
joining methods include: bolting, welding
fastening devices include: pins, rivets, bolts, clips

Task C-11 Performs welding activities

Task Descriptor

Depending on the work environment and jurisdictional regulations, metal fabricators (fitters) may tack and then pass the weldment on to welders, or see the welding process through to its completion.

C-11.01 Applies heat prior to tack welding

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-11.01.01P	determine pre-heat temperature of component material	pre-heat temperature of component material is determined according to work site welding procedures
C-11.01.02P	select and use ***temperature measuring tools***	***temperature measuring tools*** are selected and used to stay within welding parameters

C-11.01.03P	select and use ***equipment for pre-heating***	***equipment for pre-heating*** is selected and used according to specifications
C-11.01.04P	measure temperature of heated materials	temperature of heated materials is measured to prevent distortion and cracking

Range of Variables

temperature measuring tools include: temperature sticks, digital heat sensors
equipment for pre-heating includes: rosebuds, tiger torches, induction heaters

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-11.01.01L	demonstrate knowledge of applying heat prior to tack welding	describe procedures to apply heat prior to tack welding
		identify ***equipment for pre-heating***, and describe their characteristics, applications, limitations and operation
		identify ***temperature measuring tools***, and describe their characteristics, applications, limitations and operation
		identify pre- and post-weld heat requirements
		identify ***indicators of temperature***
		identify types, sequence and sizes of tacks, and describe their specifications and applications
		describe procedures for joint design and material preparation
C-11.01.02L	demonstrate knowledge of codes, standards and certification requirements for tacking	describe codes, standards and certification requirements for tacking

Range of Variables

equipment for pre-heating includes: rosebuds, tiger torches, induction heaters
temperature measuring tools include: temperature sticks, digital heat sensors
indicators of temperature include: colour of heated materials, heat affected zone

C-11.02 Performs tack welding

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-11.02.01P	select and use ***welding tools and equipment***	***welding tools and equipment*** are selected and used according to materials and workplace procedures
C-11.02.02P	install ***protection*** to near-by components	***protection*** is installed to protect near-by components from ***damage***
C-11.02.03P	determine position and size, and apply tacks	position and size are determined, and tacks are applied according to component being tacked
C-11.02.04P	remove defective tacks	defective tacks are removed using ***tools*** without damaging base metal

Range of Variables

welding tools and equipment include: gas metal arc welding (GMAW), shielded metal arc welding (SMAW), gas tungsten arc welding (GTAW)

protection includes: metal plates, heat blankets

damage includes: sparks, burn marks

tools include: chisels, grinders, gougers

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-11.02.01L	demonstrate knowledge of performing tack welding	identify types of metal, and describe their ***characteristics***, applications, limitations and operation
		describe procedures to tack weld
		identify types, sequence and sizes of tacks, and describe their specifications and applications
		identify weld sizes, and describe their characteristics and applications
		describe back stepping and weld sequence

C-11.02.02L	demonstrate knowledge of ***welding tools and equipment***, their characteristics, applications, limitations and operation	identify ***welding tools and equipment***, and describe their characteristics, applications, limitations and operation
		identify ***hazards*** associated with ***welding processes***
		identify ***welding processes***, and describe their characteristics, applications, limitations and operation
		identify power sources, and describe their specifications and applications
		describe gas cylinder safety measures
		describe characteristics of shielding gases
		identify electrodes and wires, and describe their characteristics, applications, limitations and operation
		describe filler metal transfer modes
		describe amperage (wire feed speed) and voltage (wire stick out) characteristics
C-11.02.03L	demonstrate knowledge of codes, standards and certification requirements for tacking and welding	describe codes, standards and certification requirements for tacking and welding

Range of Variables

characteristics include: ductility, grade
welding tools and equipment include: GMAW, SMAW, GTAW
hazards include: fire, toxic fumes, ultraviolet light
welding processes include: GMAW, SMAW, GTAW, flux cored arc welding (FCAW), metal cored arc welding (MCAW)

C-11.03 Minimizes welding distortions

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-11.03.01P	estimate possible distortion to stay within allowances	possible distortion is estimated to stay within allowances by referencing specifications
C-11.03.02P	select and use ***restraints***	***restraints*** are selected and used to counteract distortion

C-11.03.03P	determine sequence of welding	sequence of welding is determined to minimize warping, pulling and cracking
C-11.03.04P	limit distortion and stress in component	distortion and stress in component is limited by applying ***stress removal methods***

Range of Variables

restraints include: strong backs, clamps, braces, jigs
stress removal methods include: peening, heating

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-11.03.01L	demonstrate knowledge of minimizing welding distortions	describe procedures to minimize welding distortions
		identify ***restraints*** used to counteract distortion
		explain importance of determining sequence of welding
		describe ***stress removal methods***
		describe ***causes and effects of welding distortions***

Range of Variables

restraints include: strong backs, clamps, braces, jigs
stress removal methods include: peening, heating
causes and effects of welding distortions include: longitudinal, angular, transverse

C-11.04 Applies welding processes

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-11.04.01P	select, set up and use ***welding equipment***	***welding equipment*** is selected, set up and used according to workplace welding procedures, codes and standards
C-11.04.02P	select and use ***filler metals***	***filler metals*** are selected and used according to specifications of base material
C-11.04.03P	select and use ***ventilation equipment***	***ventilation equipment*** is selected and used to prevent inhalation of particles and fumes

C-11.04.04P	weld components to required size	components are welded to required size according to ***specifications***
C-11.04.05P	adjust amperage, voltage and gas flow rates	amperage, voltage and gas flow rates are adjusted to achieve desired weld profile
C-11.04.06P	manipulate ***welding processes***	***welding processes*** are manipulated to achieve weld profile according to welding details
C-11.04.07P	remove slag and spatter with ***tools and equipment***	slag and spatter are removed with ***tools and equipment*** to make weld visible for inspection
C-11.04.08P	repair ***welding defects*** using grinders and gougers	***welding defects*** are repaired using grinders and gougers

Range of Variables

welding equipment includes: GMAW, SMAW, GTAW
filler metals include: wire, electrodes
ventilation equipment includes: fume extractors, suction lines, respirators
specifications include: number of passes, weld profile
welding processes include: GMAW, SMAW, GTAW, FCAW, MCAW
tools and equipment include: chipping hammers, grinders, wire brushes
welding defects include: porosity, undercut, crater cracks

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-11.04.01L	demonstrate knowledge of ***welding equipment***, their characteristics, applications, limitations and operation	identify ***welding equipment*** and describe their characteristics, applications, limitations and operation
		describe gas cylinder safety measures
		describe characteristics of shielding gases
		identify electrodes and wires, and describe their characteristics, applications, limitations and operation
		describe amperage (wire feed speed) and voltage (wire stick out) characteristics
C-11.04.02L	demonstrate knowledge of ***ventilation equipment***, their characteristics, applications, limitations and operation	identify ***ventilation equipment*** and describe their characteristics, applications, limitations and operation
C-11.04.03L	demonstrate knowledge of applying ***welding processes***	describe ***welding processes***, and describe their characteristics, applications, limitations and operation
		identify types of metal, and describe their ***characteristics***, applications, limitations and operation
		identify ***filler metals*** and their associated transfer modes

		identify ***hazards*** associated with ***welding processes***
		identify possible ***welding defects***
		identify ***tools and equipment*** used to remove slag and spatter
		identify weld sizes, and describe their characteristics, applications, limitations and operation
		describe back stepping and weld sequence
C-11.04.04L	demonstrate knowledge of codes, standards and certification requirements pertaining to welding	describe codes, standards and certification requirements pertaining to welding

Range of Variables

welding equipment includes: GMAW, SMAW, GTAW
ventilation equipment includes: fume extractors, suction lines, respirators
welding processes include: GMAW, SMAW, GTAW, FCAW, MCAW
characteristics (of metals) include: ductility, grade
filler metals include: wire, electrodes
hazards include: fire, toxic fumes
welding defects include: porosity, undercut, crater cracks
tools and equipment include: chipping hammers, grinders, wire brushes

C-11.05 Corrects welding distortions

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-11.05.01P	measure amount of distortion	amount of distortion is measured using ***equipment*** to determine if it is within tolerance
C-11.05.02P	rectify distortions	distortions are rectified using ***methods*** according to specifications
C-11.05.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used

Range of Variables

equipment include: plumb bobs, straight edges, levels, string line
methods include: mechanical, thermal
tools and equipment include: come-alongs, hydraulic rams, torches

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-11.05.01L	demonstrate knowledge of correcting welding distortions	describe ***methods*** used to rectify welding distortions
		identify ***tools and equipment*** to correct welding distortions, and describe their characteristics, applications, limitations and operation
		identify ***equipment*** to measure amount of distortion
		identify types of metal, and describe their ***characteristics***, applications, limitations and operation
		describe ***causes and effects of welding distortions***
		describe mechanical forces required for correction
C-11.05.02L	demonstrate knowledge of jurisdictional regulations and certification requirements for welding	describe jurisdictional regulations and certification requirements for welding

Range of Variables

methods include: mechanical, thermal
tools and equipment include: come-alongs, hydraulic rams, torches
equipment include: plumb bobs, straight edges, levels, string line
characteristics (of metals) include: ductility, grade
causes and effects of welding distortions include: longitudinal, angular, transverse

Task C-12 Completes project

Task Descriptor

This is the final stage of the process, where metal fabricators (fitters) ensure the product meets jurisdicitional regulations and customer specifications.

C-12.01 Identifies type of finish

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-12.01.01P	identify ***finishing process***	identify ***finishing process*** according to drawings
C-12.01.02P	identify areas not to be finished	areas not to be finished are identified

Range of Variables

finishing processes include: painting, galvanizing

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-12.01.01L	demonstrate knowledge of ***finishing processes***, their characteristics, applications and limitations	identify ***finishing processes***, and describe their characteristics, applications and limitations
		identify ***types of finishes*** on bare metal, and describe their characteristics, applications and limitations
		identify final product requirements

Range of Variables

finishing processes include: painting, galvanizing
types of finishes include: polished, brushed, mill

C-12.02 Prepares material for finishing

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

	Skills	
	Performance Criteria	**Evidence of Attainment**
C-12.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used to remove burrs, sharp edges, weld spatter and slag so that finishing materials will adhere to components
C-12.02.02P	ensure that welds are profiled	welds are profiled according to specifications
C-12.02.03P	sort assemblies for specific finishes to prevent cross-contamination	assemblies for specific finishes are sorted to prevent cross-contamination
C-12.02.04P	fill and blend ***surface blemishes***	***surface blemishes*** are filled and blended using ***welding processes***
C-12.02.05P	install tagging system after finishing process	tagging system is installed after finishing process to ensure traceability
C-12.02.06P	prepare weldments for galvanizing	weldments are prepared for galvanizing by providing air bleeds and drain holes

Range of Variables

tools and equipment include: buffing wheels, sanders, grinders, sand-blasters
surface blemishes include: plate clamp gouges, arc strikes, defects
welding processes include: GMAW, SMAW, GTAW, FCAW, MCAW

	Knowledge	
	Learning Outcomes	**Learning Objectives**
C-12.02.01L	demonstrate knowledge of preparing material for finishing	describe procedures used to prepare material for finishing
		identify ***tools and equipment*** used to prepare material for finishing, and describe their characteristics, applications, limitations and operation
		identify final product requirements
		describe tagging procedures

Range of Variables

tools and equipment include: buffing wheels, sanders, grinders, sand-blasters

Appendix A
Acronyms

CAD	computer-assisted design
CNC	computer numerically controlled
FCAW	flux cored arc welding
GMAW	gas metal arc welding
GTAW	gas tungsten arc welding
MCAW	metal cored arc welding
MIG	metal inert gas
NC	National Coarse
NF	National Fine
NPT	National Pipe Thread
OH&S	Occupational Health and Safety
PPE	personal protective equipment
SDS	Safety Data Sheets
SCBA	self-contained breathing apparatus
SMAW	shielded metal arc welding
WHMIS	Workplace Hazardous Material Information Systems
WLL	working load limit

Appendix B
Tools and Equipment / Outils et équipement

Personal Protective Equipment and Safety Equipment / Équipement de protection individuelle et équipement de sécurité

air quality tester	équipement d'analyse de la qualité de l'air
cutting goggles	lunettes de sécurité pour le coupage
dust mask	masque antipoussières
eye wash station	douche oculaire
face shields	masques de protection
fall protection equipment	équipement de protection contre les chutes
fire extinguishers	extincteurs
fire resistant clothing	vêtements ignifuges
first aid kit	trousse de premiers soins
gloves	gants
hard hats	casques de protection
hearing protection	protecteurs auditifs
reflective vest and coveralls	combinaison et veste réfléchissante
respirator	respirateur
safety boots	bottes de sécurité
safety glasses and goggles	lunettes de sécurité
self-contained breathing apparatus (SCBA)	appareil respiratoire autonome (ARA)
welding helmets / shields	masques de soudeurs

Hand Tools / Outils à main

ball peen hammer	marteau à panne ronde
bar clamps	serre-joints à coulisse
c-clamps	serre-joints en C
chisels	ciseaux
dogs and wedges	crochets de retenue et coins
drift pins	tige d'assemblage
drill bit kit	ensemble de mèches de forets
files	limes
locking pliers	pinces-étaux
marking devices	appareils de marquage
plumb bob	fil à plomb
screwdrivers	tournevis
sledge hammer	masse
tap and dies	tarauds et matrices

toggle clamps	crampons articulés
torque wrench	clé dynamométrique
welding magnets	aimants de soudure
wrenches (spanner, allan, pipe)	clés (tricoise, hexagonale, à tuyau)

Power Tools / Outils mécaniques

angle grinder	meuleuse d'angle
belt sander	ponceuse à courroie
bevelling machine	biseauteuse mécanique
concrete drills	mèches creuses
die grinders (electric and pneumatic)	meuleuses à rectifier les matrices (électriques et pneumatiques)
drills (electric and pneumatic)	perceuses (électriques et pneumatiques)
hammer drill	marteau perforateur
hydraulic portable punch	poinçon hydraulique portatif
impact tool	outil à chocs
hydraulic rams	béliers hydrauliques
magnetic drill	perceuse magnétique
metal cutting saw with carbide blade	scie à couper le métal avec une lame au carbure
nibblers	grignoteuses
pneumatic needle guns	pistolets à aiguilles à pointeau pneumatique
pneumatic riveter	riveteuse pneumatique
powder-actuated tools	outils à charge explosive
reamer drill (electric and pneumatic)	alésoir mécanique (électrique et pneumatique)

Stationary Machinery, Cutting Equipment, Forming Equipment and Accessories / Machines fixes, équipement de découpage, équipement de formage et accessoires

angle master	gabarit pour les angles
angle shear	cisailles à angles
band saw	scie à ruban
beam line	chaîne d'usinage de poutres
bench grinder	touret
bench vice	étau d'établi
bevellers	biseauteuses
brake press	presse-plieuse
CNC punches	poinçons à CNC
cold saw	scie circulaire à froid
dies	matrices
drill press	perceuse à colonne
drill press vice	étau de perceuse à colonne
dry cutter saw	scie de coupe à sec

forge	forge
friction saw	scie à friction
hold down clamps	serre-tôles
ironworker	cisaille-poinçonneuse
mandrel bender	cintreuse sur mandrin
manual pipe bender	cintreuse de tuyaux manuelle
oxy-fuel cutting equipment	équipement d'oxycoupage
pipe cutters and threaders	coupe-tuyaux et machines à tarauder les tuyaux
plasma cutting equipment	équipement de découpe au plasma
plate rollers	lamineurs de tôles fortes
power hack saw	scie alternative à métaux
radial arm drill	perceuse radiale
shape/manual die bender	façonneuse/cintreuse à matrice manuelle
shape roller	lamineurs de forme
shears (mechanical, electric and hydraulic)	cisailles (mécaniques, électriques et hydrauliques)
stationary belt sander	ponceuse à courroie stationnaire

Welding Equipment / Équipement de soudage

carbon air arc gouger	équipement de gougeage à l'arc au carbone avec jet d'air
chipping hammer	marteau burineur
fillet gauges	gabarits de mesures de soudures
gas tungsten arc welding (GTAW) equipment	équipement de soudage à l'électrode de tungstène (GTAW)
ground clamps	pinces de mise à la terre
heating equipment (rosebuds, tiger torch, induction heaters)	équipement de chauffage (buse multiflamme, buse de lance-flamme, four à induction)
MIG pliers	pinces pour procédé MIG
shielded metal arc welding (SMAW) equipment	matériel de soudage à l'arc avec électrode enrobée (SMAW)
submerged arc welding	soudage à l'arc submergé
welding cables	câbles de soudages
wire brush	brosse métallique
wire feed welding equipment [flux core welding (FCAW) and gas metal arc welding (GMAW)]	équipement de soudage à l'entraînement du fil-électrode [soudage à l'arc avec fil fourré (FCAW), et soudage à l'arc sous gaz avec fil plein (GMAW)]

Layout and Measuring Equipment / Équipements de traçage et de mesure

beam board	planche à poutres
beam gauge	calibre à poutres
bevel square	fausse équerre
centre finder	pointeau à centrer

chalk line	cordeau à tracer
combination square	équerre combinée
digital heat sensor	capteurs de chaleur numériques
dividers	compas à pointes sèches
levels (torpedo, 2, 4 foot)	niveau (torpille, 2 et 4 pieds)
measuring tape	ruban à mesurer
micrometers	micromètre
paint marker	marqueur à peinture
piano wire and string line	corde à piano et cordeau
plumb bob	fil à plomb
protractor	rapporteur d'angles
punches (center, prick, drift, transfer)	poinçons (pointeau, pointeau de traçage, chasse-goupille, poinçon de transfert)
ruler	règle
scientific calculator	calculatrice scientifique
scribe	pointe à tracer
small clamps	presses
soapstone	pierre de savon
stair gauges	guide de traçage pour l'escalier
steel square (2 foot)	équerre en acier (2 pieds)
steel thickness gauge	jauge d'épaisseur d'acier
straight edge	règlet d'ajusteur
temperature stick	crayon thermosensible
templates	gabarits
trammel points	compas à pointes sèches
transits	théodolites
vernier calipers	pied à coulisse
wrap around	gabarit panoramique

Rigging, Hoisting and Lifting Equipment and Material Handling Equipment / Équipement de gréage, de hissage et de levage et équipement de manutention

beam clamps	pinces à poutre
blocks	moufles
bridge crane	pont de levage
carts	chariots
chain falls	palans à chaînes
chain slings	élingues de chaînes
come-alongs	palans à levier
conveyor roller	rouleau de convoyeur
dollies	diables
forklift	chariot élévateur à fourche

grip hoist (TirforTM)	treuil à main (tirfor)
hydraulic and manual jacks	crics manuels et vérins hydrauliques
jib crane	grue à flèche
lifting magnets	électroaimants de levage
load indicators	indicateurs de charge
plate clamps	pinces à plaque
plate hooks	crochets pour tôle forte
pneumatic lift	monte-charge pneumatique
power rollers	rouleaux motorisés
ropes	cordes
shackles	manilles
spreader bars	barres d’écartement
suction cups	ventouses
synthetic slings	élingues synthétiques
tag line rope	câble stabilisateur
tuggers	chariots tracteurs
turnbuckles	tendeurs
wire rope slings	élingues en câbles métalliques

Access Equipment / Équipement d’accès

ladders	échelles
man lifts	monte-personnes
personnel basket	nacelle
scaffolding	échafaudage
scissor lifts	plateforme élévatrice à ciseaux

Appendix C
Glossary/Glossaire

arc templates (sweep)	a template used for verifying the inside radius of material being rolled	**gabarits d'arc**	gabarit utilisé pour vérifier le rayon intérieur du matériau en cours de roulage
back stepping	a welding sequence designed to minimize distortion by welding short distances, from a forward point back to the previous weld	**soudage à rebours**	séquence de soudage conçue afin de minimiser les déformations; elle consiste à souder sur de courtes distances, d'un point à l'autre, dans la direction opposée à la direction générale de la soudure
base metal	the metal that is being welded	**métal de base**	métal sur lequel la soudure est exécutée
bender	equipment used to bend tube, pipe or rod; some types include mandrel benders, tube benders and manual benders	**cintreuse**	équipement utilisé pour le cintrage des tubes, des tuyaux ou des tiges; il peut s'agir de cintreuses sur mandrin, de cintreuses à tubes et de cintreuses manuelles
brake press	stationary equipment used to bend metal sheet or plate	**presse-plieuse**	équipement fixe permettant de plier des tôles fortes ou des plaques métalliques
Computer Numerical Control (CNC)	a control system in which numerical values corresponding to desired tool or control positions are generated by a computer/computer program	**commande numérique par ordinateur (CNC)**	système de commande grâce auquel des données numériques correspondant aux positions d'outil ou d'usinage sont calculées par un ordinateur ou par un logiciel
ductility	ability of a material (such as metal or asphalt cement) to undergo permanent deformation through elongation (reduction in cross sectional area) or bending at room temperature without fracturing; easily molded or shaped	**ductilité**	propriété d'un matériau (par exemple le métal ou le ciment bitumineux) pouvant subir une déformation permanente sous l'effet d'un effort de traction (réduction de la surface en coupe transversale) ou être courbé sans se rompre sous des conditions de température ambiante; matériau qui peut facilement être moulé ou façonné
ferrous	containing iron	**ferreux**	métaux contenant du fer
filler metal	the metal that is added to the base metal through the welding process	**métaux d'apport**	métal ajouté au métal de base au cours d'une opération de soudage

galvanizing	a metallurgical process done to coat steel with another metal (usually zinc) to prevent corrosion	**galvanisation**	procédé métallurgique consistant à recouvrir l'acier d'une couche de métal (généralement du zinc) pour le protéger de la corrosion
heat numbers	reference numbers applied to materials at time of manufacture; used for traceability	**numéros de coulée**	numéros de références appliqués aux matériaux lors de leur fabrication; ces numéros sont utilisés à des fins de traçabilité
induction heater	type of heating equipment that generates heat by creating an electromagnetic field	**four à induction**	équipement de chauffage dans lequel la chaleur est engendrée par un champ électromagnétique
ironworker	stationary equipment used to perform a number of tasks including plate and bar shearing, coping and mitering of structural shapes, punching, bending and notching operations	**cisaille-poinçonneuse**	équipement fixe permettant d'effectuer diverses opérations, comme le cisaillage de tôles fortes et de barres, le chantournage et la coupe en onglet de profilés, le poinçonnage, le cintrage et l'usinage d'entailles
jig	a device used to position and hold parts for repetitive assemblies	**gabarit de montage**	dispositif permettant de positionner et d'immobiliser des pièces lors d'assemblages répétitifs
layout	the process of transferring lines, centres, and other informative markings from the blueprint	**tracer**	opération consistant à reporter sur une pièce des lignes, des axes et d'autres indications inscrites sur les plans
material allowance	total overall amount of material required to fabricate the part including any extra material required for the process	**matériaux nécessaires**	quantité totale de matériaux nécessaires à la fabrication d'une pièce, incluant tous les suppléments de matériaux requis au cours de l'opération
metallurgy	science of the chemistry and physical properties of metals	**métallurgie**	science qui étudie les propriétés physiques et chimiques des métaux
notching	a shearing process done to remove a small notch of material (usually with an ironworker)	**usinage d'une entaille**	opération de cisaillage permettant de pratiquer une petite entaille sur le matériau (généralement au moyen d'une cisaille-poinçonneuse)
oxy-fuel cutting	cutting that uses the flame of an oxy-fuel torch and high pressure stream of oxygen	**oxycoupage**	procédé de coupe utilisant la flamme d'un chalumeau d'oxycoupage aux gaz et un jet d'oxygène à haute pression
piece marks	numbers and letters that identify a sub-component or a component used to locate the piece on the assembly	**marques de pièces**	série de numéros et de lettres qui caractérisent un sous-composant ou un composant et qui est utilisée pour localiser une pièce dans un assemblage

plasma cutting equipment	equipment used to cut ferrous and non-ferrous metals by superheated gas; the heat is generated by an electrical arc, turning the gas into plasma	**équipement de découpe au plasma**	équipement de découpage des métaux ferreux et non ferreux au moyen de gaz surchauffés; la chaleur est engendrée par un arc électrique, qui transforme le gaz en plasma
plate roller	stationary equipment used to roll metal sheet plate into cylinders or curved sections	**lamineur de tôles fortes**	équipement fixe utilisant des rouleaux pour donner une forme cylindrique ou recourbée aux tôles fortes métalliques
shape roller	stationary equipment used to roll metal shapes such as angle iron, tubing and channel	**lamineur de forme**	équipement fixe utilisant des rouleaux afin de créer des profilés de métal tels que des cornières, des tubes et des profilés en U
shears	stationary equipment used to cut metal sheet plate	**cisailles**	équipement fixe permettant de couper les tôles fortes métalliques
slag	the residue produced when welding or cutting	**laitier**	résidu résultant des procédés de soudage ou de découpage
softeners	material used to protect rigging equipment and components from damage caused by contact with each other	**plastifiants**	matériel utilisé pour protéger les composants et l'équipement de gréage qui pourraient s'endommager entre eux
stretch-out	a length of a flat piece of metal prior to forming	**développé**	pièce de métal plate et allongée non formée
tack weld	a small weld used to hold parts in position prior to final welding	**soudage par point**	petite soudure permettant de fixer les éléments dans leur position avant le soudage final
template	a gauge or pattern used as a guide to replicate a piece being fabricated	**gabarit**	jauge ou modèle utilisé comme guide pour reproduire une pièce en fabrication
tolerance	a permissible deviation from a specified dimension	**tolérance**	écart admissible entre une valeur réelle et une dimension spécifiée
traceability	part of a quality assurance system that keeps track of the origin of materials by heat numbers or parts numbers	**traçabilité**	étape du processus d'assurance de la qualité qui permet le suivi des matériaux d'origine grâce aux numéros de coulées et aux marques de pièces
quality assurance	system of verifications to ensure that manufactured items conform to standards and specifications	**assurance de la qualité**	processus de vérification permettant d'assurer que les pièces ont été fabriquées conformément aux normes et aux spécifications
weldment	a welded assembly or an assembly in the process of being welded	**ensemble soudé**	assemblage soudé ou assemblage en cours de soudage

weld distortion	change in the shape of the welded material that is being caused by the expansion and contraction of the metals due to the heat input from the welding process	**déformation de soudure**	changement dans la forme du matériel soudé causé par la dilatation et la contraction des métaux engendrées par l'apport de chaleur lors du soudage