PROGRAM PROGRAMME
EXCELLENCE
RED SEAL · SCEAU ROUGE

Red Seal Occupational Standard

Boilermaker

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

Boilermaker

Title: BOILERMAKER

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

PDF

Cat. No.: Em15-3/8-2025E-PDF

ISBN/ISSN: 978-0-660-76130-5

Foreword

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

Background

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

Standards have the following objectives:

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

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

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

Acknowledgements

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

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

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

- Craig Beauchamp, RSE – Manitoba
- Nicholas Crook (Nick), RSE – Saskatchewan
- James Fisher, RSE – Ontario
- Peter Fleming, RSE – International Brotherhood of Boilermakers Canada
- Wesley Kerr, RSE – Alberta
- Bradley Kulbaba, RSE – Manitoba
- Keith Muise, RSE – Newfoundland and Labrador
- Bruno Noel, RSE – New Brunswick
- Roger Prior, RSE – British Columbia
- Russell Reid, RSE – Alberta
- Collin Robertson, RSE – British Columbia
- James Wade, RSE – Newfoundland and Labrador

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

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

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

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

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

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

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

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

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

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

- **Task**: distinct actions that describe the activities within a major work activity
  - **Task Descriptor**: a general description of the task
    - **Sub-task**: distinct actions that describe the activities within a task
      - **Skills**:
        - **Performance Criteria**: description of the activities that are done as the sub-task is performed
        - **Evidence of Attainment**: proof that the activities of the sub-task meet the expected performance of a tradesperson who has reached 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 Boilermaker Trade

“Boilermaker” is this trade’s official Red Seal occupational title approved by the CCDA. This standard covers tasks performed by boilermakers.

Boilermakers construct, fabricate, weld, assemble, install, erect, alter, maintain, repair, dismantle, demolish and test various items. These include, but are not limited to pressure vessels, heat exchangers, steam generators, boilers, economizers, air heaters, deaerators, induced draft (ID) and forced draft (FD) fans, tanks, pollution control devices and systems, duct systems, furnaces, reactors, water towers and reservoirs, penstocks, scroll casing, stacks and other related components and parts, as well as their access structures, assemblies and internals, inclusive of piping and external piping up until the first flange, including all types of structural and plate work on dust, air, gas, steam, oil, water and other liquid-tight containers.

Boilermakers work from engineer-approved drawings to fabricate components from steel or other materials. They calculate, select and attach rigging and work with cranes and other hoisting devices to lift components into place. The systems must be tested for leaks and other defects and deficiencies to ensure they are operating safely and efficiently.

Boilermakers require a good understanding of welding methods and procedures. However, while welding is a component of this trade, jurisdictions may or may not permit certain welding processes without further certification.

Boilermakers are employed in industries that are governed by various codes and standards in metal fabricating, construction, shipbuilding, petroleum, mining, smelting and power generation (e.g., hydro, nuclear, thermal, solar, tidal). They may be employed in construction and maintenance in a variety of industrial workplaces such as pulp mills, water treatment plants, steel mills, cement, chemical, fertilizer and potash plants, breweries, shipyards, offshore platforms, mines and power generation and co-generation stations, as well as ethanol, oil and gas extraction facilities, upgraders and refineries where the installation, repair, and maintenance, or demolition of the above equipment is required.

Boilermakers use both hot and cold working methods to shape steel components and other materials to form boilers, tanks and vessels. They must use various metal forming machines such as plate shears, punch presses and bending rolls. Tools such as levels, wedges, grinders and cutting torches are used to lay out, fit and smooth edges so the parts fit together. They also use a variety of test equipment and measuring devices.

Work is performed indoors or outdoors and may be at extreme heights or underground. Boilermakers can safely work in environments containing hazards and conditions such as, vibration, excessive noise, fumes, asbestos and other toxic environments, confined spaces, extreme temperatures and radiation. Safety training and procedures are a priority to ensure risk is minimized and to avoid occupational injuries and long-term impacts.

Key attributes for people wanting to enter the Boilermaker trade are good hand-eye coordination, manual dexterity, and mechanical and mathematical aptitude. Boilermakers must possess the full range of knowledge, abilities and skills required of the trade, including an understanding of mechanical drawings. They also require strength and stamina to work with heavy loads and equipment. Boilermakers must be willing to travel and adapt to changing work environments (e.g., confined spaces, working at heights and working under supplied air). It is common in this trade to work long hours and many consecutive shifts.

This analysis recognizes similarities with the work of metal fabricators, industrial mechanics (millwrights), steamfitters/pipefitters, ironworkers and welders.

With experience, boilermakers may act as mentors and trainers to apprentices in the trade. They may also advance to supervisory positions, quality assurance inspectors and safety personnel.

Trends in the Boilermaker Trade

Technology

Boilermakers continue to make great advancements in the construction and maintenance of industrial equipment using current technologies and processes. Boilermakers may access digital technologies and software to assist in fabrication, new construction and maintenance and repair such as 3D models, simulations, and animations of equipment and components.

The use of computer-based training and orientation is becoming more common. Boilermakers may use virtual and augmented reality tools for training purposes such as confined space, safety, welding, and rigging, hoisting, and positioning.

Stress relieving technologies are used more frequently due to an increase in the variety of materials that boilermakers work with.

There are a number of technological advancements in green technologies such as hydrogen, battery plants for electric vehicles, cogeneration plants, small modular reactors (SMRs), large-scale nuclear reactors, mining and carbon capture affecting the work of boilermakers.

Health and Safety

There are improvements in personal protective equipment (PPE) and clothing for boilermakers that can protect them from respiratory hazards, noise, heat, cold, radiation and burns.

There is a greater emphasis on the process and documentation of work to prevent and monitor workplace injuries and overexertion, and support recovery.

The awareness of mental health and well-being is becoming better recognized in this trade, often being provided by the union. Some examples of the services available include addiction treatment centres, 24/7 family assisted programs, and health and welfare benefits.

Tools and Equipment

There is an increased use of computerized and automated machines in the fabrication of equipment and components. Boilermakers are encouraged to acquire skills in automation and robotics to engage in tasks such as welding using robotic welding cells, automated welding equipment and automated cutting and fitting equipment.

Advancements in hydraulic torque and tensioning equipment allow boilermakers to tighten studs on various equipment such as high pressure or large flanges with greater ease and accuracy.

Environmental

Boilermakers contribute to environmental protection processes such as Carbon Capture, Utilization, and Storage (CCUS). This process involves first capturing, then either utilizing or storing carbon dioxide (CO_2), to prevent it from entering the atmosphere. This is essential in the global effort to achieve net-zero emissions.

Boilermakers participate in projects that can improve the energy efficiency and sustainability of industrial processes. They contribute to reducing carbon emissions by constructing and maintaining eco-friendly boilers such as biomass boilers that use organic materials for fuel, solar thermal systems that capture solar energy for heating, and nuclear energy production projects (SMRs and large-scale nuclear). They will be involved in hydrogen-based energy solutions, ensuring a sustainable and diverse energy mix for the future.

Legislative and Regulatory

Safety regulations and legislation in each jurisdiction are also subject to frequent updates and changes.

With each new piece of legislation, new systems need to be manufactured. Boilermakers are heavily involved in the fabrication, field construction, erection, installation, maintenance and repair of these systems.

Other

Boilermakers play a crucial role in constructing and maintaining industrial equipment. They work across a wide variety of industries, including aeronautical, aerospace, petrochemical, nuclear and cryogenic fields.

Skills for Success Summary

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

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

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

Reading

Boilermakers read and interpret summaries of toolbox meetings, short notes from co-workers about work activities and directions on product labels. They also read jurisdictional regulations, company policies and procedures, as well as code books, collective agreements and Safety Data Sheets (SDS). Boilermakers also read reference books such as metal trades and welding handbooks, crane and rigging handbooks and training manuals.

Document Use

Boilermakers locate information in various tables, bills of lading, work procedures, inspection and test plans (ITP), work permits, code books, load charts, SDS, equipment catalogues and manufacturers' specifications. They interpret various drawings such as rigging, fabrication (prints) and shop drawings to identify work to be completed. They may also make scale drawings.

Writing

Boilermakers may write work-related notes to co-workers and keep personal logbooks to record daily activities noting information such as hours worked, tasks completed, problems encountered, observations and concerns. They may also write production plans to sequence and schedule tasks. Boilermakers may complete job safety analysis (JSA) reports, field-level risk assessments (FLRA), health and safety report forms as well as hazard or near-miss report forms.

Oral Communication

Boilermakers discuss safety issues with colleagues and supervisors during daily toolbox meetings. They interact with supervisors to get direction and discuss technical issues, health and safety concerns, timelines and personnel matters. They may consult with draftspersons, quality control officers and engineers to discuss problems with fabrication drawings (prints) such as code violations, technical challenges and design flaws. They may also consult with union representatives.

Boilermakers are often required to use personal protective equipment (PPE) such as ear protection, self-contained breathing apparatus (SCBA), respirators and full-face masks which may impede communication. Boilermakers also work in situations where visibility is restricted and communication is challenging, such as working in confined spaces, at heights and in loud environments. They use two-way radios to direct equipment operators and to communicate with personnel or use hand signals when oral communication is not possible.

Numeracy

Boilermakers apply mathematical concepts such as calculating linear dimensions for cutting and forming materials, geometry for layout applications and trigonometry for calculation of angles. Boilermakers use formulas to solve for things such as area and volume of regular and irregular shapes, tube expansion, material weights, rigging selection, and working load limits (WLL) of wire ropes and rigging systems. They are required to interpret numerical data such as determining a crane's ability to lift a load. Boilermakers are expected to work with both the imperial and metric systems and must be able to convert between the two.

Thinking

Boilermakers use critical thinking skills to perform diagnostics, troubleshooting and problem-solving tasks. They may suggest a more feasible timeframe when dealing with tight timelines and while coordinating with other trades. They also determine and implement actions to address hazardous job conditions. For example, they may choose appropriate safety equipment, isolate an area, or call other trades to facilitate assigned tasks.

Working with Others

Due to the potentially dangerous nature of their work, working with others is a critical skill. Often a boilermaker-welder is paired with a boilermaker-mechanic to form a skilled team. Boilermakers may also work in larger team situations and with other tradespeople. They should be able to communicate effectively, complete the tasks assigned to them and integrate their work with that of the other trades. They must be self-disciplined, ensuring that work done independently is accurate and completed within prescribed time limits.

Digital Technology

Boilermakers may use digitized programmable equipment such as scientific calculators, digital levels and lasers. They may also use application equipment (e.g., robotics) and computer-controlled equipment such as welding overlays and computer numerical controlled (CNC) cutting machines. Boilermakers may use computer-assisted training tools such as on-line programs, simulators, or software packages for health and safety training. They may also use computer-aided design (CAD) software.

Continuous Learning

Technical upgrading is offered by companies when new products, procedures and equipment are introduced. Boilermakers may take courses on the job or at community colleges, or access on-line programs. However, one of the most practical ways for boilermakers to gain new expertise is to learn on the job from more experienced co-workers, mentors or supervisors. It is common for boilermakers to also have welding certification.

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 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:

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

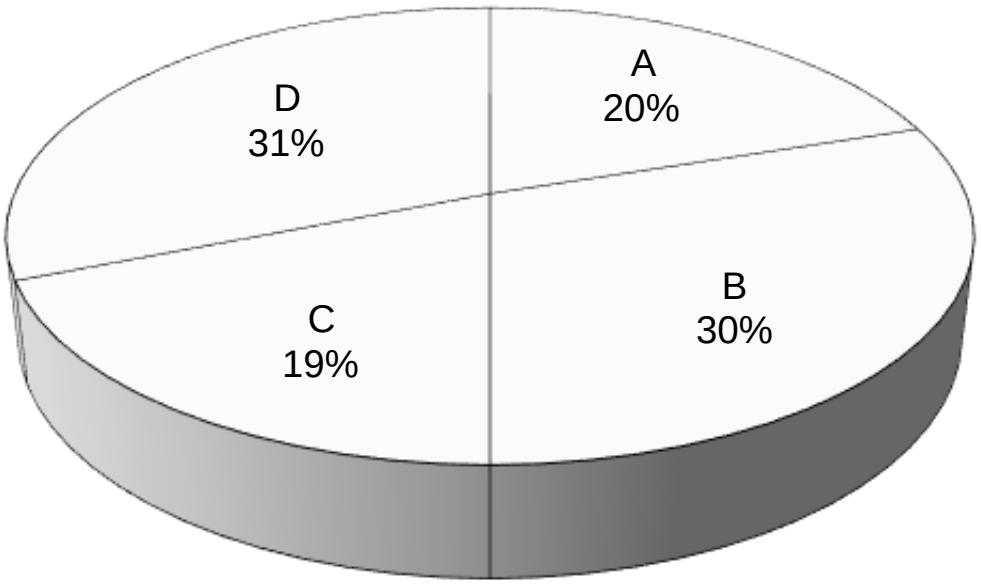
Industry Expected Performance

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 and Weightings



Major Work Activity	Percentage
A – Performs common occupational skills	20%
B – Performs rigging, hoisting and positioning	30%
C – Completes new construction	19%
D – Performs repairs, maintenance, upgrading and testing	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 120 questions.

Task Matrix and Weightings

Major Work Activity A – Performs common occupational skills 20%

Task A-1 Maintains safe and healthy workplace 17%	Sub-task A-1.01 Maintains safe work environment	Sub-task A-1.02 Uses personal protective equipment (PPE) and safety equipment	Sub-task A-1.03 Monitors confined spaces
	Sub-task A-1.04 Participates in healthy and respectful work environment		
Task A-2 Uses, inspects and maintains tools, equipment and work platforms 30%	Sub-task A-2.01 Uses hand, measuring and layout tools	Sub-task A-2.02 Uses power tools	Sub-task A-2.03 Uses shop equipment
	Sub-task A-2.04 Uses cutting and welding tools and equipment	Sub-task A-2.05 Uses hydraulic equipment and pneumatic tools and equipment	Sub-task A-2.06 Uses work platforms, scaffolding and access equipment
	Sub-task A-2.07 Uses mobile elevating work platforms (MEWP)		
Task A-3 Organizes work 17%	Sub-task A-3.01 Organizes project tasks and procedures	Sub-task A-3.02 Uses documents, drawings and specifications	Sub-task A-3.03 Handles materials and components
	Sub-task A-3.04 Demobilizes site		

Task A-4 Performs cutting and welding activities 36%	Sub-task A-4.01 Cuts material	Sub-task A-4.02 Prepares weld joints for fitting	Sub-task A-4.03 Fits weld joints
	Sub-task A-4.04 Performs tack welds	Sub-task A-4.05 Performs basic welding	Sub-task A-4.06 Performs advanced welding
Task A-5 Maintains continuous learning 0%	Sub-task A-5.01 Upskills in new trade practices and procedures	Sub-task A-5.02 Upskills in emerging technologies	
Task A-6 Uses communication and mentoring techniques 0%	Sub-task A-6.01 Uses communication techniques	Sub-task A-6.02 Uses mentoring techniques	

Major Work Activity B –Performs rigging, hoisting and positioning 30%

Task B-7 Plans lift 34%	Sub-task B-7.01 Determines load	Sub-task B-7.02 Performs pre-lift analysis	Sub-task B-7.03 Selects rigging, hoisting and positioning equipment
	Sub-task B-7.04 Secures lift area		
Task B-8 Rigs, hoists and positions load 52%	Sub-task B-8.01 Inspects rigging, hoisting and material handling equipment	Sub-task B-8.02 Fabricates rigging accessories and components	Sub-task B-8.03 Assembles rigging, hoisting and positioning equipment

	Sub-task B-8.04 Attaches rigging equipment to load	Sub-task B-8.05 Performs hoisting and positioning operations	Sub-task B-8.06 Secures load before rigging removal
Task B-9 Performs post-lift activities 14%	Sub-task B-9.01 Conducts post-lift inspection	Sub-task B-9.02 Disassembles rigging, hoisting and positioning equipment	Sub-task B-9.03 Maintains rigging, hoisting and positioning equipment

Major Work Activity C – Completes new construction 19%

Task C-10 Performs fabrication 33%	Sub-task C-10.01 Lays out components for fabrication	Sub-task C-10.02 Cuts components for fabrication	Sub-task C-10.03 Forms components for fabrication
	Sub-task C-10.04 Constructs components		
Task C-11 Assembles and fits vessels and components 44%	Sub-task C-11.01 Aligns vessels and components	Sub-task C-11.02 Fits vessels and components	
Task C-12 Fastens components 23%	Sub-task C-12.01 Bolts components	Sub-task C-12.02 Expands tubes	Sub-task C-12.03 Lays up fibreglass

Major Work Activity D – Performs repairs, maintenance, upgrading and testing 31%

Task D-13 Services vessels and components 64%	Sub-task D-13.01 Inspects vessels and components for defects	Sub-task D-13.02 Prepares vessels and components for servicing	Sub-task D-13.03 Repairs vessels and components
	Sub-task D-13.04 Performs preventative maintenance and upgrades	Sub-task D-13.05 Tests materials, vessels and components	
Task D-14 Removes vessels and components 36%	Sub-task D-14.01 Dismantles vessels and components	Sub-task D-14.02 Removes materials and components	

Harmonization of Apprenticeship Training

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

1. Trade Name

The official Red Seal name for this trade is Boilermaker.

2. Number of Levels of Apprenticeship

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

3. Total Training Hours

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
	Context	Context
	Safety and Health Related Functions	Safety and Health Related Functions
	Tools and Equipment and Work Platforms	Tools and Equipment and Work Platforms
	Communication and Mentoring	

Level 1	Level 2	Level 3
Safety and Health Related Functions 1.01 Maintains safe work environment 1.02 Uses PPE and safety equipment 1.03 Monitors confined spaces 1.04 Participates in healthy and respectful workplace		
Tools, Equipment and Work Platforms 2.01 Uses hand, measuring and layout tools 2.02 Uses power tools 2.03 Uses shop equipment 2.04 Uses cutting and welding tools and equipment 2.05 Uses hydraulic and pneumatic tools and equipment 2.06 Uses work platforms, scaffolding and access equipment 2.07 Uses mobile elevating work platforms (MEWP)	**Tools, Equipment and Work Platforms** 2.02 Uses power tools 2.03 Uses shop equipment 2.04 Uses cutting and welding tools and equipment 2.05 Uses hydraulic and pneumatic tools and equipment 2.06 Uses work platforms, scaffolding and access equipment 2.07 Uses mobile elevating work platforms (MEWP)	**Tools, Equipment and Work Platforms** 2.02 Uses power tools 2.03 Uses shop equipment 2.04 Uses cutting and welding tools and equipment 2.05 Uses hydraulic and pneumatic tools and equipment 2.06 Uses work platforms, scaffolding and access equipment 2.07 Uses mobile elevating work platforms (MEWP)
Organizes Work 3.01 Organizes project tasks and procedures 3.02 Uses documents, drawings and specifications 3.03 Handles materials and components 3.04 Demobilizes site	**Organizes Work** 3.01 Organizes project tasks and procedures 3.02 Uses documents, drawings and specifications 3.03 Handles materials and components	**Organizes Work** 3.01 Organizes project tasks and procedures 3.02 Uses documents, drawings and specifications 3.03 Handles materials and components

Level 1	Level 2	Level 3
Cutting and Welding Activities 4.01 Cuts materials 4.02 Prepares weld joints for fitting. 4.03 Fits weld joints 4.04 Performs tack welds 4.05 Performs basic welding	**Cutting and Welding Activities** 4.01 Cuts materials 4.02 Prepares weld joints for fitting 4.03 Fits weld joints 4.05 Performs basic welding	**Cutting and Welding Activities** 4.02 Prepares weld joints for fitting 4.03 Fits weld joints 4.05 Performs basic welding 4.06 Performs advanced welding
		Continuous Learning 5.01 Upskills in new trade practices and procedures 5.02 Upskills in emerging technology
Communication Techniques 6.01 Uses communication techniques		**Communication and Mentoring Techniques** 6.01 Uses communication techniques 6.02 Uses mentoring techniques
Lift Planning 7.01 Determines load 7.03 Selects rigging, hoisting and positioning equipment 7.04 Secures lift area	**Lift Planning** 7.01 Determines load 7.03 Selects rigging, hoisting and positioning equipment	**Lift Planning** 7.01 Determines load 7.02 Performs pre-lift analysis 7.03 Selects rigging, hoisting and positioning equipment

Level 1	Level 2	Level 3
Rigging, Hoisting and Positioning Loads 8.01 Inspects rigging, hoisting and positioning equipment 8.04 Attaches rigging equipment to load 8.05 Performs hoisting and positioning operations	**Rigging, Hoisting and Positioning Loads** 8.01 Inspects rigging, hoisting and positioning equipment 8.03 Assembles rigging, hoisting and positioning equipment 8.04 Attaches rigging equipment to load 8.05 Performs hoisting and positioning operations 8.06 Secure load before rigging removal	**Rigging, Hoisting and Positioning Loads** 8.02 Fabricates rigging accessories and components 8.03 Assembles rigging, hoisting and positioning equipment 8.05 Performs hoisting and positioning operations
Post-Lift Activities 9.01 Conducts post-lift inspection 9.02 Disassembles rigging, hoisting and positioning equipment 9.03 Maintains rigging, hoisting and positioning equipment	**Post-Lift Activities** 9.01 Conducts post-lift inspection 9.02 Disassembles rigging, hoisting and positioning equipment	**Post-Lift Activities** 9.02 Disassembles rigging, hoisting and positioning equipment
Fabrication 10.01 Lays out components for fabrication 10.02 Cuts components for fabrication 10.04 Constructs components	**Fabrication** 10.01 Lays out components for fabrication 10.02 Cuts components for fabrication 10.03 Forms components for fabrication 10.04 Constructs components	**Fabrication** 10.01 Lays out components for fabrication 10.03 Forms components for fabrication 10.04 Constructs components

Level 1	Level 2	Level 3
Vessels and Components (Introduction) 11.02 Prepares vessels and components for servicing	**Vessels and Components (Assemble and Fit)** 11.01 Aligns vessels and components 11.02 Fits vessels and components	**Vessels and Components (Assemble and Fit)** 11.01 Aligns vessels and components 11.02 Fits vessels and components
Fastens Components 12.01 Bolts components	**Fastens Components** 12.01 Bolts components 12.02 Expands tubes 12.03 Lays up fibreglass	**Fastens Components** 12.02 Expands tubes
	Vessels and Components (Service) 13.01 Inspects vessels and components for defects 13.02 Prepares vessels and components for servicing 13.03 Repairs vessels and components 13.04 Performs preventative maintenance and upgrades 13.05 Tests materials, vessels and components	**Vessels and Components (Service)** 13.02 Prepares vessels and components for servicing 13.03 Repairs vessels and components 13.04 Performs preventative maintenance and upgrades 13.05 Tests materials, vessels and components
	Vessels and Components (Removal) 14.01 Dismantles vessels and components 14.02 Removes materials and components	**Vessels and Components (Removal)** 14.01 Dismantles vessels and components 14.02 Removes materials and components

Major Work Activity A – Performs common occupational skills

Task A-1 Maintains safe and healthy workplace

Task Descriptor

Maintaining a safe work environment is the responsibility of all workers. Boilermakers must be familiar with the care and use of personal protective equipment (PPE) and safety equipment. Specialized safety training is integral to performing many work functions.

Boilermakers must monitor confined spaces to ensure the safety of workers doing repairs or construction. They must participate in ensuring a healthy and inclusive workplace.

A-1.01 Maintains safe work environment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.01.01P	participate in site orientation and safety training	site orientation and safety training is completed
A-1.01.02P	identify location of Workplace Hazardous Materials Information System (WHMIS) documentation	WHMIS documentation is located, and directions on Safety Data Sheets (SDS) are followed
A-1.01.03P	identify and report unsafe conditions and **hazards**	unsafe conditions and **hazards** are reported to supervisor and Health and Safety Representative, and documented according to jurisdictional regulations, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-1.01.04P	review Job Safety Analysis (JSA)	JSA is reviewed, **hazards** are understood and controls are put in place according to site-specific requirements, company policies and procedures, and jurisdictional regulations
A-1.01.05P	participate in daily safety (toolbox) talks	safety (toolbox) meetings and discussions are participated in to ensure information is understood, shared and documented
A-1.01.06P	complete **safety analysis cards**	**safety analysis cards** are completed daily to document tasks to be performed, risks involved and mitigation strategies according to site-specific requirements, and company policies and procedures
A-1.01.07P	execute hazard mitigation strategies	hazard mitigation strategies are executed according to **safety analysis cards** to prevent personal injuries
A-1.01.08P	identify ventilation requirements and select **ventilation equipment**	ventilation requirements are identified and **ventilation equipment** is selected according to task and site-specific requirements
A-1.01.09P	set up **work environment protection**	**work environment protection** is set up according to site-specific requirements and task
A-1.01.10P	perform housekeeping tasks	housekeeping tasks are performed to prevent tripping hazards, falling objects and slips according to site-specific requirements, and company policies and procedures
A-1.01.11P	reference **safety regulations**	**safety regulations** are adhered to by workers on site according to jurisdictional regulations
A-1.01.12P	installs locks, blinds and tags	locks, blinds and tags are installed according to safety regulations, site-specific policies, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-1.01.13P	handle and store **hazardous materials**	**hazardous materials** are handled and stored according to WHMIS and site-specific policies
A-1.01.14P	perform spotter duties	spotter duties are performed when operating and transporting mobile equipment on site according to site-specific requirements, company policies and procedures, and jurisdictional regulations
A-1.01.15P	perform spark watch	spark watch is performed during and after **hot work** according to task, site-specific requirements, company policies and procedures, and jurisdictional regulations
A-1.01.16P	monitor supplied breathing air	supplied breathing air is monitored to maintain uninterrupted supply according to company policies and procedures, and jurisdictional regulations
A-1.01.17P	coordinate tasks with other workers	tasks with other workers are coordinated to avoid injury to self and others

Range of Variables (include, but not limited to)

hazards: fire, electrical shocks, heat exposure, gaseous environment, flying debris, arc flashes, plant operations, mobile equipment on site, overhead cranes, spills, heavy metal particulates, chromium, manganese, vanadium, asbestos, radiation, reactive chemicals, hazardous gases

safety analysis cards: field-level risk assessment (FLRA), pre-safety inspection (PSI), lift plans, hazard assessments (HA)

ventilation equipment: air movers, fans, smoke busters

work environment protection: hoarding, fire blankets, flash screens, barrier tape, barriers, lockouts, high lines, guard rails, mesh/netting

safety regulations: lock-out and tag-out, jurisdictional Occupational Health and Safety (OHS), site-specific, Transportation of Dangerous Goods (TDG), WHMIS

hazardous materials: asbestos, silica, ceramic fibers, lead, chromium, combustible materials, solvents, acids, oxidizers, pressurized gases

hot work: welding, burning, grinding, air-arc gouging

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.01.01L	demonstrate knowledge of processes to maintain safe work environment
a.	describe company safety policies and procedures
b.	identify **work environment protection** used to maintain safe work environment, and describe procedures for use
c.	identify common causes of accidents and worksite **hazards**, and describe procedures to mitigate and eliminate potential risks
d.	describe procedures to handle, store, transport, safely dispose of or recycle **hazardous materials**
e.	describe fundamentals of housekeeping
f.	describe procedures to inspect work environment
A-1.01.02L	demonstrate knowledge of documentation pertaining to workplace safety
a.	identify JSA, and describe purpose and application
b.	identify safe work permit requirements
c.	identify **safety analysis cards**, and describe their purpose and application
A-1.01.03L	demonstrate knowledge of workplace **hazards**
a.	identify workplace **hazards**
b.	identify classes of fires, and describe procedures to select and use fire-extinguishing equipment
A-1.01.04L	demonstrate knowledge of training and certification requirements to maintain safe work environment
a.	identify training and certification requirements to maintain safe work environment
A-1.01.05L	demonstrate knowledge of regulatory requirements pertaining to maintaining safe work environment
a.	identify jurisdictional health and **safety regulations**, and acts pertaining to maintaining safe work environment
A-1.01.06L	demonstrate knowledge of environmental regulations and considerations pertaining to maintaining safe work environment
a.	identify environmental regulations and considerations when maintaining safe work environment

Range of Variables (include, but not limited to)

work environment protection: hoarding, fire blankets, flash screens, barrier tape, barriers, lockouts, high lines, guard rails, mesh/netting

hazards: fire, electrical shocks, heat exposure, gaseous environment, flying debris, arc flashes, plant operations, mobile equipment on site, overhead cranes, spills, heavy metal particulates, chromium, manganese, vanadium, asbestos, radiation, reactive chemicals, hazardous gases

hazardous materials: asbestos, silica, ceramic fibers, lead, chromium, combustible materials, solvents, acids, oxidizers, pressurized gases

safety analysis cards: FLRA, PSI, lift plans, HA

safety regulations: lock-out and tag-out, OHS, site-specific, TDG, WHMIS

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	yes	yes	yes	yes	yes	yes	ND	ND	ND

Skills

Reference Code	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 task, training, company policies and procedures, and jurisdictional regulations
A-1.02.02P	inspect PPE and safety equipment	PPE and safety equipment are inspected before each use to verify operating condition, and to ensure they are free from damage according to manufacturers' specifications, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-1.02.03P	install or set up safety equipment	safety equipment is installed or set up according to manufacturers' and engineering specifications, site-specific requirements, company policies and procedures, and jurisdictional regulations
A-1.02.04P	store PPE and safety equipment	PPE and safety equipment are stored according to manufacturers' specifications, company policies and procedures, and jurisdictional regulations

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.02.01L	demonstrate knowledge of PPE and safety equipment, and their characteristics, limitations and applications
a.	identify types of PPE and safety equipment, and describe their characteristics, limitations and applications
A-1.02.02L	demonstrate knowledge of procedures to use PPE and safety equipment
a.	identify **hazards**, and describe safe work practices pertaining to using PPE and safety equipment
b.	describe PPE and safety equipment operations
c.	describe procedures to select, fit and inspect PPE
d.	identify manufacturers' specifications pertaining to use of PPE and safety equipment
A-1.02.03L	demonstrate knowledge of legislation and regulations pertaining to PPE and safety equipment
a.	identify and describe workplace safety and health regulations related to use of PPE and safety equipment

Range of Variables (include, but not limited to)

hazards: sparks, working at heights, excessive noise, gaseous environments

A-1.03 Monitors confined spaces

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.03.01P	obtain and verify entry permit	entry permit is obtained and verified prior to personnel entering confined space according to site-specific requirements, jurisdictional regulations, and company policies and procedures
A-1.03.02P	complete initial atmospheric testing and review results	initial atmospheric testing is completed and results are reviewed according to site-specific requirements, jurisdictional regulations and company policies and procedures
A-1.03.03P	document personnel entering and exiting confined spaces, and verify that they are wearing PPE	personnel entering and exiting confined spaces are documented, and verified for PPE according to entry permit
A-1.03.04P	maintain constant contact with personnel in confined spaces	constant contact with personnel in confined spaces is maintained using various **methods** according to task, site-specific requirements, jurisdictional regulations, and company policies and procedures
A-1.03.05P	monitor and document atmospheric conditions of confined spaces	atmospheric conditions of confined spaces are monitored and documented according to entry permit
A-1.03.06P	recognize and report emergency situations to emergency personnel	emergency situations are recognized and reported to emergency personnel according to situation and site policy

Reference Code	Performance Criteria	Evidence of Attainment
A-1.03.07P	direct evacuation of confined spaces	evacuation of confined spaces is directed according to site-specific requirements, and company policies and procedures
A-1.03.08P	secure confined space during inactivity	confined space is secured during inactivity according to site policy, and company policies and procedures

Range of Variables (include, but not limited to)

methods: two-way radios, line-of-sight, verbal communication, air horns

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.03.01L	demonstrate knowledge of confined spaces
a.	define confined spaces
b.	identify **locations** requiring monitoring of confined spaces
c.	identify **hazardous gases** in confined space environment
d.	describe site-specific requirements for monitoring confined spaces
A-1.03.02L	demonstrate knowledge of procedures to monitor and secure confined spaces
a.	identify **confined space monitoring equipment**, and describe their characteristics and applications
b.	identify potential **hazards of confined spaces**
c.	describe **considerations to preplan** confined space entry
d.	describe de-energization and lock-out procedures
e.	describe confined space rescue plans and procedures
f.	describe **methods** to maintain constant contact with personnel in confined spaces
g.	identify procedures used to secure confined spaces during inactivity
A-1.03.03L	demonstrate knowledge of first aid training and certification requirements pertaining to confined space entry

Reference Code	Learning Outcomes and Objectives
	a. identify first aid training and certification requirements pertaining to confined space entry
A-1.03.04L	demonstrate knowledge of legislation and regulations pertaining to confined space entry
	a. identify and describe legislation and regulations pertaining to confined space entry

Range of Variables (include, but not limited to)

locations: vessels, trenches, boilers, tanks, duct work, precipitators, stacks, towers
hazardous gases: chlorine, carbon monoxide, hydrogen sulfide, nitrogen, argon, oxygen, acetylene, propane, sulphur dioxide
confined space monitoring equipment: air horns, radios, flashlights, identification vests, gas monitors
hazards of confined spaces: hazardous atmosphere, lack of ventilation, sludge in confined space, exceeding lower and upper explosive limits, presence of toxic or flammable material, falling hazards, excessive noise, electrical hazards, radioactive material, engulfment, physical hazards, lighting
considerations to preplan: atmospheric testing and monitoring procedures, PPE and safety equipment, ground-fault interrupters, explosion-proof lighting, rescue plan and equipment
methods: two-way radios, line-of-sight, verbal communication, air horns

A-1.04 Participates in healthy and respectful work environment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-1.04.01P	perform self-assessment of physical and mental health	self-assessment of physical and mental health is performed, and signs and symptoms of fatigue and stress are identified

Reference Code	Performance Criteria	Evidence of Attainment
A-1.04.02P	identify **supports and resources** for personal mental health	**supports and resources** for personal mental health are identified
A-1.04.03P	identify **techniques to manage health and wellness**	**techniques to manage health and wellness** are identified
A-1.04.04P	create plan identifying **demands of the trade** to manage work-life balance	plan identifying **demands of the trade** is created to manage work-life balance

Range of Variables (include, but not limited to)

supports and resources: professional networks and associations, collaboration with colleagues and community members, counselling, mentoring, peer support groups

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

demands of the trade: long hours, extensive travel, away from home, working conditions, financial inconsistency, support systems

Knowledge

Reference Code	Learning Outcomes and Objectives
A-1.04.01L	demonstrate knowledge of personal health and well-being
a.	describe how personal health and well-being impacts professional practice and healthy work environments
b.	identify and describe physical and emotional requirements of trade
c.	identify workplace stressors
d.	describe elements of healthy organizational cultures and importance of sense of collaboration and community
e.	identify **behaviours** that affect physical and mental health
A-1.04.02L	demonstrate knowledge of **techniques to manage health and wellness**
a.	describe stress and time management techniques
b.	describe **techniques to manage health and wellness**
A-1.04.03L	demonstrate knowledge of professionalism and **professional ethics**
a.	identify characteristics and purpose of professionalism and **professional ethics**

Reference Code	Learning Outcomes and Objectives
	b. describe **factors** that impact professionalism
	c. identify **elements of codes of ethics, codes of conduct and other professional standards**, and describe their characteristics and applications

Range of Variables (include, but not limited to)

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

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

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

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

elements of codes of ethics, codes of conduct and other professional standards: professional obligations, how to engage in the practice in a professional way, signals accountability to the public, maintain public trust and credibility of the profession, defines misconduct, support and promote anti-harassment and anti-discrimination practices

Task A-2 Uses, inspects and maintains tools, equipment and work platforms

Task Descriptor

Boilermakers must use, inspect and maintain hand, power, shop, cutting and welding, and hydraulic and pneumatic tools and equipment in order to perform the duties of the trade. Boilermakers may work at heights necessitating the set-up, operation and maintenance of work platforms and access equipment.

A-2.01 Uses hand, measuring and layout tools

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.01.01P	select and use hand, measuring and layout tools	hand, measuring and layout tools are selected and used according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.01.02P	identify, tag and remove from service worn, damaged and defective hand, measuring and layout tools	worn, damaged, or defective hand, measuring and layout tools are identified, tagged, and removed from service and repaired or replaced according to manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.01.03P	sharpen chisels, wedges, chipping hammers, prick punches and centre punches	chisels, wedges, chipping hammers, prick punches and centre punches are sharpened according to manufacturers' specifications
A-2.01.04P	change worn or dull **components**	worn or dull **components** are changed according to task, manufacturers' specifications and site-specific requirements

Reference Code	Performance Criteria	Evidence of Attainment
A-2.01.05P	clean, maintain and store hand, measuring and layout tools	hand, measuring and layout tools are cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

components: blades, thread taps and dies

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.01.01L	demonstrate knowledge of hand, measuring and layout tools, their characteristics and applications
a.	identify types of hand, measuring and layout tools, and describe their characteristics and applications
b.	describe operating principles of hand, measuring and layout tools
c.	interpret information pertaining to hand, measuring and layout tools found in manufacturers' specifications
A-2.01.02L	demonstrate knowledge of procedures to use and maintain hand, measuring and layout tools
a.	identify **hazards**, and describe safe work practices pertaining to using and maintaining hand, measuring and layout tools
b.	describe procedures to use hand, measuring and layout tools
c.	describe procedures used to inspect and tag hand, measuring and layout tools
d.	identify defects and criteria for replacement, repair or removal of hand, measuring and layout tools
e.	describe setup of transits
f.	describe process to transfer elevation points using water level
g.	identify precision tools that require third-party calibration and documents
h.	describe procedure to use hand threading equipment for production and repair of internal and external threads

Reference Code	Learning Outcomes and Objectives
	i. describe process of precision measuring using micrometer (metric and imperial)
	j. describe procedures to clean, maintain and store hand, measuring and layout tools
	k. describe procedures to dispose of damaged hand, measuring and layout tools

Range of Variables (include, but not limited to)

hazards: flying debris, pinch/crush points, dropped tools, cuts, punctures, overexertion, struck by tools

A-2.02 Uses power tools

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.02.01P	select and use power tools and their **components**	power tools and their **components** are selected and used according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.02.02P	identify, tag and remove from service worn, damaged and defective power tools and their **components**	damaged, worn or defective power tools and their **components** are identified, tagged, and removed from service and replaced according to jurisdictional regulations, manufacturers' specifications, site-specific requirements, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.02.03P	change worn or dull **components**	worn or dull **components** are changed according to manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.02.04P	clean, maintain and store power tools	power tools are cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

components: blades, bits, taps and dies

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.02.01L	demonstrate knowledge of power tools and **components**, their characteristics and applications
a.	identify types of power tools, and **components**, and describe their characteristics and applications
b.	describe operating principles of power tools and **components**
c.	interpret information pertaining to power tools and **components** found in manufacturers' specifications
A-2.02.02L	demonstrate knowledge of procedures to use and maintain power tools and **components**
a.	identify **hazards**, and describe safe work practices pertaining to using and maintaining power tools and **components**
b.	describe procedures to use power tools and **components**
c.	describe procedures used to inspect and tag power tools and **components**
d.	identify **defects** and criteria for replacement, repair or removal of power tools and **components**
e.	describe **applications of grinders**
f.	describe installation procedures for grinding discs or stones

Reference Code	Learning Outcomes and Objectives
	g. describe use of power threading equipment for production and repair of internal and external threads
	h. describe procedures to clean, maintain and store power tools and **components**
	i. describe procedures to dispose of damaged power tools and **components**

Range of Variables (include, but not limited to)

components: blades, bits, taps and dies

hazards: electrical faults, pinch points, projectiles, improper grinding disc selection, toxic coatings

defects: cut cords, breaks, burns, bends

applications of grinders: clean torch-cut edges, remove tacks/burrs, cut material, wire brush (e.g., to remove layers of paint, rust), regrind chisels and punches

A-2.03 Uses shop equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.03.01P	select and use shop equipment and their **components**	shop equipment and their **components** are selected and used according to task, manufacturers' specifications, site-specific requirements, jurisdictional regulations and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.03.02P	identify, tag and remove from service worn, damaged and defective shop equipment	damaged, worn or defective shop equipment is identified, tagged, and removed from service and replaced according to manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.03.03P	change damaged, worn or dull **components**	damaged, worn or dull **components** are changed according to manufacturers' specifications and site-specific requirements
A-2.03.04P	monitor shop equipment	shop equipment is monitored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.03.05P	top up fluids for shop equipment	fluids for shop equipment are topped up according to manufacturers' specifications
A-2.03.06P	clean, lubricate and adjust shop equipment	shop equipment is cleaned, lubricated and adjusted according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

components: blades, dies, grinding wheels, stones, safety guards

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.03.01L	demonstrate knowledge of shop equipment, their characteristics and applications
a.	identify types of shop equipment, and describe their characteristics and applications
b.	describe operating principles of shop equipment

Reference Code	Learning Outcomes and Objectives
	c. interpret information pertaining to shop equipment found in manufacturers' specifications
A-2.03.02L	demonstrate knowledge of procedures to use and maintain shop equipment
	a. identify **hazards**, and describe safe work practices pertaining to using and maintaining shop equipment
	b. describe procedures to use shop equipment, and **components**
	c. describe procedures used to inspect and tag shop equipment
	d. identify **defects** and criteria for replacement, repair and locking out shop equipment
	e. describe power roll operations, and identify calculations for forming
	f. describe roll and press brake capacity and allowances, and proper direction to roll or bend
	g. describe power press brake operations for forming
	h. describe methods of positioning dies for specific operations
	i. describe procedures to clean, maintain and store shop equipment and **components**
	j. describe procedures to dispose of damaged shop tools and **components**
	k. describe disposal requirements for **shop fluids**

Range of Variables (include, but not limited to)

hazards: hydraulic/pneumatic line ruptures, electrical faults, pinch points, projectiles, moving materials, cuts

components: blades, dies, grinding wheels, stones, safety guards

defects: broken, cracked or jammed blades, brakes, gears and punches

shop fluids: cutting fluid, hydraulic fluids, other common chemicals

A-2.04 Uses cutting and welding tools and equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.04.01P	select and inspect cutting and welding tools and equipment	cutting and welding tools and equipment are selected and inspected according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.04.02P	identify, tag and remove from service worn, damaged and defective cutting and welding tools and equipment	worn, damaged and defective cutting and welding tools and equipment are identified, tagged, and removed from service and replaced or repaired according to manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.04.03P	change worn or consumed **components**	worn or consumed **components** are changed according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.04.04P	inspect hoses, cables, connectors and ground clamps	hoses, cables, connectors and ground clamps are inspected for **defects** according to manufacturers' specifications, industry standards, and company policies and procedures
A-2.04.05P	repair defective hoses, cables, connectors and ground clamps	defective hoses, cables, connectors and ground clamps are repaired according to manufacturers' specifications, site-specific requirements, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.04.06P	use cutting and welding tools and equipment	cutting and welding tools and equipment are used according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.04.07P	clean, maintain and store cutting and welding tools and equipment	cutting and welding tools and equipment are cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

components: cutting and heating tips, electrode holders, collets, gas lenses, hoses, cables, gases, welding/cutting lenses

defects: cuts, breaks, burns

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.04.01L	demonstrate knowledge of cutting and welding tools and equipment, their characteristics and applications
a.	identify types of cutting and welding tools and equipment, and describe their characteristics and applications
b.	identify types of cutting processes, and describe their characteristics and applications
c.	identify types of welding processes, and describe their characteristics and applications
d.	describe operating principles of cutting and welding tools and equipment
e.	interpret information pertaining to cutting and welding tools and equipment found in manufacturers' specifications
A-2.04.02L	demonstrate knowledge of procedures to use and maintain cutting and welding tools and equipment
a.	identify **hazards**, and describe safe work practices pertaining to using and maintaining cutting and welding tools and equipment

Reference Code	Learning Outcomes and Objectives
b.	describe procedures used to inspect and tag cutting and welding tools and equipment
c.	identify **defects** and criteria for replacement, repair or removal of cutting and welding tools and equipment
d.	describe procedures to use cutting and welding tools and equipment
e.	describe procedures to clean, maintain and store cutting and welding tools and equipment
f.	describe procedures to dispose of damaged cutting and welding tools and equipment
A-2.04.03L	demonstrate knowledge of certification requirements
a.	identify certification requirements for cutting and welding tools and equipment

Range of Variables (include, but not limited to)

hazards: burns, fume and particulates inhalation, explosions, radiation exposure, suffocation

defects: cuts, breaks, burns

A-2.05 Uses hydraulic and pneumatic tools and equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.05.01P	select and inspect hydraulic and pneumatic tools and equipment	hydraulic and pneumatic tools and equipment are selected and inspected according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.05.02P	identify, tag and remove from service worn, damaged and defective hydraulic and pneumatic tools and equipment	damaged, worn or defective hydraulic and pneumatic tools and equipment are identified, tagged, and removed from service and replaced according to jurisdictional regulations, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.05.03P	top up fluids for hydraulic equipment	fluids for hydraulic equipment are topped up according to manufacturers' specifications
A-2.05.04P	lubricate pneumatic equipment	pneumatic equipment is lubricated according to manufacturers' specifications
A-2.05.05P	use hydraulic and pneumatic equipment	hydraulic equipment is used according to task and manufacturers' specifications
A-2.05.06P	clean, maintain and store hydraulic and pneumatic tools and equipment	hydraulic and pneumatic tools and equipment is cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.05.01L	demonstrate knowledge of hydraulic and pneumatic tools and equipment, their characteristics and applications
a.	identify types of hydraulic and pneumatic tools and equipment, and describe their characteristics and applications
b.	describe operating principles of hydraulic and pneumatic tools and equipment
c.	interpret information pertaining to hydraulic and pneumatic tools and equipment found in manufacturers' specifications

Reference Code	Learning Outcomes and Objectives
A-2.05.02L	demonstrate knowledge of procedures to use and maintain hydraulic and pneumatic tools and equipment
a.	identify **hazards**, and describe safe work practices pertaining to using and maintaining hydraulic and pneumatic tools and equipment
b.	describe procedures to use hydraulic and pneumatic tools and equipment
c.	describe procedures used to inspect and tag hydraulic and pneumatic tools and equipment
d.	identify criteria for replacement, repair or removal of hydraulic and pneumatic tools and equipment
e.	describe procedures to clean, maintain and store hydraulic and pneumatic tools and equipment
f.	describe procedures to dispose of damaged hydraulic and pneumatic tools and equipment
g.	describe procedures to dispose of hydraulic fluids
A-2.05.03L	demonstrate knowledge of certification requirements pertaining to hydraulic and pneumatic tools and equipment
a.	identify certification requirements to use hydraulic and pneumatic tools and equipment
A-2.05.04L	demonstrate knowledge of regulatory requirements pertaining to hydraulic and pneumatic tools and equipment
a.	identify codes, standards and regulations pertaining to hydraulic and pneumatic tools and equipment

Range of Variables (include, but not limited to)

hazards: airline rupture, hydraulic line ruptures, electrical faults, pinch points, projectiles

A-2.06 Uses work platforms, scaffolding, and access equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.06.01P	select and use work platforms scaffolding and access equipment	work platforms, scaffolding and access equipment are selected and used according to task, manufacturers' specifications, jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.02P	create, interpret and follow scaffold tags	scaffold tags are created, interpreted and followed to assess whether scaffolding is ready and safe for use and to determine fall arrest requirements according to jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.03P	install and alter scaffolding	scaffold components are assembled and altered according to task, manufacturers' specifications, jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.04P	dismantle work platforms, scaffolding and access equipment	work platforms, scaffolding and access equipment are dismantled in sequence according to task, manufacturers' specifications, jurisdictional regulations, site-specific requirements, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.06.05P	secure work platforms, scaffolding and access equipment	work platforms, scaffolding and access equipment are secured according to jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.06P	assemble swing stages and bosun's chairs	swing stages and bosun's chairs are assembled according to manufacturers' and engineered specifications, and jurisdictional regulations
A-2.06.07P	install lifelines for bosun's chairs and swing stages	lifelines are installed for bosun's chairs and swing stages to secure anchor point according to engineered specifications
A-2.06.08P	install **safety features**	**safety features** are installed according to task, manufacturers' and engineered specifications, jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.09P	identify, tag and remove from service worn, damaged and defective work platforms, scaffolding and access equipment	worn, damaged and defective work platforms, scaffolding and access equipment are identified, tagged and removed from service according to jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.06.10P	clean, maintain and store work platforms, scaffolding and access equipment	work platforms, scaffolding and access equipment are cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

safety features: toe boards, guard rails, guy wires, fall protection equipment, safety gates, mesh/netting

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.06.01L	demonstrate knowledge of work platforms, scaffolding and access equipment, their characteristics and applications
a.	identify types of work platforms, scaffolding and access equipment, and describe their characteristics and applications
b.	describe operating principles of work platforms, scaffolding and access equipment
c.	interpret information pertaining to work platforms, scaffolding and access equipment found in manufacturers' specifications
A-2.06.02L	demonstrate knowledge of procedures to erect, use, maintain and dismantle work platforms, scaffolding and access equipment
a.	identify **hazards** and describe safe work practices pertaining to using and maintaining work platforms, scaffolding and access equipment
b.	describe procedure to set-up work platforms, scaffolding and access equipment
c.	describe procedures to erect and dismantle work platforms, scaffolding and access equipment
d.	describe procedures to use work platforms, scaffolding and access equipment
e.	describe procedures used to inspect and tag worn, damaged and defective work platforms, scaffolding and access equipment
f.	identify defects and criteria for replacement, repair or removal of work platforms, scaffolding and access equipment
g.	describe procedures to clean, maintain and store work platforms, scaffolding and access equipment
h.	describe procedures to dispose of damaged work platforms, scaffolding and access equipment
A-2.06.03L	demonstrate knowledge of certification requirements pertaining to work platforms, scaffolding and access equipment
a.	identify certification requirements to select, erect, install, alter, use and dismantle work platforms, scaffolding and access equipment
A-2.06.04L	demonstrate knowledge of regulatory requirements pertaining to work platforms, scaffolding and access equipment
a.	identify codes, standards and regulations pertaining to work platforms, scaffolding and access equipment

Range of Variables (include, but not limited to)

hazards: electrocution, toxic fumes, falls, burns, fire, confinement, overhead obstruction, access and egress

A-2.07 Uses mobile elevating work platforms (MEWP)

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-2.07.01P	assess work site environment	ground conditions are assessed, load ratings are adhered to, electrical and overhead hazards are identified, and corrective measures are taken according to jurisdictional regulations, site-specific requirements, and company policies and procedures
A-2.07.02P	select and use **mobile elevating work platforms (MEWPs)**	**MEWPs** are selected and used according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.07.03P	inspect **MEWPs**	**MEWPs** are inspected to verify **components** and their operation according to manufacturers' specifications, industry standards, and company policies and procedures
A-2.07.04P	attach safety harnesses and complete inspection	safety harnesses are attached to anchor points and inspection is completed on **MEWPs** according to manufacturers' specifications, site specific requirements, and company policies and procedures

Reference Code	Performance Criteria	Evidence of Attainment
A-2.07.05P	identify, tag and remove from service worn, damaged and defective **MEWPs**	worn, damaged and defective **MEWPs** are identified, tagged and removed from service according to jurisdictional regulations, manufacturers' specifications, site-specific requirements, and company policies and procedures
A-2.07.06P	clean, maintain and store **MEWPs**	**MEWPs** are cleaned, maintained and stored according to task, manufacturers' specifications, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

MEWPs: scissor lifts, telescoping and articulating boom lifts

components: hoses, tires, fluid levels, controls, motors, cables, lifelines, rigging attachments, safety netting

Knowledge

Reference Code	Learning Outcomes and Objectives
A-2.07.01L	demonstrate knowledge of **MEWPs**, their characteristics and applications
a.	identify types of **MEWPs,** and describe their characteristics and applications
b.	describe operating principles of **MEWPs**
c.	interpret information pertaining to **MEWPs** found in manufacturers' specifications
A-2.07.02L	demonstrate knowledge of procedures to use and maintain **MEWPs**
a.	identify **hazards**, and describe safe work practices pertaining to using and maintaining **MEWPs**
b.	describe procedures to operate **MEWPs**
c.	identify and describe use of anchor points
d.	identify work site environment conditions and their impact on **MEWPs** setup and operation
e.	describe rescue plan and back-up features for **MEWPs** operation failure
f.	inspect and tag **MEWPs**

Reference Code	Learning Outcomes and Objectives
g.	identify defects and criteria for replacement, repair or removal of **MEWPs**
h.	describe procedures to clean, maintain and store **MEWPs**
i.	describe procedures to dispose of damaged **MEWPs**
A-2.07.03L	demonstrate knowledge of certification requirements pertaining to **MEWPs**
a.	identify certification requirements to use **MEWPs**
A-2.07.04L	demonstrate knowledge of regulatory requirements pertaining to **MEWPs**
a.	identify codes, standards and regulations pertaining to **MEWPs**

Range of Variables (include, but not limited to)

MEWPs: scissor lifts, telescoping and articulating boom lifts
hazards: tipping, crush/pinch points, equipment overloaded, electrocution, injuries from equipment, falls from heights, unstable and changing ground conditions, environmental conditions

Task A-3 Organizes work

Task Descriptor

In order to organize their work, boilermakers must be able to use documents and drawings to retrieve information and visualize the information in three dimensions. Proper handling and identification of materials is important to ensure that all required material is well-organized and available for the job completion. Boilermakers handle materials and components using material handling equipment for smaller items and rigging, hoisting and positioning equipment for larger items. The skills and knowledge for rigging, hoisting and positioning equipment are under Major Work Activity B.

A-3.01 Organizes project tasks and procedures

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.01.01P	identify activities of project	project activities are identified according to job scope
A-3.01.02P	identify material requirements	material requirements are identified according to job specifications and **quality control documents**
A-3.01.03P	prioritize sequence of activities in operation	sequence of activities in operation are prioritized according to timelines, and availability of **materials**, **tools and equipment**
A-3.01.04P	coordinate tasks with co-workers and other trades	tasks are coordinated with co-workers and other trades according to job scope
A-3.01.05P	set up work areas, **materials**, **tools and equipment**	work areas, **materials**, **tools and equipment** are set up according to plans, procedures and job scope
A-3.01.06P	adapt to changing **job conditions**	changing **job conditions** are identified and measures are taken to complete tasks

Reference Code	Performance Criteria	Evidence of Attainment
A-3.01.07P	estimate time requirement to complete each task	time requirement to complete each task is estimated
A-3.01.08P	complete and interpret **permits**	**permits** required for tasks are completed and interpreted according to site policies and jurisdictional regulations
A-3.01.09P	inspect and inventory **materials**, **tools and equipment**	**materials**, **tools and equipment** are inspected and inventoried according to site and company policies and jurisdictional regulations
A-3.01.10P	organize and store **materials**, **tools and equipment**	**materials**, **tools and equipment** are organized and stored according to site and company policies and jurisdictional regulations

Range of Variables (include, but not limited to)

quality control documents: mill test report, specifications, welding procedures, heat numbers, inspection, test plan

materials: gaskets, fasteners, welding consumables, blinds, steel, tubes, plates, studs, fibreglass, nuts, bolts, expanded metals

tools and equipment: shipping containers, tools, tool trailers, cranes, machinery

job conditions: weather, other trades' work, process concerns, timelines, material availability, labour availability

permits: crane, gas testing, hot and cold work, entry

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.01.01L	demonstrate knowledge of elements involved in planning and organizing job tasks and procedures
a.	identify **sources of information** relevant to organizing job tasks and procedures
b.	describe **considerations** to plan and organize job tasks and procedures
c.	describe sequence of job tasks and procedures
d.	identify **materials**, **tools and equipment** required for job tasks
e.	identify requirements to coordinate with other trades

Reference Code	Learning Outcomes and Objectives
f.	estimate time required to complete each task
A-3.01.02L	demonstrate knowledge of regulatory requirements pertaining to organizing project tasks and procedures
a.	identify **permits**, codes, standards and regulations pertaining to organization of project tasks and procedures

Range of Variables (include, but not limited to)

sources of information: drawings, specifications, client requirements, codes, jurisdictional regulations, job procedures, maintenance history
considerations: available space, schedule/sequence, permits, hazards assessment, personnel, tools and equipment, materials and supplies, storage location, quality control
materials: gaskets, fasteners, welding consumables, blinds, steel, tubes, plates, studs, fibreglass, nuts, bolts, expanded metals
tools and equipment: shipping containers, tools, tool trailers, cranes, machinery
permits: crane, gas testing, hot and cold work, entry

A-3.02 Uses documents, drawings and specifications

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.02.01P	locate and interpret **information** and **specifications** on **drawings** and in **documents**	**information** and **specifications** on **drawings** and in **documents** are located and interpreted to perform work activities
A-3.02.02P	create sketch	sketch is created to clarify technical information
A-3.02.03P	convert between metric and imperial measurements	conversion between metric and imperial measurements is completed and compared for accuracy

Reference Code	Performance Criteria	Evidence of Attainment
A-3.02.04P	complete **documents**	**documents** are completed according to jurisdictional regulations, site-specific requirements, and company policies and procedures

Range of Variables (include, but not limited to)

information: scale, not to scale, colour code, legend, title blocks, current revisions, bill of materials, Issued for Construction (IFC) stamp, assembly techniques, welding processes

specifications: measurements, weights, dimensions, tolerances, grades of material, welding criteria

drawings: fabrication, assembly, structural, detail, engineered lift, erection, as-builts, site plan

documents: quality control, welding procedures, flange management, safety (e.g., FLRA, JSA, SDS, WHMIS), lift table, information requests, progress reports, commissioning reports

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.02.01L	demonstrate knowledge of **documents**, **drawings** and **specifications**, their use and interpretation
a.	identify types of **documents** and **drawings**
b.	identify common parts of **drawings**
c.	identify and interpret **information** and **specifications** contained in **documents** and **drawings**
d.	describe procedures for fabricating and assembling **components** from **drawings** and **documents**
e.	describe how to create bill of materials from **information** found on **drawings**
f.	outline an order of assembly to complete **component**
g.	identify **symbols** found on technical **drawings**
h.	determine types, sizes, shapes, and grades of **materials** required from **drawings**
i.	describe procedures to draft and complete **documents**

Reference Code	Learning Outcomes and Objectives
A-3.02.02L	demonstrate knowledge of calculations relevant to **drawings**
a.	calculate conversions between metric and imperial systems
b.	perform **mathematical calculations** of fractions and decimals

Range of Variables (include, but not limited to)

documents: quality control, welding procedures, flange management, safety (e.g., FLRA, JSA, SDS, WHMIS), lift table, information requests, progress reports, commissioning reports

drawings: fabrication, assembly, structural, detail, engineered lift, erection, as-builts, site plan

specifications: measurements, weights, dimensions, tolerances, grades of material, welding criteria

information: scale, not to scale, colour code, legend, title blocks, current revisions, bill of materials, IFC stamp, assembly techniques, welding processes

components: saddles, nozzles, skirts, shells, ladders, internals, heads

symbols: welding, steel designation, fasteners, tubes, plates, studs, fibreglass, nuts, bolts

materials: gaskets, fasteners, welding consumables, blinds, steel, tubes, plates, studs, fibreglass, nuts, bolts, expanded metals

mathematical calculations: additions, subtractions, multiplications, divisions

A-3.03 Handles materials and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.03.01P	identify materials and **components**	materials and **components** are identified according to task
A-3.03.02P	determine weights of materials and **components**	weights of materials and **components** are determined

Reference Code	Performance Criteria	Evidence of Attainment
A-3.03.03P	select and use **material handling tools and lifting devices**	**material handling tools and lifting devices** are selected and used according to task
A-3.03.04P	store materials and **components**	materials and **components** are stored in protected location to prevent **contamination** according to manufacturers' specifications, and company policies and procedures
A-3.03.05P	organize materials and **components**	materials and **components** are organized according to space availability, type of material and sequence of installation
A-3.03.06P	load and unload materials and **components**	materials and **components** are loaded and unloaded considering **hazards**

Range of Variables (include, but not limited to)

components: ladders, platforms, saddles, manifolds, heads, shells

material handling tools and lifting devices: forklifts, plate clamps, plate racks, pallet jack, cranes

contamination: corrosion, cross-contamination, dirt, oil, ultraviolet, radioactive

hazards (of loading/unloading): uneven weight distribution, capacity of hoisting equipment, oversized loads

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.03.01L	demonstrate knowledge of materials and **components**, their characteristics and applications
a.	identify types of materials and **components**, and describe their characteristics and applications
b.	describe space constraints
c.	identify types of metals, and describe their characteristics and applications
d.	interpret designations for pipe and tube
e.	identify various types, grades and size of bolts, studs and screws

Reference Code	Learning Outcomes and Objectives
f.	identify **standard fittings**, their sizing, designation, function and pressure rating
A-3.03.02L	demonstrate knowledge of safe handling practices for materials and **components**
a.	describe safety requirements for handling materials and **components**
b.	describe safety requirements for storing gas cylinders and hazardous materials
A-3.03.03L	demonstrate knowledge of regulatory requirements pertaining to handling and storing of materials and **components**
a.	identify codes, standards and regulations pertaining to handling, storing and disposal of materials and **components**

Range of Variables (include, but not limited to)

components: ladders, platforms, saddles, manifolds, heads, shells

standard fittings: nozzles, couplings, tees, elbows, flanges (including slip-on and weld neck), blind flanges, blanking plates, plugs, valves (e.g., backflow, check)

A-3.04 Demobilizes site

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-3.04.01P	gather and inventory tools, equipment and excess materials	tools, equipment and excess materials are gathered and inventoried
A-3.04.02P	remove tools, equipment and excess materials	tools, equipment and excess materials are removed and returned to owner
A-3.04.03P	restore work area to operational state	work area is restored to operational state

Knowledge

Reference Code	Learning Outcomes and Objectives
A-3.04.01L	demonstrate knowledge of procedures to demobilize sites
a.	describe inventory practices for demobilizing sites
b.	identify **hazards** and describe safe work practices when demobilizing sites
c.	describe steps necessary to restore site to its operational state

Range of Variables (include, but not limited to)

hazards: slips, trips, falls, pinch points, cuts, overexertion

TASK A-4 Performs cutting and welding activities

Task Descriptor

Boilermakers use various processes to cut material and to prepare and fit joints. They perform tack welding to temporarily join components.

For the purpose of this standard, basic welding is non-structural and not pressure welding.

Final welding and more advanced welding procedures may be performed by qualified boilermaker-welders as allowed by jurisdictional regulations.

A-4.01 Cuts material

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.01.01P	select cutting tools and equipment	cutting tools and equipment are selected according to **material** type and task

Reference Code	Performance Criteria	Evidence of Attainment
A-4.01.02P	set up cutting tools and equipment, and work area	cutting tools and equipment, and work area are set up according to location and task
A-4.01.03P	identify **cutting issues**	**cutting issues** are identified
A-4.01.04P	take **corrective measures**	**corrective measures** are taken according to **requirements**
A-4.01.05P	perform cut	cut is performed according to job specifications
A-4.01.06P	clean up after cut	sharp edges and slag are removed after cut

Range of Variables (include, but not limited to)

materials: metals (e.g., alloy steels, ferrous or non-ferrous metals, carbon steels), fibreglass, composites

cutting issues: incorrect tip type, poor cut quality, incorrect speed and heat, faulty equipment

corrective measures: using appropriate tip for material thickness, adjusting speed, replacing faulty equipment, tip angle, cleanliness of tip

requirements: speed, fuel mixture, distance of tip to material, tip selection, blade angle, blade pitch (teeth per inch), blade clearance, air pressure, gas pressure

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.01.01L	demonstrate knowledge of **materials**, their characteristics and applications
a.	identify types of **materials**, and describe their characteristics and applications
b.	interpret information pertaining to **materials** to be cut found on drawings and specifications
A-4.01.02L	demonstrate knowledge of cold-cutting processes, their associated equipment and accessories
a.	identify tools and equipment used to cold-cut **materials**, and describe their procedures for use
b.	identify **hazards** and describe safe work practices when cold-cutting **materials**

Reference Code	Learning Outcomes and Objectives
c.	describe procedure to select and prepare **materials** to be cut
d.	identify processes associated with cutting **materials**, and describe their characteristics and applications
e.	identify **cold-cutting techniques**, and describe their characteristics and applications
f.	describe common cold-cutting faults
g.	describe process of manual cutting on **materials** of various thickness
h.	describe cutting/threading of pipe using manual and mechanical process
A-4.01.03L	demonstrate knowledge of hot-cutting processes, their associated equipment and accessories
a.	identify tools and equipment used to hot-cut **materials**, and describe their procedures for use
b.	identify **hazards** and describe safe work practices when hot-cutting **materials**
c.	identify **hot-cutting techniques**, and describe their characteristics and applications
d.	describe process to perform flame cutting
e.	describe process to light torches
f.	list and describe different types of **flames**
g.	describe and demonstrate set-up of oxy-fuel equipment
h.	describe procedure to check for leaks
i.	identify characteristics of oxygen and fuel gas cylinders
j.	describe construction and purpose of manifold system
k.	identify and select fuel gases for manual and automatic flame cutting of carbon steel
l.	identify types of regulators, and describe their characteristics, applications, correct adjustments and care
m.	describe assembly, installation and maintenance of hoses, fittings and flashback arrestors
n.	explain and demonstrate setting of oxy-fuel pressures, balancing and flame adjustments
o.	list and describe causes of backfires and flashbacks
p.	describe design, maintenance, selection and operation of oxy-fuel tips

Reference Code	Learning Outcomes and Objectives
q.	describe set-up and operation of carbon arc cutting-air (CAC-A) equipment (gouger)
r.	describe set-up and operation of plasma arc cutting equipment
A-4.01.05L	demonstrate knowledge of regulatory requirements pertaining to oxy-fuel cutting equipment
a.	identify codes, standards and regulations pertaining to oxy-fuel cutting equipment

Range of Variables (include, but not limited to)

materials: metals (e.g., alloy steels, ferrous or non-ferrous metals, carbon steels), fibreglass, composites

hazards (cold-cutting techniques): cuts, respiratory particulates, noise

cold-cutting techniques: shear, milling, band saw, hack saw, carbide tooth blade, water-jet

hazards (hot-cutting techniques): cuts, respiratory particulates, noise, burns

hot-cutting techniques: flame cutting, plasma arc, CAC-A (gouger), abrasive disc, oxygen lance

flames: oxidizing, carbonizing, neutral

A-4.02 Prepares weld joints for fitting

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.02.01P	select and use **tools and equipment**	**tools and equipment** are selected and used according to material type and task
A-4.02.02P	prepare **weld joints**	**weld joints** are prepared using **methods** according to **specifications**

A-4.02.03P	dam and purge components	components are dammed and purged according to type of metal and task
A-4.02.04P	clean **weld joints**	**weld joints** are cleaned prior to fit-up to protect integrity of weld and prevent weld defects according to specifications

Range of Variables (include, but not limited to)

tools and equipment: grinders, bevellers, oxy-acetylene torches, milling guns, files
weld joints: groove type (e.g., U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)
methods: grinding, shaping, beveling, cleaning
specifications: weld procedures, American Society of Mechanical Engineers (ASME) code, American Petroleum Institute (API), American Society for Testing and Materials (ASTM) code, drawings, Canadian Standards Association (CSA), Canadian Welding Bureau (CWB), Inspection Test Plan (ITP)

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.02.01L	demonstrate knowledge of **weld joints**, their characteristics and applications
a.	identify types of **weld joints**, and describe their characteristics and applications
b.	identify **weld joint** preparation and **weld joint** tolerances from specifications
A-4.02.02L	demonstrate knowledge of processes of preparing **weld joints** for fitting
a.	identify **tools and equipment** used to prepare **weld joints** for fitting, and describe their procedures for use
b.	identify **hazards**, and describe safe work practices when preparing **weld joints** for fitting
c.	determine if metal requires cleaning based on condition
d.	describe process to lay out and fit-up **weld joints**
A-4.02.03L	demonstrate knowledge of regulatory requirements pertaining to **weld joints**
a.	identify codes, standards and regulations pertaining to **weld joints**

Range of Variables (include, but not limited to)

weld joints: groove type (e.g., U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)
tools and equipment: grinders, bevellers, oxy-acetylene torches, milling guns, files
hazards: burns, cuts, abrasions, rotating equipment, respiratory particulates, noise

A-4.03 Fits weld joints

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.03.01P	select and use **fitting tools**	**fitting tools** are selected and used according to material type and task
A-4.03.02P	determine alignment tolerances	alignment tolerances are determined according to **specifications**
A-4.03.03P	fit-up **weld joints**	**weld joints** are fit-up according to, welding procedure, **specifications** and offset
A-4.03.04P	determine and implement heat treatment procedure	heat treatment procedure is determined and implemented according to **specifications**

Range of Variables (include, but not limited to)

fitting tools: locking pliers, key plates, leaf springs, strongbacks, C-clamps, levels, hammers, dogs and wedges, hydraulic jacks, hickey bars, hi-low gauge, hose clamps, wall bangers
specifications: weld procedures, ASME code, API, ASTM code, drawings, CSA, CWB
weld joints: groove type (U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.03.01L	demonstrate knowledge of **weld joints**, their characteristics and applications

Reference Code	Learning Outcomes and Objectives
a.	identify types of **weld joints**, and describe their characteristics and applications
b.	interpret information pertaining to **weld joints** found on drawings and **specifications**
A-4.03.02L	demonstrate knowledge of **weld joint** fitting techniques and procedures
a.	identify **fitting tools** used to fit **weld joints**, and describe their procedures for use
b.	identify **hazards** and describe safe work practices when fitting **weld joints**
c.	describe fitting techniques and procedures
d.	describe procedures for **weld joints** spacing (gap)
e.	describe heat treatment procedures
f.	identify heat treatment equipment used to control heat treatment, and describe their procedures for use
A-4.03.03L	demonstrate knowledge of regulatory requirements pertaining to fitting **weld joints**
a.	identify codes, standards and regulations related to fitting **weld joints**

Range of Variables (include, but not limited to)

weld joints: groove type (U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)
specifications: weld procedures, ASME code, API, ASTM code, drawings, CSA, CWB
fitting tools: locking pliers, key plates, leaf springs, strongbacks, C-clamps, levels, hammers, dogs and wedges, hydraulic jacks, hickey bars, hi-low gauge, hose clamps, wall bangers
hazards: burns, cuts, abrasions, rotating equipment, respiratory particulates, noise

A-4.04 Performs tack welds

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.04.01P	interpret welding symbols	tacks are performed according to welding symbols
A-4.04.02P	select welding equipment	welding equipment is selected according to material type, task and **specifications**
A-4.04.03P	select consumables	consumables are selected according to material type and **specifications**
A-4.04.04P	pre- and post-heat weldments	weldments are pre- and post-heated according to material type and **specifications**
A-4.04.05P	place tack welds	tack welds are placed according to task and **specifications**
A-4.04.06P	remove tack welds	tack welds are removed according to **specifications**

Range of Variables (include, but not limited to)

specifications: weld procedures, ASME code, API, ASTM code, drawings, CSA, CWB

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.04.01L	demonstrate knowledge of weldments, their characteristics and applications
a.	identify types of weldments, and describe their characteristics and applications
b.	identify parent and filler metals in weldments
c.	interpret information pertaining to weldments found on drawings and **specifications**

Reference Code	Learning Outcomes and Objectives
d.	identify welding symbols
A-4.04.02L	demonstrate knowledge of process to perform tack welds
a.	identify welding equipment used to perform tack welds, and describe their procedures for use
b.	identify **hazards** and describe safe work practices when performing tack welds
c.	describe procedures for **tacking operations**
A-4.04.03L	demonstrate knowledge of regulatory requirements pertaining to tack welding
a.	identify codes, standards and regulations related to tack welding

Range of Variables (include, but not limited to)

specifications: weld procedures, ASME code, API, ASTM code, drawings, CSA, CWB

hazards: arc flash, burns, cuts, abrasions, rotating equipment, respiratory particulates, noise

tacking operations: joint spacing, holding or clamping devices, number and spacing of tack welds, pre-setting/distortion allowances of joint member, current type, amperage and polarity, hot tacks

A-4.05 Performs basic welding

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.05.01P	interpret **welding processes**, welding symbols, **specifications** and jurisdictional regulations	**welding processes**, welding symbols, **specifications** and jurisdictional regulations are interpreted

Reference Code	Performance Criteria	Evidence of Attainment
A-4.05.02P	select various welding consumables	types and sizes of welding consumables are selected according to material type, procedures and **specifications**
A-4.05.03P	ground **arc welding equipment**	**arc welding equipment** is grounded according to task, manufacturers' specifications, site-specific specifications, and company policies and procedures
A-4.05.04P	set up **related welding equipment**	**related welding equipment** is set up according to **specifications**
A-4.05.05P	perform basic welding techniques	basic welds are performed according to **specifications** and jurisdictional regulations

Range of Variables (include, but not limited to)

welding processes: shielded metal arc welding (SMAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), flux cored arc welding (FCAW), sub arc welding (SAW)

specifications: weld procedures, ASME code, API, ASTM code, drawings, manufacturers', CWB, material, CSA

arc welding equipment: power sources, electrode holders and cables, terminals, connectors, ground clamps, remotes, wire feeders

related welding equipment: weld machines, cables, purge assemblies, ground clamps, orbital GTAW

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.05.01L	demonstrate knowledge of basic welding information
a.	interpret information pertaining to basic welding found on drawings and **specifications**
b.	identify and interpret basic welding symbols
A-4.05.02L	demonstrate knowledge of basic **welding processes**, their associated equipment and accessories
a.	identify **arc welding equipment**, and describe their characteristics and applications

Reference Code	Learning Outcomes and Objectives
b.	identify **related welding equipment**, and describe their characteristics and applications
c.	identify **hazards** and describe safe work practices when performing basic welding
d.	identify **welding processes**, and describe their characteristics and applications
e.	describe elements and sequence of **welding processes**
f.	explain electrode classification and rod coating (flux)
g.	identify common **weld faults**
h.	list and describe functions of flux
i.	identify polarity settings and their applications
j.	describe grounding techniques and methods
k.	describe storage requirements of electrodes
l.	describe welding procedures to minimize distortion
m.	describe heat treatment processes
A-4.05.03L	demonstrate knowledge of training and certification requirements pertaining to **welding processes**
a.	identify training and certification requirements pertaining to **welding processes**
A-4.05.04L	demonstrate knowledge of regulatory requirements pertaining to **welding processes**
a.	identify codes, standards and regulations pertaining to **welding processes**

Range of Variables (include, but not limited to)

specifications: weld procedures, ASME code, API, ASTM code, drawings, manufacturers', CWB, material, CSA

welding processes: SMAW, GMAW, GTAW, FCAW, SAW

arc welding equipment: power sources, electrode holders and cables, terminals, connectors, ground clamps, remotes, wire feeders

related welding equipment: weld machines, cables, purge assemblies, ground clamps, orbital GTAW

hazards: arc flash, burns, cuts, abrasions, rotating equipment, respiratory particulates, noise

weld faults: porosity, inclusion, undercut, cold lapping, lack of penetration, incomplete fusion, under bead cracking

A-4.06 Performs advanced welding

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-4.06.01P	interpret welding procedures, symbols, **specifications** and jurisdictional regulations for advanced welding	welding procedures, symbols, **specifications** and jurisdictional regulations are interpreted
A-4.06.02P	select various welding consumables for alloy and **specialty metals**	types and sizes of welding consumables are selected according to **specifications**, material type and procedure being used
A-4.06.03P	ground **arc welding equipment**	**arc welding equipment** is grounded according to task, manufacturers' specifications, site-specific specifications, and company policies and procedures
A-4.06.04P	set up **advanced welding equipment**	**advanced welding equipment** is set up according to **specifications**
A-4.06.05P	perform groove joint welding	groove joints are welded according to **specifications**
A-4.06.06P	perform **advanced welding processes**	advanced welds are performed according to **specifications**

Range of Variables (include, but not limited to)

specifications: weld procedures, ASME code, API, ASTM code, drawings, material, CSA, CWB

specialty metals: stainless alloys, chromoly, aluminum, titanium

arc welding equipment: power sources, electrode holders and cables, terminals, connectors, ground clamps, remotes, wire feeders

advanced welding equipment: SAW, automated welding, GTAW, orbital GTAW

advanced welding processes: SMAW, GMAW, GTAW, FCAW, SAW

Knowledge

Reference Code	Learning Outcomes and Objectives
A-4.06.01L	demonstrate knowledge of advanced welding information
a.	interpret information pertaining to advanced welding found on drawings and **specifications**
b.	identify and interpret welding symbols
c.	identify and interpret supplementary symbols
A-4.06.02L	demonstrate knowledge of **advanced welding processes**, their associated equipment and accessories
a.	identify **advanced welding equipment**, and describe their characteristics and applications
b.	identify **hazards** and describe safe work practices when performing advanced welding
c.	describe elements and sequence of **advanced welding processes**
d.	describe damming and purging process and identify when it applies
e.	describe polarity settings and their applications and limitations
A-4.06.03L	demonstrate knowledge of electrode classifications
a.	describe effects of alloy additions to coating for arc welding electrodes
A-4.06.04L	demonstrate knowledge of training and certification requirements pertaining to **advanced welding processes**
a.	identify training and certification requirements pertaining to **advanced welding processes**
A-4.06.05L	demonstrate knowledge of regulatory requirements pertaining to **advanced welding processes**
a.	identify codes, standards and regulations pertaining to **advanced welding processes**

Range of Variables (include, but not limited to)

specifications: weld procedures, ASME code, API, ASTM code, drawings, material, CSA, CWB

advanced welding processes: SMAW, GMAW, GTAW, FCAW, SAW

advanced welding equipment: SAW, automated welding, GTAW, orbital GTAW

hazards: arc flash, burns, cuts, abrasions, rotating equipment, respiratory particulates, noise

Task A-5 Maintains continuous learning

Task Descriptor

Boilermakers must stay current on new and emerging technologies, new types of equipment, energy sources and materials being introduced in the trade. There are also trade practices and tools used in the trade in areas such as welding, fastening equipment, quality control methods and power sources.

A-5.01 Upskills in new trade practices and procedures

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-5.01.01P	apply **continuous learning methods**	**continuous learning methods** are applied
A-5.01.02P	develop and maintain professional development plan	professional development plan is developed and maintained with established learning goals (short and long term) and time frames
A-5.01.03P	identify available **supports and resources** for learning	available **supports and resources** for learning are identified

Range of Variables (include, but not limited to)

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

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

Knowledge

Reference Code	Learning Outcomes and Objectives
A-5.01.01L	demonstrate knowledge of upskilling in new trade practices and procedures
a.	identify **continuous learning methods**
b.	explain importance of staying current on new trade practices and procedures
c.	identify **supports and resources** for learning
A-5.01.02L	demonstrate knowledge of professional development plan
a.	identify **elements of a professional portfolio**
b.	identify link between professionalism and continuous learning
c.	identify **factors** that may impact learning needs and goals

Range of Variables (include, but not limited to)

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

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

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

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

A-5.02 Upskills in emerging technologies

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
A-5.02.01P	read **information** about latest advancements and emerging technologies	**information** about latest advancements and emerging technologies is read to stay informed
A-5.02.02P	attend seminars, webinars and training sessions	seminars, webinars and training sessions organized by equipment manufacturers, suppliers, unions and employers are attended

Range of Variables (include, but not limited to)

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

Knowledge

Reference Code	Learning Outcomes and Objectives
A-5.02.01L	demonstrate knowledge of upskilling in emerging technologies
a.	identify types of **information** on emerging technologies
b.	explain importance of staying current on emerging technologies

Range of Variables (include, but not limited to)

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

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	yes	yes	yes	yes	yes	yes	ND	ND	ND

Skills

Reference Code	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	communicate understanding and comfort level in performing trade tasks	opportunities for practice and gradual exposure to new tasks is offered and understanding is confirmed

Reference Code	Performance Criteria	Evidence of Attainment
A-6.01.08P	use questions to improve communication	questions are used to enhance understanding, on-the-job training and goal setting
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 (include, but not limited to)

active listening: hearing, interpreting, reflecting, responding, paraphrasing
electronic messages: email, text messages

Knowledge

Reference Code	Learning Outcomes and Objectives
A-6.0.01L	demonstrate knowledge of trade terminology
a.	define terminology used in trade
A-6.01.02L	demonstrate knowledge of effective communication practices
a.	describe importance of using effective verbal and non-verbal communication with people in the workplace
b.	describe importance of teamwork
c.	identify **sources of information** to effectively communicate
d.	identify communication and **learning styles**
e.	describe effective listening and speaking skills
f.	describe how to receive and give instructions effectively
g.	identify communication that constitutes bullying, **harassment** and **discrimination**
h.	identify communication styles appropriate to different systems and applications of **electronic messages**

Range of Variables (include, but not limited to)

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

learning styles: visual, auditory, kinesthetic (hands-on)

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

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

electronic messages: email, text messages

A-6.02 Uses mentoring techniques

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

Skills

Reference Code	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	demonstrate 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	set up conditions where apprentice or learner feels comfortable communicating and asking questions	conditions are such that apprentice or learner feels comfortable communicating and asking questions
A-6.02.06P	recognize and discuss multiple techniques for performing trade tasks and options for apprentice or learner	multiple techniques for performing trade tasks and options for apprentice or learner are recognized and discussed

Reference Code	Performance Criteria	Evidence of Attainment
A-6.02.07P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice or learner improves with practice to a point where task can be done with little supervision
A-6.02.08P	give supportive and constructive feedback	apprentice or learner adopts best practice after receiving supportive or constructive feedback
A-6.02.09P	support apprentices or learners in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-6.02.10P	support anti-**harassment** and anti-**discrimination** practices in workplace	workplace is **harassment** and **discrimination**-free
A-6.02.11P	support accommodations and alternate work practices that are appropriate for apprentice or learner	accommodations and alternate work practices that are appropriate for apprentice or learner are supported
A-6.02.12P	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
A-6.02.13P	share information with colleagues and management	information shared with colleagues and management, and advantages are explained

Range of Variables (include, but not limited to)

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

practice conditions: 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

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

Range of Variables (include, but not limited to)

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

learning styles: visual, auditory, kinesthetic (hands-on)

learning needs: learning disabilities, learning preferences, language proficiency

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

Major Work Activity B – Performs rigging, hoisting and positioning

Task B-7 Plans lift

Task Descriptor

Boilermakers plan lifts by assessing loads and performing a pre-lift analysis. They calculate and verify load requirements to select rigging, hoisting and positioning equipment accordingly. Boilermakers secure the lift area to ensure that safe rigging, hoisting and positioning practices are followed to minimize hazards, avoid personal injury and equipment damage.

B-7.01 Determines load

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.01.01P	identify load to be hoisted	load to be hoisted is identified according to task
B-7.01.02P	check load	load is checked for shape, **unknown weight factors and material integrity**
B-7.01.03P	select and use **measuring tools and equipment**	**measuring tools and equipment** are selected and used according to task
B-7.01.04P	calculate total weight of load	total weight of load is calculated by measuring load, and according to formulas and reference materials
B-7.01.05P	verify total weight of load	total weight of load is verified according to fabrication drawings or bill of lading

Reference Code	Performance Criteria	Evidence of Attainment
B-7.01.06P	determine centre of gravity	centre of gravity is determined according to visual inspection of weight distribution, calculations and measurements

Range of Variables (include, but not limited to)

unknown weight factors and material integrity: product residue, build-up of foreign matter, corrosion, material damage, temporary bracing and fasteners
measuring tools and equipment: tape measures, calculators, reference cards, charts, measuring and layout equipment, manufacturers' digital data, dynamometer

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.01.01L	demonstrate knowledge of load requirements
a.	list and describe **properties of load** to be lifted that need to be considered
B-7.01.02L	demonstrate knowledge of calculations and **related factors** to determine load weight
a.	identify formulas and calculations to determine load weight
b.	describe procedures to determine center of gravity
c.	identify **related factors** for calculations and load weight
d.	describe procedures to inspect load
B-7.01.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

properties of load: dimensions, shape, weight, centre of gravity, condition of load, condition of attachment points
related factors: reference materials, catalogs, drawings, bills of lading

B-7.02 Performs pre-lift analysis

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.02.01P	determine final location and orientation of load	final location and orientation of load is determined according to erection drawings and markings on equipment and structure
B-7.02.02P	determine **type of lift**	**type of lift** is determined according to application, site conditions, weight of load, drawings, engineered specifications and jurisdictional regulations
B-7.02.03P	determine **rigging factors**	**rigging factors** are determined to select rigging, hoisting and positioning equipment according to task
B-7.02.04P	perform walk-through	walk-through inspection is performed to determine travel path and rigging requirements according to **rigging factors**
B-7.02.05P	identify location for rigging, hoisting and positioning equipment	location for rigging, hoisting and positioning equipment is identified considering **hoisting and positioning factors**
B-7.02.06P	confirm **load securing methods**	**load securing methods** are confirmed in final location according to erection drawings and engineered specifications
B-7.02.07P	identify procedure and **access equipment** required for rigging attachment and removal	procedure and **access equipment** required for rigging attachment and removal is identified according to site conditions and jurisdictional regulations

Reference Code	Performance Criteria	Evidence of Attainment
B-7.02.08P	determine **communication methods**	**communication methods** are determined according to line of sight and site-specific requirements
B-7.02.09P	identify **personnel** needed to perform rigging tasks	**personnel** needed to perform rigging tasks are identified according to task, site-specific requirements and jurisdictional regulations
B-7.02.10P	determine head room, boom clearances, fleet angles, anchor points, block loading and parts of line including friction	head room, boom clearances, fleet angles, anchor points, block loading and parts of line including friction are determined according to calculations, engineered drawings, and manufacturers' specifications
B-7.02.11P	determine if permit is required	permit requirements are determined according to site-specific requirements and jurisdictional regulations
B-7.02.12P	determine if test lift is required	test lift requirements are determined according to site-specific requirements, company policies and procedures and jurisdictional regulations
B-7.02.13P	perform test lift	test lift is performed according to site-specific requirements, company policies and procedures and jurisdictional regulations

Range of Variables (include, but not limited to)

type of lift: simple, tandem, critical (e.g., hoisting personnel, tandem, near capacity, powerlines), engineered

rigging factors: obstacles, head room, opening size, hazards, weight of load, fleet angles, anchor points, block loading, parts of line including friction, sling tension, boom deflection, radius and distance to be lifted, hoisting location

hoisting and positioning factors: ground conditions, crane swing radius, obstacles, load charts, hazards, weight of load, environmental (e.g., rain, wind, snow, working on water), capacity of structure being used to support rigging and mobile equipment

load securing methods: lashing, welding, using fasteners, shoring, bolting, guy line cables, bracing

access equipment: mobile elevating work platform, personnel baskets, scaffolding, fall arrest system, ladders, rope access, scissor lifts

communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)

personnel: supervisor, operators, signaler, riggers, tag line persons

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.02.01L	demonstrate knowledge of rigging, hoisting and positioning equipment
a.	identify types of rigging, hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
b.	identify **types of lifts**, and describe their characteristics and applications
c.	interpret information pertaining to rigging, hoisting and positioning found on drawings and engineered specifications
B-7.02.02L	demonstrate knowledge of procedures to perform pre-lift analysis
a.	describe procedures to inspect area surrounding lift
b.	identify **hazards**, and describe safe work practices pertaining to rigging, hoisting and positioning
c.	identify and describe **communication methods** used during rigging, hoisting and positioning
d.	identify and describe delegation of responsibilities for **personnel**
e.	describe procedures to perform walk-through
f.	describe procedures to perform test lift
g.	explain effects of sling angle when preparing for rigging, hoisting and positioning operations

Reference Code	Learning Outcomes and Objectives
B-7.02.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning equipment
a.	interpret codes, standards and regulations pertaining to rigging, hoisting and positioning equipment

Range of Variables (include, but not limited to)

types of lifts: simple, tandem, critical (e.g., hoisting personnel, tandem, near capacity, powerlines), engineered
hazards: overhead obstacles, boom interference, ground conditions, swing path, powerlines
communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)
personnel: supervisor, operators, signaler, riggers, tag line persons

B-7.03 Selects rigging, hoisting and positioning equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.03.01P	verify **characteristics of load**	**characteristics of load** determined in load assessment are verified according to drawings and specifications
B-7.03.02P	select rigging equipment	rigging equipment is selected according to rigging tag information, working load limits (WLL), rigging configuration, sling tension and engineered drawings
B-7.03.03P	select hoisting and positioning equipment	hoisting and positioning equipment is selected according to pre-lift analysis

Reference Code	Performance Criteria	Evidence of Attainment
B-7.03.04P	protect rigging, hoisting and positioning equipment, and load	rigging, hoisting and positioning equipment, and load are protected during lift to avoid equipment and load damage according to manufacturers' specifications, task and site-specific requirements

Range of Variables (include, but not limited to)

characteristics of load: shape, strength, size, centre of gravity, weight, pick points

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.03.01L	demonstrate knowledge of rigging, hoisting and positioning equipment, their characteristics and applications
a.	identify types of rigging, hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
b.	identify **factors** to consider when selecting rigging, hoisting and positioning equipment
c.	identify wire ropes, and describe **wire rope characteristics** and applications
d.	describe and demonstrate testing and strength reductions of knots and splices
e.	identify and describe construction, grades and applications of natural fibre and synthetic ropes
f.	interpret and describe **rigging tag information**
B-7.03.02L	demonstrate knowledge of calculations required to select rigging, hoisting and positioning equipment
a.	explain effects of sling angles when preparing for rigging, hoisting and positioning operations
b.	calculate rigging, hoisting and positioning equipment capacities
c.	identify elements of crane charts
d.	identify swing zone and swing clearance
e.	identify elements tables and charts for slings and attachments

Reference Code	Learning Outcomes and Objectives
f.	identify and describe breaking strength (BS) and WLL formulas, design factors, efficiencies and reductions for natural fibre, synthetic fibre and wire ropes
B-7.03.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning equipment
a.	interpret codes, standards and regulations pertaining to rigging, hoisting and positioning equipment

Range of Variables (include, but not limited to)

characteristics of load: shape, strength, size, centre of gravity, weight, pick points

factors: weight being hoisted, radius and distance to be lifted, parts of line used, hoisting location

wire rope characteristics: types of steel used for wire ropes, lays and their advantages, wire rope cores, classifications, constructions, WLL, wire rope faults and removal criteria, care and handling of wire rope

rigging tag information: date, size, capacity, material, manufacturer, configuration

B-7.04 Secures lift area

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-7.04.01P	establish safety perimeter	non-essential personnel are cleared of lifting area and safety perimeter is established by installing **signage** and by assigning personnel to monitor lift perimeter according to site-specific requirements

Reference Code	Performance Criteria	Evidence of Attainment
B-7.04.02P	perform walk-around inspection	walk-around inspection is performed to confirm **hazards**, path of travel, swing direction or ground conditions have not changed since pre-lift site inspection

Range of Variables (include, but not limited to)

signage: barricades, barrier tape, tags, signs
hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing, miscommunication with personnel, leading edges

Knowledge

Reference Code	Learning Outcomes and Objectives
B-7.04.01L	demonstrate knowledge of rigging, hoisting and positioning equipment
a.	identify types of rigging, hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
b.	identify types of lifts, and describe their characteristics and applications
c.	interpret information pertaining to rigging, hoisting and positioning found on drawings and specifications
d.	identify **sources for safe work practices**, and describe their applications
B-7.04.02L	demonstrate knowledge of **procedures to secure lift area**
a.	describe **procedures to secure lift area**
b.	identify **hazards**, and describe safe work practices pertaining to securing lift area prior to rigging, hoisting and positioning
B-7.04.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	interpret codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

sources for safe work practices: company policies, site procedures, jurisdictional regulations, manufacturers' specifications

procedures to secure lift area: installing and tagging barriers, assessing ground conditions, ensuring that work area is not congested or obstructed for emergency access, limiting approach, obtaining required permits

hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing, miscommunication with personnel, leading edges

TASK B-8 Rigs, hoists and positions load

Task Descriptor

Rigging is an integral part of the boilermaker trade. Rigging equipment is used to ensure loads or personnel can be hoisted in a safe and secure manner. Hoisting a load is lifting the equipment or components into place according to a lift plan. Positioning is done to deliver and align a load to the desired location. In many cases, it is a team effort involving operators, signallers, riggers and supervisors. It is important that boilermakers participate in hoisting and positioning operations for safety and to ensure that personnel, equipment, and components are protected during the operation. Fabricated lifting equipment must be designed by an engineer.

B-8.01 Inspects rigging, hoisting and positioning equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.01.01P	conduct inspection of rigging, hoisting and positioning equipment	inspection of rigging, hoisting and positioning equipment is conducted to verify valid certification, identify damage, pre-use and throughout task, according to industry standards, manufacturers' specifications, company policies and procedures and jurisdictional regulations
B-8.01.02P	identify **damaged** rigging, hoisting and positioning equipment	**damaged** rigging, hoisting and positioning equipment is identified, tagged, removed from service and replaced according to company policies and procedures, manufacturers' specifications and jurisdictional regulations
B-8.01.03P	verify WLL	WLL is verified according to **rigging tag information**

Range of Variables (include, but not limited to)

damaged: kinks, broken wires, arc mark, tears, cuts, cracks, rust, corrosion, chemical burns, bird caging, contamination, wear, overload, illegible/missing tag, seized components
rigging tag information: date, size, capacity, manufacturer, configuration, material

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.01.01L	demonstrate knowledge of rigging, hoisting and positioning equipment, their characteristics, applications and procedures for use
a.	identify types of rigging, hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
b.	interpret **rigging tag information**
B-8.01.02L	demonstrate knowledge of procedures to inspect rigging, hoisting and positioning equipment
a.	describe sequence of inspection of rigging, hoisting and positioning equipment
b.	describe procedures to inspect rigging, hoisting and positioning equipment
c.	identify removal criteria for damaged rigging, hoisting and positioning equipment
B-8.01.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

rigging tag information: date, size, capacity, manufacturer, configuration, material

B-8.02 Fabricates rigging attachments and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.02.01P	lay out attachments and components for fabrication	attachments and components for fabrication are laid out according to lug charts, fabrication drawings and engineered specifications
B-8.02.02P	build, construct or assemble rigging attachments and components	rigging attachments and components are built, constructed or assembled according to manufacturers' and engineered specifications
B-8.02.03P	inspect fabricated attachments and components	fabricated attachments and components are inspected according to engineered specifications, company policies and procedures, and jurisdictional regulations prior to use
B-8.02.04P	test fabricated attachments and components	fabricated attachments and components are tested according to site-specific requirements, company policies and procedures, and jurisdictional regulations

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.02.01L	demonstrate knowledge of rigging, hoisting and positioning equipment, their components, characteristics, applications and procedures for use
a.	identify types of rigging, hoisting and positioning equipment, their components, and describe their characteristics, applications and procedures for use

Reference Code	Learning Outcomes and Objectives
B-8.02.02L	demonstrate knowledge of procedures to fabricate rigging attachments and components
a.	identify tools and equipment used to fabricate rigging attachments and components, and describe their procedures for use
b.	identify different **fabrication methods**
c.	describe limitations to fabricating rigging attachments and components
d.	identify **rigging equipment that can be fabricated**
B-8.02.03L	demonstrate knowledge of regulatory requirements pertaining to fabricating rigging attachments and components
a.	identify codes, standards and regulations pertaining to fabricating rigging attachments and components

Range of Variables (include, but not limited to)

fabrication methods: cutting, welding, drilling, bolting, assembling
rigging equipment that can be fabricated: lifting lugs, spreader bars (must be certified by an engineer before use), equalizer beams

B-8.03 Assembles rigging, hoisting and positioning equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.03.01P	select and use tools and equipment	tools and equipment are selected and used to assemble rigging, hoisting and positioning equipment according to task, lift plan and manufacturers' specifications
B-8.03.02P	determine order of assembly	order of assembly is determined according to task, lift plan and manufacturers' specifications

Reference Code	Performance Criteria	Evidence of Attainment
B-8.03.03P	identify **procedures** and requirements	**procedures** and requirements for assembly are identified according to equipment being used, manufacturers' specifications and company procedures
B-8.03.04P	use **communication methods**	**communication methods** are used during assembly according to task, site conditions and company policies
B-8.03.05P	set up rigging, hoisting and positioning equipment, and their **components**	rigging, hoisting and positioning equipment, and their **components** are set up according to engineered and manufacturers' specifications

Range of Variables (include, but not limited to)

procedures: spooling cable on drum, preparing ground, reeving blocks, mounting tuggers, assembling crane components

communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)

components: boom, tracks, counterweight, wire rope, jib, pads, mats, block, wedge socket, shackles, spreader bars

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.03.01L	demonstrate knowledge of rigging, hoisting and positioning equipment, their **components**, characteristics, applications and procedures for use
a.	identify types of rigging, hoisting and positioning equipment, their **components**, and describe their characteristics, applications and procedures for use
B-8.03.02L	demonstrate knowledge of **procedures** used to assemble rigging, hoisting and positioning equipment and their **components**
a.	identify tools and equipment used to assemble rigging, hoisting and positioning equipment, and their **components**, and describe their procedures for use
b.	identify **hazards**, and describe safe work practices pertaining to assembling rigging, hoisting and positioning equipment, and their **components**

Reference Code	Learning Outcomes and Objectives
	c. describe procedures for placement, assembly and installation of rigging, hoisting and positioning equipment, and their **components**
	d. describe **communication methods** used during assembly of rigging, hoisting and positioning equipment, and their **components**
	e. identify reeving techniques, and describe their characteristics and applications
	f. identify topics discussed in pre-lift meetings
	g. describe elements of engineered specifications
	h. list and describe types, parts and configurations of hoisting and positioning equipment
	i. identify slings and sling arrangements, and describe their characteristics and applications
	j. identify slings and hitches used for hoisting and positioning
	k. describe use and location for slings, tag lines and sling configurations on **loads** for hoisting and positioning
	l. describe procedures to determine centre of gravity for different types of **loads**
B-8.03.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
	a. identify codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

components: boom, tracks, counterweight, wire rope, jib, pads, mats, block, wedge socket, shackles, spreader bars

procedures: spooling cable on drum, preparing ground, reeving blocks, mounting tuggers, assembling crane components

hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing, miscommunication with personnel, leading edges, electrical, energized components

communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)

loads: smooth heavy loads, long flexible loads, off balance loads, heavy fragile units, finished or coated loads, large surface area (sail)

B-8.04 Attaches rigging equipment to load

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.04.01P	access rigging points	rigging points are accessed using work platforms and access equipment according to task
B-8.04.02P	install **rigging attachments**	**rigging attachments** are installed by mechanical or welding techniques according to site-specific requirements, engineered specifications and task
B-8.04.03P	assemble and connect main rigging	main rigging is assembled and connected to load according to rigging plan
B-8.04.04P	stage secondary rigging	secondary rigging is staged to transfer loads
B-8.04.05P	adjust rigging equipment	rigging equipment is adjusted for orientation according to site-specific requirements, engineered specifications and task
B-8.04.06P	identify and attach **control devices**	**control devices** are identified and attached according to task, company policies and procedures, jurisdictional requirements and rigging plan
B-8.04.07P	select and use **knots, bends and hitches**	**knots, bends and hitches** are selected and used according to lift requirements to ensure control of load

Range of Variables (include, but not limited to)

rigging attachments: hooks and shackles, wire rope clips, eyebolts, chains, turn buckles, additional industry attachments, lifting lugs

control devices: tag lines, holdbacks, guy wires, cable puller

knots, bends and hitches: bowline, self-centering bowline, running bowline, clove hitch, half hitch, reef (square) knot, timber hitch, rolling hitch, sheet bend, fisherman bend

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.04.01L	demonstrate knowledge of rigging, hoisting and positioning equipment, their characteristics, applications and procedures for use
a.	identify types of rigging, hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
B-8.04.02L	demonstrate knowledge of procedures to attach rigging equipment to load
a.	identify tools and equipment used to attach rigging equipment to load, and describe their procedures for use
b.	identify **hazards**, and describe safe work practices pertaining to attaching rigging equipment to load
c.	list and describe requirements and specifications involved in attaching rigging equipment to loads
d.	describe function, advantages and limitations of various **sling configurations**
e.	identify types of **knots, bends and hitches**, and describe their characteristics and applications
f.	demonstrate ability to tie **knots, bends and hitches**
g.	describe steps to splice natural fibre and synthetic fibre ropes
h.	describe procedures to attach tagline to control load
i.	identify types of **splices**, and describe their characteristics and applications
j.	identify **rigging attachments**, and describe their characteristics, applications and procedures for use
k.	identify attachment points
l.	identify jacking points
m.	identify jacking equipment, and describe their characteristics, applications and procedures for use
n.	identify rolling equipment, and describe their characteristics, applications and procedures for use

Reference Code	Learning Outcomes and Objectives
B-8.04.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing, miscommunication with personnel, leading edges, electrical, energized components

sling configurations: basket, choker, bridle hitch, vertical hitch

knots, bends and hitches: bowline, self-centering bowline, running bowline, clove hitch, half hitch, reef (square) knot, timber hitch, rolling hitch, sheet bend, fisherman bend

splices: back, side, short

rigging attachments: hooks and shackles, wire rope clips, eyebolts, chains, turn buckles, additional industry attachments, lifting lugs

B-8.05 Performs hoisting and positioning operations

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.05.01P	participate in pre-lift meeting	pre-lift meeting is attended to understand roles and responsibilities according to lift plan, task and site-specific requirements
B-8.05.02P	use **communication methods**	**communication methods** are used during hoisting and positioning according to site conditions
B-8.05.03P	operate hoisting and positioning equipment	hoisting and positioning equipment is operated according to lift plan, manufacturers' specifications and jurisdictional regulations

Reference Code	Performance Criteria	Evidence of Attainment
B-8.05.04P	control **load**	**load** is controlled using tag lines, holdbacks and secondary rigging according to site conditions, and company policies and procedures
B-8.05.05P	recognize and correct lift or rigging irregularities	lift or rigging irregularities are recognized and corrected according to task and industry standards
B-8.05.06P	transfer **loads** to various hoisting and positioning equipment	**loads** are transferred to various hoisting and positioning equipment according to drawings, task and final placement

Range of Variables (include, but not limited to)

communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)

loads: smooth heavy loads, long flexible loads, off balance loads, heavy fragile units, finished or coated loads, large surface area (sail)

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.05.01L	demonstrate knowledge of hoisting and positioning equipment, their characteristics, applications and procedures for use
a.	identify types of hoisting and positioning equipment, and describe their characteristics, applications and procedures for use
b.	interpret information pertaining to hoisting and positioning found on drawings and specifications
B-8.05.02L	demonstrate knowledge of procedures to perform hoisting and positioning operations
a.	identify **hazards**, and describe safe work practices pertaining to performing hoisting and positioning operations
b.	describe procedures to perform hoisting and positioning operations
c.	identify topics discussed in pre-lift meetings
d.	describe elements of engineered specifications
e.	list and describe types, parts and configurations of hoisting and positioning equipment

Reference Code	Learning Outcomes and Objectives
f.	identify various slings and sling arrangements, and describe their characteristics and applications
g.	identify slings and hitches used for hoisting and positioning
h.	describe use and location for slings, tag lines and sling configurations on **loads** for hoisting and positioning
i.	describe procedures to determine centre of gravity for different types of **loads**
j.	interpret load charts, lift radius and boom length
B-8.05.03L	demonstrate knowledge of **communication methods**
a.	list and demonstrate hand signals used when performing hoisting and positioning operations
b.	describe methods and precautions in using hand signals
c.	describe and demonstrate voice communications on two-way radios
d.	list and describe precautions used in verbal communication
B-8.05.04L	demonstrate knowledge of regulatory requirements pertaining to hoisting and positioning operations
a.	identify codes, standards and regulations pertaining to hoisting and positioning operations

Range of Variables (include, but not limited to)

hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing, miscommunication with operators and personnel, leading edges, electrical, energized components

loads: smooth heavy loads, long flexible loads, off balance loads, heavy fragile units, finished or coated loads, large surface area (sail)

communication methods: visual (e.g., hand signals), audio (e.g., two-way radios, voice, horns)

B-8.06 Secures load before rigging removal

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-8.06.01P	confirm orientation of load	orientation of load is confirmed before detaching from rigging, hoisting and positioning equipment according to fabrication and erection drawings, match marks and other reference points
B-8.06.02P	ensure stability of load	stability of load is ensured by using shims, wedges, cribbing and **bracing methods**
B-8.06.03P	prepare load for removal of rigging	load is prepared for removal of rigging by using bolts, nuts, welding, and other fastening equipment and ensure load is secure
B-8.06.04P	use grounding procedures	grounding and load isolation procedures are used while load is attached to hoisting equipment, when welding is required
B-8.06.05P	temporarily suspend loads	loads for subsequent placement are temporarily suspended using lashing or **other equipment**

Range of Variables (include, but not limited to)

bracing methods: guy wires, lines, temporary supports, adjustable brace poles, turn buckle, chains

other equipment: chain falls, come-alongs, manual cable puller (grip hoist), strong backs, beam clamps, pad eyes, dunnage, cribbing, lashing, guylines

Knowledge

Reference Code	Learning Outcomes and Objectives
B-8.06.01L	demonstrate knowledge of procedures to secure load before rigging removal
a.	identify tools and equipment used to secure load before rigging removal, and describe their procedures for use
b.	identify and describe procedures to secure orientated load before rigging removal
c.	identify **bracing methods**
d.	identify **other equipment** used to temporarily suspend loads
e.	identify types of slings and sling arrangements, and describe their characteristics and applications
f.	identify and describe location of sling configurations on loads for hoisting
B-8.06.02L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning

Range of Variables (include, but not limited to)

bracing methods: guy wires, lines, temporary supports, adjustable brace poles, turn buckle, chains

other equipment: chain falls, come-alongs, manual cable puller (grip hoist), strong backs, beam clamps, pad eyes, dunnage, cribbing, lashing, guylines

Task B-9 Performs post-lift activities

Task Descriptor

Post-lift inspections and disassembly of hoisting equipment are done after the lift is completed. Boilermakers continually maintain rigging and hoisting equipment to ensure personnel safety, optimal operation of the equipment and to avoid equipment damage.

B-9.01 Conducts post-lift inspection

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.01.01P	inspect area	area is inspected post lift for hazards, obstructions, damages and other anomalies
B-9.01.02P	eliminate hazards	hazards identified during post-lift inspection are eliminated by taking **actions**
B-9.01.03P	assess, tag and report any damaged installed equipment and materials	damaged installed equipment and materials are assessed, tagged and reported to supervisors according to company policies and procedures
B-9.01.04P	inspect rigging, hoisting and positioning equipment	rigging, hoisting and positioning equipment is inspected, and damaged equipment is removed from service according to jurisdictional regulations, manufacturers' specifications, and company policies and procedures
B-9.01.05P	ensure area is clear and safe, and remove barriers and signs	area is clear and safe, and barriers and signs are removed

Range of Variables (include, but not limited to)

actions: installing barriers and signs, re-installing grating and railing, housekeeping, post-lift meeting

Knowledge

Reference Code	Learning Outcomes and Objectives
B-9.01.01L	demonstrate knowledge of post-lift inspections
a.	list and describe elements of inspections done after each lift
b.	list and describe elements of inspections done after job completion
B-9.01.02L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning
B-9.01.03L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	identify procedures and practices that contribute to environmental protection

B-9.02 Disassembles rigging, hoisting and positioning equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.02.01P	coordinate work	work is coordinated when other equipment is required to complete task
B-9.02.02P	identify order of **component** disassembly	order of **component** disassembly is identified according to task
B-9.02.03P	select and use tools and equipment	tools and equipment are selected and used according to rigging, hoisting and positioning equipment being disassembled

Reference Code	Performance Criteria	Evidence of Attainment
B-9.02.04P	load and secure equipment for transport	equipment for transport is loaded and secured according to manufacturers' specifications, destination and jurisdictional regulations

Range of Variables (include, but not limited to)

component: boom, tracks, counterweight, reeving, outrigger boxes, gantry, jib, pads and mats

Knowledge

Reference Code	Learning Outcomes and Objectives
B-9.02.01L	demonstrate knowledge of procedures to disassemble rigging, hoisting and positioning equipment and their **components**
a.	identify tools and equipment used to disassemble rigging, hoisting and positioning equipment and their **components**, and describe their procedures for use
b.	identify **hazards**, and describe safe work practices pertaining to disassembling rigging, hoisting and positioning equipment and their **components**
c.	identify rigging, hoisting and positioning equipment requiring disassembly
d.	describe sequence of disassembly of rigging, hoisting and positioning equipment
B-9.02.02L	demonstrate knowledge of training and certification requirements to perform rigging, hoisting and positioning operations
a.	identify safety training and certification requirements to perform rigging, hoisting and positioning operations
B-9.02.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning operations
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning operations

Range of Variables (include, but not limited to)

components: boom, tracks, counterweight, reeving, outrigger boxes, gantry, jib, pads and mats
hazards: slip, trip, falls, overexertion, pinching, crushing, leading edges

B-9.03 Maintains rigging, hoisting and positioning equipment

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
B-9.03.01P	clean and lubricate rigging, hoisting and positioning equipment	rigging, hoisting and positioning equipment is cleaned and lubricated according to manufacturers' specifications
B-9.03.02P	store and secure rigging, hoisting and positioning equipment	rigging, hoisting and positioning equipment is stored and secured according to manufacturers' specifications, site-specific requirements, and company policies and procedures
B-9.03.03P	perform inspection of rigging, hoisting and positioning equipment	inspections are performed to recognize damaged and defective rigging, hoisting and positioning equipment according to manufacturers' specifications, and company policies and procedures
B-9.03.04P	tag and remove damaged or defective rigging, hoisting and positioning equipment from service	damaged or defective rigging, hoisting and positioning equipment is tagged and removed from service according to manufacturers' specifications, and company policies and procedures

Knowledge

Reference Code	Learning Outcomes and Objectives
B-9.03.01L	demonstrate knowledge of procedures to maintain rigging, hoisting and positioning equipment
a.	identify **hazards**, and describe safe work practices pertaining to maintaining rigging, hoisting and positioning equipment
b.	describe maintenance requirements for rigging, hoisting and positioning equipment
c.	describe procedures to store and secure rigging, hoisting and positioning equipment
d.	describe procedures to dispose of rigging, hoisting and positioning equipment
e.	describe best practices for care and handling of fibre and wire ropes
B-9.03.02L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting and positioning equipment
a.	identify codes, standards and regulations pertaining to rigging, hoisting and positioning equipment

Range of Variables (include, but not limited to)

hazards: slip, trip, falls, struck by material, overexertion, pinching, crushing

Major Work Activity C – Completes new construction

Task C-10 Performs fabrication

Task Descriptor

Fabrication is the creation of the components from stock material following specific instructions from a drawing or a concept. The fabrication process includes layout, cutting, forming and assembly of components. Most components are built in a shop and transported to the jobsite; however, fabrication can also occur in the field.

C-10.01 Lays out components for fabrication

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.01.01P	select and use tools and equipment	tools and equipment are selected and used according to task
C-10.01.02P	select and locate **material** and **components**	**material** and **components** are selected and located according to drawings and specifications
C-10.01.03P	measure **material**	**material** is measured to ensure **dimensions** are according to drawings and specifications
C-10.01.04P	perform mathematical calculations	mathematical calculations are performed to obtain proper orientation, alignment and projections according to specifications
C-10.01.05P	transfer **dimensions** and measurements	**dimensions** and measurements are transferred to **components** and **materials** according to drawings and specifications

Reference Code	Performance Criteria	Evidence of Attainment
C-10.01.06P	make jigs and templates	jigs and templates are made according to task and specifications
C-10.01.07P	identify and mark final product	various sections of final product are identified and marked for site assembly and installation using various **identification methods**
C-10.01.08P	prepare and clean **material** to be cut	**material** to be cut is prepared and cleaned

Range of Variables (include, but not limited to)

material: metals, fibreglass, composites, stainless steel

components: access ladders, platforms, davits, headers, pipe turns, offsets, ducts, cylinders, cones, pressure vessel shells, vessel internals, support structures

dimensions: thickness, length, width, diameter, circumference, orientation, elevation, volume, area, chord length

identification methods: match-marking, tagging, piece mark numbering, item list, heat number

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.01.01L	demonstrate knowledge of procedure to lay out **material** and **components** for fabrication
a.	identify, select and use tools and equipment
b.	identify types of **material** to be used and **components** being fabricated
c.	describe **identification methods** for **material** and **components**
d.	describe various **layout methods**
e.	describe steps to develop templates using parallel lines and radial line development
C-10.01.02L	demonstrate knowledge of calculations required to lay out **components**
a.	calculate **dimensions** of squares, rectangles and circles for layout
b.	calculate orientation, alignment, elevations and projections
C-10.01.03L	demonstrate knowledge of drawing interpretation
a.	read drawings to determine **materials** required and lay out template or **components**

Reference Code	Learning Outcomes and Objectives
	b. read drawing and identify **components** listed for fabrication
	c. list and describe abbreviations applicable to layout and development
	d. lay out and fabricate **components** from drawings
C-10.01.04L	demonstrate knowledge of sustainability and environmental stewardship practices
	a. describe practices that avoid material waste through pre-planning

Range of Variables (include, but not limited to)

material: metals, fibreglass, composites, stainless steel
components: access ladders, platforms, davits, headers, pipe turns, offsets, ducts, cylinders, cones, pressure vessel shells, vessel internals, support structures
identification methods: match-marking, tagging, piece mark numbering, item list, heat number
layout methods: parallel-line, triangulation, radial line development, mathematical formulas, geometric construction
dimensions: thickness, length, width, diameter, circumference, orientation, elevation, volume, area, chord length

C-10.02 Cuts components for fabrication

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.02.01P	select **cutting method**	**cutting method** is selected according to material type, dimensions, work environment, task and specifications
C-10.02.02P	select tools and equipment	tools and equipment are selected according to task

Reference Code	Performance Criteria	Evidence of Attainment
C-10.02.03P	set up cutting tools	cutting tools are set up according to task and manufacturers' specifications
C-10.02.04P	measure components	components are measured to ensure accuracy
C-10.02.05P	position and secure material	material to be cut is positioned and secured
C-10.02.06P	perform cut	cut is performed according to drawings and specifications

Range of Variables (include, but not limited to)

cutting method: oxy-fuel, grinding, gouging, plasma, saw, shear

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.02.01L	demonstrate knowledge of procedures used to cut components for fabrication and their associated tools and equipment
a.	identify cutting tools and equipment, and describe their applications and procedures for use
b.	describe **cutting methods**
c.	describe process of cutting material of various thickness
d.	identify **oxy-fuel cutting equipment**
e.	describe procedure to set up **oxy-fuel cutting equipment**
f.	describe principles of oxy-fuel gas cutting process
g.	identify characteristics of oxygen and fuel gas cylinders
h.	explain purpose of manifold system
i.	identify fuel gases for manual and automatic oxy-fuel cutting of carbon steel, and describe their characteristics and applications
j.	identify regulator types, and describe their characteristics, applications, adjustments and care
k.	describe construction and maintenance of hoses, fittings and flashback arrestors

Reference Code	Learning Outcomes and Objectives
	l. describe and demonstrate setting of oxy-fuel pressures, balancing and flame adjustments
	m. list causes of backfires and flashbacks, and describe prevention strategies
	n. describe design, maintenance, selection and operation of oxy-fuel tips
	o. describe setup and operation of CAC-A equipment (gouger)
	p. describe setup and operation of PAC (plasma arc cutting) equipment
	q. describe cutting processes involved in cutting alloy steels and non-ferrous metals
	r. describe procedures to perform pipe cutting to size using pipe cutter or oxy-fuel cutting process
	s. describe procedure to check for leaks
	t. identify **cutting issues**
C-10.02.03L	demonstrate knowledge of procedures to thread components for fabrication and their associated tools and equipment
	a. identify threading tools and equipment
	b. describe procedures to thread pipe using manual and mechanical processes

Range of Variables (include, but not limited to)

cutting method: oxy-fuel, grinding, gouging, plasma, saw, shear

oxy-fuel cutting equipment: regulators, cylinders, torches, safety devices, cutting tips, hoses, striker, tip cleaners

cutting issues: incorrect tip type, poor cut quality, incorrect speed, incorrect heat, incorrect tip angle, incorrect pressures, faulty and dull equipment

C-10.03 Forms components for fabrication

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.03.01P	select and use **shop equipment**	**shop equipment** is selected and used to form components
C-10.03.02P	select and use hand and power tools	hand and power tools are selected and used to form components
C-10.03.03P	shape components	components are shaped using **forming methods** according to drawings
C-10.03.04P	check components	components are checked for dimension and tolerance according to drawings
C-10.03.05P	finish fabricated material	fabricated material is finished using **finishing methods**

Range of Variables (include, but not limited to)

shop equipment: brakes, rolls, dies, ironworkers, plate shears
forming methods: rolling, bending, braking, controlled heating
finishing methods: buffing, cleaning, grinding, deburring

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.03.01L	demonstrate knowledge of drawing interpretation
a.	interpret dimensions, symbols and abbreviations on drawings
C-10.03.02L	demonstrate knowledge of procedures to form components
a.	identify tools and **shop equipment** required to form components, and describe their characteristics and applications
b.	identify **forming methods**

Reference Code	Learning Outcomes and Objectives
	c. identify **finishing methods**
	d. identify jigs and templates, and describe their characteristics and applications
	e. identify spider bars and backing bars, and describe their characteristics and applications

Range of Variables (include, but not limited to)

shop equipment: brakes, rolls, dies, ironworkers, plate shears
forming methods: rolling, bending, braking, controlled heating
finishing methods: buffing, cleaning, grinding, deburring

C-10.04 Constructs components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-10.04.01P	select and use tools and equipment	tools and equipment are selected and used according to task and specifications
C-10.04.02P	align and orient components	components are aligned and oriented to fit according to match-marks, drawings and specifications
C-10.04.03P	secure components	components are secured to ensure correct alignment and to maintain their shape using various **securing methods** according to task
C-10.04.04P	assemble components	components are assembled using **joining and fastening methods** according to task

Range of Variables (include, but not limited to)

securing methods: clamping, dogging, bracing, lashing, tacking, spidering
joining and fastening methods: welding, bolting, riveting, tube expanding

Knowledge

Reference Code	Learning Outcomes and Objectives
C-10.04.01L	demonstrate knowledge of procedures to construct components and their associated tools and equipment
a.	interpret dimensions, symbols and abbreviations on drawings
b.	identify tools and equipment used to construct components, and describe their characteristics and applications
c.	describe **securing**, **joining and fastening methods**

Range of Variables (include, but not limited to)

securing methods: clamping, dogging, bracing, lashing, tacking, spidering
joining and fastening methods: welding, bolting, riveting, tube expanding

TASK C-11 Assembles and fits vessels and components

Task Descriptor

Boilermakers assemble, align and fit vessels and components in sections or modules according to applicable codes and standards prior to final installation. They align the components and vessels at the desired location. Fitting ensures the proper placement of the vessels and components prior to fastening them in place.

C-11.01 Aligns vessels and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-11.01.01P	select and use **alignment tools and equipment**	**alignment tools and equipment** are selected and used according to task
C-11.01.02P	identify **reference point**	**reference point** is identified according to drawings and specifications
C-11.01.03P	set **vessels** and **components**	**vessels** and **components** are set at desired location according to engineer-approved drawings and specifications
C-11.01.04P	check elevation, orientation and projection of **vessels** and **components**	elevation, orientation and projection of **vessels** and **components** are checked to confirm placement according to engineer-approved drawings and specifications

Range of Variables (include, but not limited to)

alignment tools and equipment: transits, water levels, plumb bobs, dogs/wedges, lugs, shims, key plates, strongbacks, key channels, u-bars, bull pins, key plate nuts

reference point: benchmarks or elevation marks, datum line, work points

vessels: drums, exchangers, towers, tanks, boilers

components: manways, cleanout doors, water or fluid draw-off elbows, draw-off sumps,

inlets/outlets, overflow venting, walkways, stairways, ladders, nozzles, support structures, vessel internals

Knowledge	
Reference Code	**Learning Outcomes and Objectives**
C-11.01.01L	demonstrate knowledge of procedures to align **vessels** and **components**
a.	identify **alignment tools and equipment**, and describe their applications and procedures for use
b.	describe layout and fit-up of **vessels** and **components**
c.	describe preparation, fit-up and alignment of seams
d.	describe orientation, elevation, projection and datum reference methods and procedures
C-11.01.02L	demonstrate knowledge of drawing interpretation
a.	interpret information from drawings, specifications and codes
b.	identify **reference points** according to drawings and specifications

Range of Variables (include, but not limited to)

vessels: drums, exchangers, towers, tanks, boilers

components: manways, cleanout doors, water or fluid draw-off elbows, draw-off sumps, inlets/outlets, overflow venting, walkways, stairways, ladders, nozzles, support structures, vessel internals

alignment tools and equipment: transits, water levels, plumb bobs, dogs/wedges, lugs, shims, key plates, strongbacks, key channels, u-bars, bull pins, key plate nuts

reference point: benchmarks or elevation marks, datum line, work points

C-11.02 Fits vessels and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-11.02.01P	select and use **tools and equipment**	**tools and equipment** are selected and used according to task
C-11.02.02P	inventory and assemble components	components are inventoried and assembled according to drawings and specifications
C-11.02.03P	check components	components are checked for fit and function by measuring and pre-assembly according to drawings
C-11.02.04P	measure, match-mark and cross reference elevation, orientation and projection of components	elevation, orientation and projection of components are measured, match-marked and cross-referenced according to drawings and specifications
C-11.02.05P	attach components	components are attached using **attachment methods**

Range of Variables (include, but not limited to)

tools and equipment: levels, dogs, wedges, hammers, rigging, key plates, pry bars, strongbacks

attachment methods: bolting, clipping, tacking, welding, tube expansion, riveting, chemical bonding

Knowledge

Reference Code	Learning Outcomes and Objectives
C-11.02.01L	demonstrate knowledge of procedures to fit vessels and components
a.	identify **tools and equipment** used to fit vessels and components, and describe their characteristics and applications

Reference Code	Learning Outcomes and Objectives
	b. identify and describe assembly requirements and procedures
	c. describe fitting methods and procedures
	d. describe **attachment methods**

Range of Variables (include, but not limited to)

tools and equipment: levels, dogs, wedges, hammers, rigging, key plates, pry bars, strongbacks

attachment methods: bolting, clipping, tacking, welding, tube expansion, riveting, chemical bonding

TASK C-12 Fastens components

Task Descriptor

Boilermakers use several techniques to fasten components during construction. This is a required task in order to complete the final installation.

C-12.01 Bolts components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.01.01P	select bolting hardware	bolting hardware types, grades and sizes for application are selected according to drawings and job specifications
C-12.01.02P	prepare components	components are prepared prior to fastening using **preparation methods** according to job specifications

Reference Code	Performance Criteria	Evidence of Attainment
C-12.01.03P	select approved gasket	approved gasket is selected according to job specifications
C-12.01.04P	select approved lubrication	approved lubrication is selected according to job specifications
C-12.01.05P	install **hardware**	**hardware** is installed according to job specifications
C-12.01.06P	select and use manual, pneumatic and hydraulic torquing and tensioning equipment	manual, pneumatic and hydraulic torquing and tensioning equipment are selected and used according to job requirements and manufacturers' specifications
C-12.01.07P	ensure final fit	final fit is ensured before tightening bolts on vessels and components according to specifications
C-12.01.08P	torque or tension bolts	bolts are torqued or tensioned according to specifications

Range of Variables (include, but not limited to)

preparation methods: approved lubrication, cleaning, buffing
hardware: gaskets, bolts, nuts, washers, studs, rivets

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.01.01L	demonstrate knowledge of techniques used to bolt components
a.	identify types, grades and sizes of bolts
b.	identify types, material grade, service and pressure/heat rating of gaskets
c.	identify types, size and pressure rating of flanges
d.	identify types of lubricants
e.	identify types of **torquing and tensioning equipment**
f.	describe bolting and torquing sequence

Range of Variables (include, but not limited to)

torquing and tensioning equipment: pneumatic torque wrench, hydraulic torque wrench, electric torque wrench, hydraulic tensioning system, pumps, manual torque wrench, multiplier

C-12.02 Expands tubes

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.02.01P	calculate initial measurements of components	initial measurements of components are calculated to determine final expansion
C-12.02.02P	select and use **expansion tools and equipment**	**expansion tools and equipment** are selected and used according to task and specifications
C-12.02.03P	disassemble, clean, lubricate and reassemble rolling components	rolling components are disassembled, cleaned, lubricated and reassembled to prevent damage to equipment according to job specifications
C-12.02.04P	prepare surface	surface is prepared using tube reamer, grooving tool and tube brushes to buff and clean according to job specifications
C-12.02.05P	roll tubes	tubes are rolled according to job specifications
C-12.02.06P	measure final expansion	final expansion is verified with initial calculations to confirm job specifications using **measuring instruments**

Range of Variables (include, but not limited to)

expansion tools and equipment: rolling guns, mandrels and rolls, compressor

measuring instruments: outside micrometers, inside micrometers, gauges, telescopic gauges

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.02.01L	demonstrate knowledge of techniques used to expand tubes and their associated tools and equipment
a.	identify **expansion tools and equipment**, and describe their characteristics and applications
b.	identify **measuring instruments**, and describe their characteristics and applications
c.	define expansion theory and describe techniques to expand tubes
d.	describe process of tube rolling
e.	list and describe factors to consider in tube expanding
f.	list and describe steps associated with tube installation
g.	list and describe recommended tube expansion sequences with reference to tube sheet layout, area and shape
h.	describe how to measure inside diameter of tubes
i.	describe recommended percentage wall reduction for ferrous and non-ferrous materials
j.	identify recommended lubricants, and describe their characteristics and applications
k.	identify optimum depth of expansion
l.	describe reason for grooved seats
m.	identify factors affecting quality of expanded joint
n.	describe operational relationship of mandrel and rolls
o.	describe purpose and process of bell rolling/flaring
p.	describe purpose and process of tube beading
C-12.02.02L	demonstrate knowledge of techniques used to assemble tubular heat exchangers
a.	define terms associated with tube hole arrangement
b.	identify types of baffles and describe their function and installation procedures

Reference Code	Learning Outcomes and Objectives
	c. identify tube sheet layouts and state their preference of application
	d. describe different types of **exchanger heads**
	e. list and describe the uses and limitations of **tube equipment**
C-12.02.03L	demonstrate knowledge of calculations required to expand tube
	a. calculate expanded diameter (final ID) of tube

Range of Variables (include, but not limited to)

expansion tools and equipment: rolling guns, mandrels and rolls, compressor

measuring instruments: outside micrometers, inside micrometers, gauges, telescopic gauges

exchanger heads: channel and removable cover, bonnet, channel integral with tube sheet, pull through floating head, outside packed floating head

tube equipment: tube guide, air motor, electric motor tube end mills, tube expanders, tube pullers, fly cutters, tube cutters, tube cleaners, tube removal tools

C-12.03 Lays up fibreglass

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
C-12.03.01P	select and use **tools, equipment** and **PPE**	**tools, equipment** and **PPE** are selected and used according to task, jurisdictional regulations and SDS
C-12.03.02P	prepare surface	surface is prepared by grinding, sanding and cleaning
C-12.03.03P	mix fibreglass resins	fibreglass resins are mixed according to manufacturers' and job specifications, and environmental considerations

Reference Code	Performance Criteria	Evidence of Attainment
C-12.03.04P	apply **lay-up techniques**	**lay-up techniques** are applied according to manufacturers' specifications
C-12.03.05P	identify and repair **malformations**	**malformations** are identified and repaired according to job specifications
C-12.03.06P	store and dispose of fibreglass materials	fibreglass materials are stored and disposed of according to SDS

Range of Variables (include, but not limited to)

tools and equipment: power cutter (circular saw), power disc sander, extension cords, rags, heat lamps, fans, scale, thermometer, rollers and brushes

PPE: disposable coveralls, safety goggles, full-faced respirator, chemical-resistant gloves, organic vapour cartridges, butyl rubber gloves, face shields

lay-up techniques: rolling, brushing, spraying

malformations: air bubbles, delamination, impurities

Knowledge

Reference Code	Learning Outcomes and Objectives
C-12.03.01L	demonstrate knowledge of **fibreglass chemicals** and **lay-up materials**, their characteristics and applications
a.	identify **fibreglass chemicals**, and describe their characteristics and applications
b.	interpret information found on drawings and specifications
c.	identify **lay-up materials**, and describe their characteristics and applications
d.	identify types and grades of **fibreglass chemicals**
e.	identify accelerators, retarders and promoters
f.	identify and describe **fibreglass chemicals** and **lay-up materials** required for lay-up and repairs
C-12.03.02L	demonstrate knowledge of procedures used to lay up fibreglass
a.	identify tools and materials used for preparation and assembly, and describe their characteristics and applications

Reference Code	Learning Outcomes and Objectives
	b. identify **hazards** and describe safe work practices pertaining to fiberglass chemicals
	c. identify measuring equipment, and describe their characteristics and applications
	d. describe procedures to lay up fibreglass
	e. describe mixing and curing procedures, and safety considerations for handling and mixing resins, catalysts and associated chemicals
	f. describe handling and storage process for chemicals required to assemble fibreglass pipe and vessels
	g. describe process of drilling
	h. describe process of bolting
	i. describe process of cutting
	j. describe process of grinding
	k. describe process of laminating fibreglass
	l. describe uses of fibreglass in tanks, silos, stacks, scrubbers, breeching and piping

Range of Variables (include, but not limited to)

fibreglass chemicals: polyester resins, catalysts, promoters, acetone, methylene chloride, air dry additive, filler, methyl ethyl ketone peroxide (MEKP)

lay-up materials: surfacing veil, matting, woven roving

hazards: fire, explosion, dermatitis, burns, inhalation

Major Work Activity D – Performs repairs, maintenance, upgrading and testing

Task D-13 Services vessels and components

Task Descriptor

Boilermakers help to ensure the proper operation of vessels and components by verifying their integrity, repairing or replacing them when needed as per codes and jurisdictional regulations. Modifying and upgrading existing systems entails replacing components and materials to improve performance or reliability and can be done during scheduled and unscheduled maintenance. Sometimes, vessels and components cannot be repaired and need to be replaced.

Boilermakers need to know when rigging, fitting and cranes are needed to accomplish the tasks.

Inspecting and testing are important to identify defective and worn components to ensure that the system has been constructed or repaired properly.

D-13.01 Inspects vessels and components for defects

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-13.01.01P	verify **permit requirements** are met	**permit requirements** are met before proceeding with task according to site-specific specifications
D-13.01.02P	clean surfaces	surfaces are cleaned for inspection by washing, grinding, chipping or buffing according to job specifications

Reference Code	Performance Criteria	Evidence of Attainment
D-13.01.03P	identify **vessel defects**	visual inspection is performed to identify **vessel defects** according to specifications
D-13.01.04P	identify **component defects**	visual inspection is performed to identify **component defects** according to engineered drawings
D-13.01.05P	request **non-destructive testing** to verify material integrity	material integrity is identified according to **non-destructive testing** results
D-13.01.06P	report deficiencies and defects	deficiencies and defects are reported according to company policies and jurisdictional regulations

Range of Variables (include, but not limited to)

permit requirements: gas tests, hot and cold work, confined space entry, blanket permit, lock-out and tag-out

vessel defects: dents, cracks, corrosion, gouges, weld defects, arc strikes, flat spots, crowning, wear

component defects: missing hardware, dents, cracks, corrosion, gouges, undercut, arc strikes, flat spots, distortion, crowning, foreign objects

non-destructive testing: ultrasound, magnetic particle inspection (MPI), hydrostatic, air testing, vacuum box testing, x-ray, phased array, liquid penetrant inspection (LPI), positive material identification (PMI), light oil testing

Knowledge

Reference Code	Learning Outcomes and Objectives
D-13.01.01L	demonstrate knowledge of **vessels** and **components**, their characteristics, applications and operation
a.	identify **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to **vessels** and **components** found on drawings and specifications
D-13.01.02L	demonstrate knowledge of procedures to inspect **vessels** and **components** for **defects**

Reference Code	Learning Outcomes and Objectives
	a. identify tools and equipment used to inspect **vessels** and **components**, and describe their characteristics and applications
	b. identify **vessel defects** and **component defects**
	c. explain causes of **vessel defects** and **component defects**
	d. describe procedures to inspect **vessels** and **components**
	e. identify composition of **vessels**, **components** and gaskets
D-13.01.03L	demonstrate knowledge of training and certification requirements to inspect **vessels** and **components** for **defects**
	a. identify training and certification requirements to inspect **vessels** and **components** for **defects** and how to report them
D-13.01.04L	demonstrate knowledge of regulatory requirements pertaining to inspections of **vessels** and **components** for **defects** and how to report them
	a. identify codes, standards and regulations pertaining to inspections of **vessels** and **components** for **defects** and how to report them

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

vessel defects: dents, cracks, corrosion, gouges, weld defects, arc strikes, flat spots, crowning, wear

component defects: missing hardware, dents, cracks, corrosion, gouges, undercut, arc strikes, flat spots, distortion, crowning, foreign objects

D-13.02 Prepares vessels and components for servicing

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-13.02.01P	locate **vessels** and **components** to be serviced	**vessels** and **components** to be serviced are located according to client job specifications
D-13.02.02P	identify site access and requirements	site access and requirements are identified according to site-specific location
D-13.02.03P	empty, de-energize and depressurize, isolate and purge **vessels**	**vessels** are emptied, de-energized and depressurized, isolated and purged before maintenance begins according to job specifications, site-specifications, company policies and procedures, and jurisdictional regulations
D-13.02.04P	create access or openings to work area	access or openings to work area are created according to job scope
D-13.02.05P	identify site **modification requirements**	site **modification requirements** are identified according to job scope
D-13.02.06P	select material, **tools and equipment**	material, **tools and equipment** are selected according to task
D-13.02.07P	set up material, **tools and equipment**	material, **tools and equipment** are set up in designated location according to job specifications
D-13.02.08P	pre-assemble **components**	**components** to be installed are pre-assembled according to engineer-approved drawings and specifications

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

modification requirements: demolition, component removal and adjustments, site levelling, scaffold erection, lighting, power, ventilation

tools and equipment: scaffolding, maintenance decks, temporary work platforms, needle beams, welding machines, compressors, air movers, tripods, cranes, trolley beams, air lines, electrical cords, hand tools, power tools

Knowledge

Reference Code	Learning Outcomes and Objectives
D-13.02.01L	demonstrate knowledge of **vessels** and **components**, their characteristics, applications and operation
a.	identify **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to **vessels** and **components** found on drawings and specifications
D-13.02.02L	demonstrate knowledge of procedures used to prepare **vessels** and **components** for servicing
a.	identify materials, **tools and equipment** used to service **vessels** and **components**, and describe their characteristics and applications
b.	identify **vessels** and **components** to be serviced
c.	describe **vessel isolation procedures**
d.	identify fasteners and **fastening methods** required to complete task
e.	interpret required changes detailed in engineer-approved drawings and specifications of **vessels** and **components**
D-13.02.03L	demonstrate knowledge of regulatory requirements pertaining to preparing **vessels** and **components** for servicing
a.	identify codes, standards and regulations pertaining to preparing **vessels** and **components** for servicing

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

tools and equipment: scaffolding, maintenance decks, temporary work platforms, needle beams, welding machines, compressors, air movers, tripods, cranes, trolley beams, air lines, electrical cords, hand tools, power tools

vessel isolation procedures: hot bolting, odd bolting, line-break, blanking/blinding, purging

fastening methods: bolting, welding, expanding, riveting

D-13.03 Repairs vessels and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-13.03.01P	select and use tools and equipment	tools and equipment are selected and used according to task
D-13.03.02P	prepare work area	work area is prepared for installation of new **vessels** and **components**
D-13.03.03P	prepare parent material and repair pieces	parent material and repair pieces are prepared using **preparation methods**
D-13.03.04P	install **components**	**components** are installed according to **factors**
D-13.03.05P	perform orientation, alignment and fitting of **components**	**components** are oriented, aligned and fit to existing **vessels** and **components** using **fitting tools** and methods according to engineer-approved drawings and specifications

Reference Code	Performance Criteria	Evidence of Attainment
D-13.03.06P	fasten **components**	**components** are fastened to existing **vessels** and **components** using **fastening methods**
D-13.03.07P	reinstall **components** removed during repair preparation	**components** removed during repair preparation are reinstalled

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

preparation methods: cleaning, grinding, chipping, buffing, welding, media blasting, cutting, milling, gouging, water jet cutting, blanking/blinding

factors: material of vessel or component, size of repair area, work area accessibility, product stored in vessel, job scope, quality control (QC) requirements

fitting tools: dogs and wedges, screw dogs, bull pins, key plates, hickey bars, pinch bars, U-bars, drift pin, sledgehammers, finger bars, welding equipment, level

fastening methods: bolting, welding, gluing, riveting, tack welding

Knowledge

Reference Code	Learning Outcomes and Objectives
D-13.03.01L	demonstrate knowledge of **vessels** and **components**, their characteristics, applications and operation
a.	identify **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to **vessels** and **components** found on drawings and specifications
D-13.03.02L	demonstrate knowledge of procedures to repair **vessels** and **components**
a.	identify tools and equipment used to repair **vessels** and **components**, and describe their characteristics and applications
b.	describe **preparation methods**

Reference Code	Learning Outcomes and Objectives
D-13.03.03L	demonstrate knowledge of procedures to fit material to **vessels** and **components** for repair
a.	identify **fitting tools**, and describe their characteristics and applications
b.	identify methods used to fit new **components**
D-13.03.04L	demonstrate knowledge of procedures to fasten material to **vessels** and **components** for repair
a.	identify **fastening methods** used to fasten new **components**
D-13.03.05L	demonstrate knowledge of regulatory requirements pertaining to repairing of **vessels** and **components**
a.	identify codes, standards and regulations pertaining to repairing of **vessels** and **components**

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

preparation methods: cleaning, grinding, chipping, buffing, welding, media blasting, cutting, milling, gouging, water jet cutting, blanking/blinding

fitting tools: dogs and wedges, screw dogs, bull pins, key plates, hickey bars, pinch bars, U-bars, drift pin, sledgehammers, finger bars, welding equipment, level

fastening methods: bolting, welding, gluing, riveting, tack welding

D-13.04 Performs preventative maintenance and upgrades

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-13.04.01P	select and use tools and equipment	tools and equipment are selected and used according to task
D-13.04.02P	remove **contaminants** and corrosion on **vessels** and **components**	**contaminants** and corrosion on **vessels** and **components** are removed using **cleaning methods** according to specifications
D-13.04.03P	repair defects on **vessels** and **components**	defects are repaired according to specifications
D-13.04.04P	reinstall or replace **components**	**components** are reinstalled or replaced according to specifications
D-13.04.05P	tighten loose **components** and replace missing hardware	loose **components** are tightened and missing hardware are replaced according to specifications

Range of Variables (include, but not limited to)

contaminants: lead paint, asbestos, silica, insulation

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

cleaning methods: scraping, buffing, chipping, high pressure washing (e.g., chemical, water), media blasting, grinding, sweeping, vacuuming

Knowledge

Reference Code	Learning Outcomes and Objectives
D-13.04.01L	demonstrate knowledge of **vessels** and **components**, their characteristics, applications and operation
a.	identify **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to **vessels** and **components** found on drawings and specifications
D-13.04.02L	demonstrate knowledge of preventative maintenance and upgrade procedures
a.	identify tools and equipment used to perform preventative maintenance and upgrades, and describe their characteristics and applications
b.	identify **vessels** and **components** to be maintained
c.	describe preventative maintenance procedures
d.	describe upgrading procedures
e.	describe **cleaning methods**
f.	identify compatible materials when selecting replacement hardware or **components**
D-13.04.03L	demonstrate knowledge of regulatory requirements pertaining to performing preventative maintenance and upgrades
a.	identify codes, standards and regulations pertaining to performing preventative maintenance and upgrades
D-13.04.04L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	identify practices that contribute to environmental protection

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

cleaning methods: scraping, buffing, chipping, high pressure washing (e.g., chemical, water), media blasting, grinding, sweeping, vacuuming

D-13.05 Tests materials, vessels and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-13.05.01P	select and use **tools and equipment**	**tools and equipment** are selected and used according to task
D-13.05.02P	perform visual test (VT)	VT is performed to confirm work is free of **visible defects** and deficiencies
D-13.05.03P	prepare **components** for testing	**components** are prepared for testing by purging, attaching **testing equipment** and venting
D-13.05.04P	perform **advanced testing procedures**	**advanced testing procedures** are performed according to jurisdictional regulations, and company policies and procedures to confirm existence and location of **defects**, and **internal weld or structure defects**

Range of Variables (include, but not limited to)

tools and equipment: wrenches, impact wrenches, gauges, air lines, manifolds, waterlines, purge hoses, pressure gauges, pumps, hydraulic torquing and tensioning equipment

visible defects: poor surface weld integrity, misalignment, improper fit-up, thread protrusion, missing hardware, hardware not identified, undercut

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

testing equipment: test blinds, pumps, gauges, vent lines, trees, vacuum box, magnets, LPI fluid, radiation source, digital equipment

advanced testing procedures (depending on work location and training of tradesperson): LPI, MPI, ultrasonic test (UT), radiographic test, phased array ultrasonic testing (PAUT), pneumatic test, hydrostatic test, light oil test

defects: cracks, undercut, pinholes, cold laps, thinning or blistering of material

internal weld or structure defects: lack of fusion, porosity, lamination, inclusions, material makeup, lack of penetration, excessive penetration, corrosion

Knowledge

Reference Code	Learning Outcomes and Objectives
D-13.05.01L	demonstrate knowledge of materials, **vessels** and **components**, their characteristics, applications and operation
a.	identify materials, **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to materials, **vessels** and **components** found on drawings and specifications
D-13.05.02L	demonstrate knowledge of procedures to test materials, **vessels** and **components**
a.	identify **tools and equipment** and **testing equipment**, and describe their characteristics and applications
b.	identify types of **destructive testing** (DT), and describe their characteristics, applications, advantages, disadvantages, limitations and associated procedures
c.	describe types of **non-destructive testing** (NDT), and describe their characteristics, applications, advantages, disadvantages, limitations and associated procedures
d.	explain differences between DT and NDT
e.	identify **vessels** and **components** to be tested
f.	identify and describe inspection methods, procedures and record keeping
D-13.05.03L	demonstrate knowledge of training and certification requirements to test materials, **vessels** and **components**
a.	identify training and certification requirements to test materials, **vessels** and **components**
D-13.05.04L	demonstrate knowledge of regulatory requirements pertaining to testing materials, **vessels** and **components**
a.	identify codes, standards and regulations pertaining to testing materials, **vessels** and **components**

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

tools and equipment: wrenches, impact wrenches, gauges, air lines, manifolds, waterlines, purge hoses, pressure gauges, pumps, hydraulic torquing and tensioning equipment

testing equipment: test blinds, pumps, gauges, vent lines, trees, vacuum box, magnets, LPI fluid, radiation source, digital equipment

destructive testing: tensile test, impact test, bend test

non-destructive testing: visual, magnetic particle, radiographic, ultrasonic, dye penetrant, hydrostatic, vacuum box, pneumatic, PAUT, light oil test

TASK D-14 Removes vessels and components

Task Descriptor

Boilermakers remove vessels and components to be repaired or replaced. Removing equipment, vessels and components allows easier access and facilitates maintenance and repairs. Obsolete vessels and components also need to be dismantled, demolished or removed.

D-14.01 Dismantles vessels and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-14.01.01P	prepare plan to dismantle **vessels** and **components**	plan to dismantle **vessels** and **components** is prepared according to job scope, site conditions and sequence

Reference Code	Performance Criteria	Evidence of Attainment
D-14.01.02P	select and use **tools and equipment**	**tools and equipment** are selected and used according to task
D-14.01.03P	select and use **bundle pulling equipment**	**bundle pulling equipment** is selected and used according to task and manufacturers' specifications
D-14.01.04P	identify **vessels** and **components** to be salvaged	**vessels** and **components** to be salvaged are numbered, match-marked or tagged according to work plan, drawings, and company policies and procedures
D-14.01.05P	prepare **components** for dismantling	**components** are prepared for dismantling using **procedures** according to plan
D-14.01.06P	coordinate work with other trades	work with other trades is coordinated to ensure efficient and safe removal of **components**
D-14.01.07P	unbolt, unfasten or cut **vessels** and **components**	**vessels** and **components** are unbolted, unfastened or cut according to plan and site conditions
D-14.01.08P	separate **components** to be salvaged (reused or recycled)	**components** to be salvaged are placed in secure area for storage and cleaning according to site-specific specifications, and company policies and procedures

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

tools and equipment: CAC-A (gougers), hammers, torches, wrenches, impact wrenches, hydraulic nut splitters, mechanical lifting devices, cranes

bundle pulling equipment: hydraulic or pneumatic bundle extractors (bundle pullers), forklifts, cranes

procedures (dismantling): installing lifting lugs, pre-cutting, removing obstructions

Knowledge

Reference Code	Learning Outcomes and Objectives
D-14.01.01L	demonstrate knowledge of **vessels** and **components**, their characteristics, applications and operation
a.	identify **vessels** and **components**, and describe their characteristics and applications
b.	describe operating principles of **vessels** and **components**
c.	interpret information pertaining to **vessels** and **components** found on drawings and specifications
D-14.01.02L	demonstrate knowledge of **dismantling procedures** related to **vessels** and **components**
a.	identify **tools and equipment** used to dismantle **vessels** and **components**, and describe their procedures for use
b.	identify **hazards** and describe **safe work practices** when dismantling **vessels** and **components**
c.	describe **dismantling procedures** and methods
d.	describe demolition methods and procedures
e.	list and describe **factors** to consider when analyzing integrity of **components** or attachment points
D-14.01.03L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	identify **vessels** and **components** that can be re-used
b.	describe recycling procedures
c.	identify practices that contribute to environmental protection

Range of Variables (include, but not limited to)

vessels: furnaces, boilers, condensers, tanks, vats, bins, exchangers, reactors, towers, stacks, penstocks, economizers, precipitators, scrubbers, drums, evaporators, digesters, air heaters, settler

components: curtains, electrodes, tubes and tube bundles, headers, trays and hardware in towers, stairways, support structures, screens, hoppers, ductwork, platforms, ladders, breeching, expansion joints, pipes, elbows

dismantling procedures: installing lifting lugs, pre-cutting, removing obstructions

tools and equipment: CAC-A (gougers), hammers, torches, wrenches, impact wrenches, hydraulic nut splitters, mechanical lifting devices, cranes

hazards: struck by material, asphyxiation, burns, explosion, falls, rigging failure, crushed, unknown weights

safe work practices: tie off tools, follow rigging plan, plan access to work, establish lift zone around vessel, ensure isolation points of vessels or equipment to be removed, remove combustibles from work area, de-energize and isolate, identify and remove hazardous materials

factors: steel strength, rust, corrosion, weight of vessel (buildup of residue, fly ash, water retention)

D-14.02 Removes materials and components

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

Skills

Reference Code	Performance Criteria	Evidence of Attainment
D-14.02.01P	plan material, component and scrap removal	material, component and scrap removal is planned according to material or component being removed, hazards, job requirements and site conditions
D-14.02.02P	select and use **tools and equipment**	**tools and equipment** to remove materials and components are selected and used according to work plan

Reference Code	Performance Criteria	Evidence of Attainment
D-14.02.03P	select PPE to execute work plan	PPE to remove materials and components is selected and used according to work plan
D-14.02.04P	sort and dispose of materials and components	materials and components to be removed is sorted and disposed of according to work plan and jurisdictional requirements

Range of Variables (include, but not limited to)

tools and equipment: torches, gougers, hammers, rigging equipment, mobile equipment, oxygen lances

Knowledge

Reference Code	Learning Outcomes and Objectives
D-14.02.01L	demonstrate knowledge of materials and components, their characteristics and applications
a.	identify materials and components, and describe their characteristics and applications
b.	interpret information pertaining to materials and components found on drawings and specifications
D-14.02.02L	demonstrate knowledge of procedures to remove materials and components
a.	identify **tools and equipment** used to remove materials and components, and describe their procedures for use
b.	identify **hazards**, and describe safe work practices pertaining to removing materials and components
c.	describe process to plan materials and components removal
d.	describe procedures to remove materials and components
e.	describe procedures and factors for sorting materials and components to be removed
D-14.02.03L	demonstrate knowledge of regulatory requirements pertaining to disposal of waste materials and components
a.	identify regulatory requirements pertaining to disposal of waste materials and components

Reference Code	Learning Outcomes and Objectives
D-14.02.04L	demonstrate knowledge of sustainability and environmental stewardship practices
a.	identify practices that contribute to environmental protection
b.	describe procedures to dispose of and recycle removed materials and components

Range of Variables (include, but not limited to)

tools and equipment: torches, gougers, hammers, rigging equipment, mobile equipment, oxygen lances

hazards: struck by material, asphyxiation, burns, explosion, falls, rigging failure, crushed, unknown weights

Appendix A – Acronyms

API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	breaking strength
CAC-A	carbon arc cutting-air
CAD	computer-aided design
CCUS	carbon capture, utilization and storage
CNC	computer numerical controlled
CNZEAA	Canadian Net-Zero Emissions Accountability Act
CO_2	carbon dioxide
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DT	destructive testing
FCAW	flux cored arc welding
FD	forced draft
FLRA	field-level risk assessment
GMAW	gas metal arc welding
GTAW	gas tungsten arc welding
HA	hazard assessments
ID	induced draft
IFC	Issued for Construction
ITP	inspection and test plans
JSA	job safety analysis
LEED	Leadership in Energy and Environmental Design
LPI	liquid penetrant inspection
MEKP	methyl ethyl ketone peroxide
MEWP	mobile elevating work platforms
MPI	magnetic particle inspection
NDT	non-destructive test
NECB	National Energy Code of Canada for Buildings
OHS	Occupational Health and Safety
PAC	plasma arc cutting
PAUT	phased array ultrasonic testing

PMI	positive material identification
PPE	personal protective equipment
PSI	pre-safety inspection
QC	quality control
SABA	supplied air breathing apparatus
SAW	submerged arc welding
SCBA	self-contained breathing apparatus
SDS	Safety Data Sheet
SMAW	shielded metal arc welding
SMRs	small modular reactors
TDG	Transportation of Dangerous Goods
UT	ultrasonic test
VT	visual test
WHMIS	Workplace Hazardous Materials Information System
WLL	working load limit
ZCB	Zero Carbon Building
ZEV	zero-emission vehicles

Appendix B – Tools and Equipment / Outils et équipement

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

atmospheric testing equipment	équipement d'analyse de l'air atmosphérique
coveralls (fire retardant, acid-resistant, plastic oversuit, disposable)	combinaisons (combinaisons ignifuges, résistantes aux acides, en plastique, jetables)
CSA protective footwear (site approved)	chaussures de sécurité homologuées CSA (approuvée par le chantier)
cutting goggles	lunettes de sécurité pour le découpage
dosimeter	dosimètre
dust masks	masques antipoussières
ear plugs and earmuffs	bouchons et cache-oreilles antibruit
exhaust fans	ventilateurs extracteurs
explosion-proof lights	lampes antidéflagrantes
fall arrest equipment (lanyards, harnesses, retractable lanyards, tripods)	dispositifs antichute (longes, harnais, longes rétractables, trépieds)
fire extinguishers	extincteurs
fire-retardant blankets	couvertures antifeu
grinding shields	écrans de protection pour rectification
ground fault interrupter	disjoncteur de fuite à la terre
hard hat	casque de protection
head lamp	lampe de mineur
kevlar gauntlets and gloves	gants et gants à crispin en kevlar
leather protective clothing and gloves	vêtements et gants de protection en cuir
leather welding shield	écran de soudage en cuir
personal atmospheric monitoring device	dispositif personnel de contrôle de l'air
powered air-purifying respirator (PAPR)	appareil de protection respiratoire à épuration d'air motorisé

respirator (half mask and full face)	respirateurs (demi-masques et masques complets)
safety glasses, safety goggles and mono goggles, spoggles	lunettes de sécurité, lunettes protectrices et lunettes monobloc, lunettes de sécurité compacte (sport)
self-contained breathing apparatus (SCBA) and supplied air breathing apparatus (SABA)	appareils respiratoires autonomes (ARA) et appareils respiratoires autonomes à adduction d'air (ARAAA)
side shields	écrans latéraux
signage (warning tape, tags, signs, barricades)	signalisation (ruban d'avertissement, étiquettes, panneaux, barrières)
smoke eaters and ventilation systems	dispositifs fumivores et systèmes de ventilation
string/trouble light	baladeuse
tarpaulins	bâche
welding lenses	verres filtrant
welding screens	écrans de protection pour soudeur
welding shields	écrans de soudeur
whip checks and pins	câbles et tiges de sécurité pour tuyaux

Welding Equipment / Matériel de soudage

anti-spatter spray	aérosol anti-projections
automated welding machine	soudeuse automatisée
chipping hammer	marteau burineur
connectors	connecteurs
electrode holders (whips/stingers)	pinces à électrodes (porte-électrodes)
electrode ovens (stationary/portable)	fours à électrodes (fixes/portatifs)
electrode pouch	poche à électrodes
files	limes
ground clamps	pinces de mise à la terre
hand wire brush (mild steel and stainless steel)	brosse métallique (acier mou et acier inoxydable)
inspection mirror	miroir d'inspection
orbital welders	soudeuses orbitale

penlight and batteries	mini lampe de poche et piles
power sources (welding machines) with auxiliary equipment for welding processes such as SMAW, FCAW, GMAW, GTAW and SAW	sources d'alimentation électrique (soudeuses) accompagnées de matériel supplémentaire pour les procédés de soudage : SMAW, FCAW, GMAW, TIG, SAW
pre-heating torch and equipment	matériel et chalumeau de préchauffage
purge hoses	tuyaux flexibles de purge
purge paper	papier à purger
regulators	régulateurs
remotes (amperage control)	contrôle d'intensité à distance
stud welding equipment	matériel de soudage de goujons
submerged arc welding (SAW) machine	soudeuse à l'arc submergé
temperature gun	thermomètre infrarouge
temperature sticks (thermo crayon)	crayons indicateurs de temperature (crayon thermosensible)
terminals	bornes
track welder	machine à souder sur rails
tungsten	tungstène
welding cable	câble de soudure
welding cable "y" connectors	connecteurs en Y pour câble de soudage
welding electrodes	électrodes de soudage
wire feeders	dévidoir

Cutting Tools and Equipment / Outils et matériel de découpage

Hand Types	**À main**
bolt cutters	coupe-boulons
files	limes
hacksaw and blades	scies à métaux et lames
handsaw	scie à main
knife	couteau
metal-cutting chisels	ciseaux à métaux
metal-cutting snips	pinces à couper le métal
pipe/tube cutters	coupe-tuyaux et coupe-tubes

pliers	pinces
scissors	ciseaux
shears	cisaille
tap and die sets	jeux de tarauds et filières
utility knife	couteau tout usage
Powered Types	**Mécaniques**
abrasive cut-off saw	scie à tronçonner abrasive
abrasive water jet cutter	outils de coupage à jet d'eau abrasif
band saw	scie à ruban
circular saw	scie circulaire
grinders (air and electric)	rectifieuses (pneumatiques et électriques)
mitre saw	scie à onglets
nibblers	grignoteuses
power shears	cisailles mécaniques
reciprocating saw	scie alternative
track saw	scie sur glissière
tube milling machine	broyeur tubulaire
Fuel Cutting Equipment	**Autre matériel de découpage à la flamme**
oxygen lance (thermal lance)	lance à oxygène (lance thermique)
Oxy-Fuel Cutting Equipment	**Matériel d'oxycoupage**
adapters	adaptateurs
burning and heating tips	buses de brûlage et de chauffage
flashback arrestors	intercepteurs de rentrée de flamme
friction lighters (strikers)	allume-gaz (allumeur)
manifold systems	systèmes de distribution
manual cutting torches	chalumeaux manuels de coupage
oxy-fuel cart	chariot de bouteilles d'oxygaz
oxy-fuel couplings and wrenches	raccords et clés pour oxycoupage
oxy-fuel cylinders	bouteilles d'oxygaz
oxy-fuel hoses and repair kits	boyaux et trousses de réparation pour boyaux à oxygaz
radiograph and related equipment	radiographie et matériel connexe
regulators	régulateurs
tip cleaners	nettoyeurs de buse

Carbon Arc Cutting-Air (CAC-A)	Matériel de découpage à l'arc au carbone
air-arc gouger	équipement de gougeage à l'arc au carbone avec jet d'air
air and power supply	alimentation en air et en électricité
air line	conduite d'air
carbon-cutting electrodes (round/flat)	électrodes de découpage au carbone (rondes/plates)
exothermic torch	chalumeau exothermique
replacement electrode holder	isolants de rechange
replacement insulators	porte-électrodes

Measuring Tools / Outils de mesure

angle and radius gauges	indicateur d'angle et calibre à rayon
calipers/dividers	pieds à coulisse, compas à pointes sèches
combination square	équerre combinée
compass	compas
compound tube gauge	calibre de tube composé
drill point gauge	calibre de mèche
folding rule	règle pliante
framing squares	équerres de charpentier
go/no-go gauge	calibre entre n'entre pas
laser measuring tools	outils de mesure à laser
measuring tapes	rubans à mesurer
micrometers	micromètres
ribbon tape	ruban
scale rule	règle à mesurer
sliding T-bevel	fausse équerre
steel tapes	rubans à mesurer en acier
string line	cordeau
telescoping gauge	jauge télescopique
vernier caliper	pied à coulisse

Marking and Layout Tools / Outils de marquage et de traçage

beam board	planche à poutres
ball peen hammer	marteau à panne ronde
chalk	craie
chalk-line	cordeau à tracer
contour marker	marqueur à contour
dividers	compas à pointes sèches
dye	colorant
engineer's level	niveau d'ingénieur
felt pen	crayon feutre
french curves	pistolets
laser level	niveau laser
lumber crayon	crayon gras
paint brush	pinceau
paint marker	stylo de peinture
piano wire	corde à piano
plumb bob	fil à plomb
prick/center punch	pointeau
protractor	rapporteur d'angle
scribe and awl	pointe à tracer et poinçon
smart level	niveau intelligent
soapstone and holder	pierre de savon et support
spirit level	niveau à alcool
squares	équerres
steel letter/number set	ensemble de lettres et de chiffres en acier
straight edge	règle de vérification
trammel points	compas d'ellipse
transit (theodolite)	théodolite
water level	niveau à eau
wrap-around	étiquette enveloppante

Hand Tools / Outils à main

adjustable wrench	clé à molette
back-up (piper) wrench	contreclef (clé à tube)
bar clamp	serre à barre
bench vice	étau d'établi
box-end wrench	clé polygonale
C-clamp	serre-joint en C
chain wrench	clé à chaîne
combination wrench	clé mixte
end-cut pliers (nippers)	pinces coupantes en bout
hammer (slug) wrench	clé-marteau (clé à frapper)
hammer wrench holder	support à clé-marteau
hex keys	clés hexagonales
industrial (pulling) wrench	treuil industriel (treuil de traction)
lineman pliers	pinces de monteur de lignes
locking wrench pliers	pinces-étaux
needle-nose pliers	pinces à bec effilé
open-end wrench	clé à fourche
pipe wrench	clé à tube
pipe vise	étau à tubes
ratchet and socket wrench sets	jeux de clés à douilles et à rochets
screwdrivers	tournevis
side-cutter pliers	pinces à tranchant latéral
sliding clamp (bessey clamp)	pinces à jointure glissante
slip-joint pliers	étau coulissant
spud wrench	clé à mâchoires
strap wrench	clé à courroie
torque wrench	clé dynamométrique
water-pump (utility) pliers (Channel Lock™ pliers)	pinces multiprises crantées/pinces multiprises ordinaires

Fitting Tools / Outils de montage

4 lb. hammer	masse de 4 lb
alignment pins	goupilles de positionnement
bull pins	tige d'assemblage
clamping angles	équerres de montage
claw hammer	marteau à panne fendue
dogs and screw dogs	taquets (chiens) et taquets à vis (chiens à vis)
drift pin	broche fixe
finger bars	barre de retenue
flange spreader	écarteur de bride
hickey bar	barre cintreuse
hi-low gauge	jauge d'alignement interne Hi-Lo
hose clamps	brides de serrage
hydraulic jack	vérin hydraulique
hydraulic ram	bélier hydraulique
key plates and key plate nuts	plaques de retenue et écrous carrés
key channels	les canaux de clé
leaf springs	ressort à lames
locking pliers	pinces-étaux
lugs	cosses
non-sparking hammer	marteau anti-étincelles
pin punch	chasse-goupille
pry bars	levier
shims and wedges	cales et coins
sledge hammers	masses de forgeron
soft-face hammer (lead-face)	marteau à frappe douce (à tête de plomb)
steel, brass and wood wedges	coins en acier, en laiton et en bois
strongbacks	barres de retenue
sweep template	gabarit incurvé
u-bars	barres en U
wall-banger™	assembleur de murs d'eau (wall-banger[MC])

Hydraulic and Pneumatic Tools and Equipment / Outils et équipement hydrauliques et pneumatiques

air chippers	marteaux burineurs pneumatiques
air compressor	compresseur d'air
air grinders	rectifieuses pneumatiques
air hammers	marteaux pneumatiques
air movers	appareils aérauliques
air manifolds/receiver	collecteurs d'air/réservoir d'air
air supply hose	boyau d'alimentation pneumatique
air utility hoist (air tugger)	palan pneumatique
bundle extractor (bundle puller)	extracteurs de faisceaux de tubes
drills	perceuses
filters/oilers	filtres/huileurs
hydraulic and pneumatic tensioning equipment	équipement hydraulique et pneumatique de tensionnement
hydraulic and pneumatic torque wrench	clé dynamométrique hydraulique et pneumatique
hydraulic nut splitter	casse-écrous hydraulique
hydraulic rams and jacks	béliers et vérins hydrauliques
hydrostatic test pump	pompe à essai hydrostatique
impact wrenches/sockets	clé à chocs/douilles
milling machine	fraiseuse
needle scalers	marteaux dérouilleurs-détartreurs pneumatiques
pneumatic torque guns	tournevis dynamométriques pneumatiques
regulator	régulateur
rolling motor	moteur de roulage
sand blasting equipment	équipement de sablage

Power Tools and Equipment / Outils et équipement mécaniques

bench grinder	meuleuse d'établi
brake press	presse plieuse
CNC tables	table commandée par ordinateur
cut-off saw	rogneuse
die grinder	meule à rectifier les matrices
drills/presses	perceuses/presses
electric screwdriver	tournevis électrique
electric supply panel	panneau de distribution d'électricité
electric torque wrench	clé dynamométrique électrique
extension cords	rallonges
floodlights	projecteurs
grinders	rectifieuses
hammer drill	marteau perforateur
impact wrench (electric and battery)	clé à chocs (électrique et à piles)
ironworker	ferronnier
jigsaw	scie sauteuse
punch	pointeau
rolls	rouleaux
sanders	ponceuse

Rigging, Hoisting and Positioning Equipment / Équipement d'arrimage et de levage

air mats	matelas pneumatiques
attachments (links, swivels, rings, thimbles, eye bolts)	accessoires (maillons, émerillons, anneaux, bagues, boulons à œil)
beam clamps	attaches à poutre
beam trolleys	chariots à poutre
blocks (tackle, wire rope, snatch)	moufles (mouflage, câble, galoche)
chain falls	palans à chaîne
come-along	palans manuels

cranes (truck-mounted, lattice-boom, hydraulic, tower, overhead)	grues (sur camion, flèche en treillis, grues hydrauliques, tour, pont roulant)
dynamometer (load cell)	dynamomètre (cellule de charge)
equalizer plates	plaques d'équilibrage
equalizer sheaves	réa de stabilisation
fibre rope	cordes de fibre
forklifts	chariot élévateur
headache ball	poids de tension
hooks/latches	crochets/clavettes
industrial machine skates	patins rouleurs conçus pour le déplacement de charges lourdes
jacks (hydraulic, screw, air bags)	crics (hydrauliques, à vis, pneumatiques)
load binders and steamboat ratchets	tendeurs à chaîne et crics à rochet
machine rollers	rouleaux de machine
plate clamps	pinces à plaques
rigging belt	sangle de gréage
shackles	manilles
slings (wire rope, round sling, fibre material, chain, synthetic web, wire/chain mesh)	élingues (métallique, circulaire, en fibre, chaîne, en toile synthétique, treillis métallique)
softeners	plastifiants
spreader and equalizer beams and bars	palonniers et poutres de stabilisation
strand jacks	vérins à traction de câbles
swivel hoist ring	émerillons de levage
telehandler	chargeur à bras télescopique
terminal end connections for wire rope (clips, sockets)	raccords de câbles (serre-câble, douilles)
tuggers	treuils pneumatiques
wire rope	câble
wire rope puller jacks (Tirfor jacks)	cric pour treuil à mâchoire (cric Tirfor)

Tube Removal/Expansion Tools and Equipment / Outils et équipement d'extraction et de mandrinage de tube

air motor with adapter sleeves	moteur pneumatique accompagné de manchon de serrage
beading tool	outil à baguetter
collapsing tools	outils de rabattage
expanders for boilers and heat exchangers	agrandisseurs de tubes pour chaudières et échangeurs de chaleur
expansion accessories (e.g., driving links, universals, gear drive)	accessoires de mandrinage (courroies de transmission, joints universels, transmission par engrenages)
flaring/belling tools	évaseurs/tulipeurs
hydraulic or pneumatic expander (rolling guns)	extendeur hydraulique ou pneumatique (pistolets de laminage)
hydraulic stub puller	extracteur hydraulique
induction heat gun	pistolet thermique par induction
internal tube cutters (revolution tube cutter, fly cutter)	coupe-tubes internes (par ex., rotatifs, outil-mouche)
knockout tools	outils de poinçonnage
mandrels and rolls	mandrins et rouleaux
splitting chisels	ciseau à fendre
torque controlled rolling motor	moteur de mandrinage à contrôle de couple
tube end mill	fraise en bout pour tube
tube plugs	bouchons de tube
tube pullers	extracteur de tube
tube wall reducing tool	amincisseur de paroi de tube

Tube Preparation/Installation Tools / Outils de préparation et d'installation des tubes

beveller	biseauteuse
brass, lead and plastic hammer	marteau de laiton, de plomb et à embout plastique
electric motor tube end mills	fraise en bout pour tube à moteur électrique
files	limes

flapper wheels/emery cloth	roues à clapet/toile d'émeri
hand/power brushes (twist)	brosses motorisées/manuelles (à torsion)
milling gun	fraiseuse
peening tool	outil de martelage
serrating tool	machine à denteler
track saw	scie sur glissière
tube guide	guide-tube
tube hole reamer	alésoir à tube

Tools and Equipment for Fibreglass / Outils et équipement pour travailler la fibre de verre

aluminum-serrated rollers	rouleaux cannelés en aluminium
barrel heater	réchauffeur de fût
brooms	balais
carborundum grinding discs (16-36 grit)	disques de meule au carbure (grain 16 36)
catalyst dispenser	distributeur de catalyseur
fibreglass material cutting tools	matériel de découpage de la fibre de verre
grinder with flexible disc back	meule avec disque souple
heat lamps	lampes chauffantes
kilo scale	balance en kilos
masking tape	ruban masque
mohair rollers	rouleaux mohair
paint brushes	pinceaux
pizza cutter	coupe-pizza
plastic buckets	seaux de plastique
putty knife	couteau à mastic
resin spray gun/hoses	boyaux/pistolet de pulvérisation de résine
roll of cardboard	rouleaux de carton
shovels	pelles
thermometer	thermomètre
wooden mixing spatulas	spatules à mélanger en bois

MEWPs, Work Platforms, Scaffolding and Access Equipment / Plateformes de travail et équipement d'accès

aluminum framed platform	plateformes en aluminium
aluminum planks	planches en aluminium
boom lifts	pont levant électrique
bosun chair	chaise de gabier
electrical articulated boom lift	bras élévateur articulé électrique
electrical scissor lifts	plateformes élévatrice à ciseaux électriques
electrical vertical lifts	plateformes élévatrice verticales
end frames	cadres de bout
extension ladder	échelle à coulisses
floats (angel's wings)	cages (nacelle – Angel Wing)
gas powered articulated boom lift	bras élévateur articulé à essence
gas powered scissor lifts	table élévatrice à ciseaux à essence
ladder jack scaffolds	échafaudage sur échelles
ladders	échelles
mechanical scaffolds	échafaudages mécaniques
modular scaffolds	échafaudages modulaires
personnel basket (man basket)	nacelle monte-personne (panier)
ramps	rampes
rolling scaffolds	échafaudages roulants
rope access equipment	équipement d'accès par corde
sawhorses	chevalets
scissor-lift	table élévatrice à ciseaux
stationary scaffolds	échafaudages fixes
stepladders	escabeaux
suspended scaffolds	échafaudages suspendus
swing stages	échafaudages volants
system scaffolding	tour d'échafaudage
temporary access/freight elevator	voie d'accès temporaire, monte-charge
tube and clamps	tubes et serre-joints

Appendix C – Glossary / Glossaire

bag house	enclosure through which dust particles are collected as exhaust gases pass through a fabric filter	**dépoussiéreur à sacs filtrants**	sac servant à recueillir les particules de poussières lors du passage des gaz d'échappement au travers d'un filtre en tissu
blast furnace	a smelting furnace into which compressed hot air is driven to complete the first stage in the production of all iron-based metals	**haut fourneau**	fourneau de fusion dans lequel on injecte de l'air chaud comprimé pour réaliser la première étape de la production de tous les métaux ferreux
boiler	a closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity or nuclear energy	**chaudière**	récipient fermé servant à chauffer de l'eau, à produire de la vapeur, à surchauffer de la vapeur ou à effectuer plusieurs de ces opérations, sous pression ou sous vide, par l'application de chaleur obtenue à partir d'un combustible, d'électricité ou d'énergie nucléaire
boom	the main component of a crane used to carry the hoisting tackle	**flèche**	composant principal d'une grue servant à porter le dispositif de levage d'une grue
breeching (gas flue)	a component connecting the ductwork from the boiler house to the stack liner	cheminée (carneau)	un composant reliant le réseau de conduits de la chaudière au revêtement de la colonne
catalyst	an additive that changes the rate of a chemical reaction but is itself unchanged at the end of the process	**catalyseur**	additif qui change la vitesse d'une réaction chimique tout en demeurant inchangé à la fin du procédé
chain fall	a hand/pneumatic/ electric-operated chain hoist	**palan à chaîne**	palan à chaîne manuel, pneumatique ou électrique

coke oven	tightly sealed unit to keep out air so coal cannot burn; rather it “bakes” with an intense heat up to 2100°F to produce coke	**four à coke**	four hermétiquement scellé dans lequel la « cuisson » du charbon sans combustion à une température élevée pouvant atteindre 2 100 °F permet de produire du coke
come-along	ratchet-type tool with a chain and hook used for pulling	**palan à main**	outil à rochet comportant une chaîne et un crochet, permettant de tirer une charge
confined space	an enclosed or partially enclosed and possibly hazardous working area that is not intended for continuous human occupancy that has limited access and egress and where the atmosphere may change during activities	**espace clos**	endroit fermé ou partiellement fermé et possiblement dangereux qui n’est pas conçu pour être occupé par des personnes de façon continue dont l’accès et la sortie sont limités et où les conditions atmosphériques peuvent changer dans le cadre des activités
dog	a tool used with a wedge or screw to fit-up components	**taquet (chien)**	outil utilisé avec un coin ou une vis pour assembler des composants
ductwork	a passage for air and gas flow	**gaine**	canalisation dans laquelle circule de l’air et le gaz
equalizer bar	bar used to equalize the load on the legs of your slings and bridle to evenly distribute the weight	**barre d’équilibrage**	barre utilisée pour égaliser la charge sur les pattes des élingues afin de répartir uniformément le poids
ferrous	metals dominated by iron in their chemical composition (e.g., carbon and low alloy steels)	**ferreux**	désigne les métaux composés surtout de fer (c.-à-d. les aciers au carbone et les aciers faiblement alliés)

fibreglass	glass reinforcement material (e.g., chopped strand mat, woven roving)	**fibre de verre**	matériau de renforcement en verre (c.-à-d. à mat à fils coupés; tissu stratifil)
hydrostatic test	strength test that also tests the seal of a closed pressure vessel by water pressure.	**essai hydrostatique**	vérification de la résistance et de l'étanchéité d'un récipient sous pression, par mise sous pression avec de l'eau
lashing	a wire rope fastened to itself to temporarily hold a component in position safely until secured.	**arrimage**	câble noué à lui-même pour maintenir temporairement un composant en place ou en sécurité jusqu'à ce qu'il soit fixé
metallurgy	involves the science of producing metals from elements and the reaction of these metals to many different activities and situations	**métallurgie**	science de la fabrication de métaux à partir de minerais, de la fabrication et de la préparation d'alliages et de la réaction des métaux lors de différentes activités et dans différentes situations
non-ferrous	metals that contain little or no iron in their chemical composition (e.g., aluminum, copper)	**non ferreux**	désigne les métaux contenant peu ou pas de fer (c.-à-d. aluminium, cuivre)
outriggers	extendable beams attached to a crane or equipment base mounting that rest on supports at the outer ends and provide a means of stabilizing the crane or equipment	**stabilisateurs**	bras extensibles fixés à la base d'une grue ou de l'équipement, qui reposent sur des supports à leur extrémité et permettent d'équilibrer la grue ou l'équipement

oxy-fuel cutting	a group of cutting processes used to sever metals by means of the chemical reaction of oxygen with the base metal at elevated temperatures	**oxycoupage**	ensemble de procédés de découpage exploitant la réaction chimique de l'oxygène avec le métal de base à des températures élevées
parts of line	the number of individual ropes or cables supporting a travelling block in a tackle system	**sections de câble**	nombre de longueurs de câbles individuels supportant une poulie mobile dans un système de mouflage
penstock	conveys water from the reservoir to the generating unit such as in a hydro-electric dam	**conduite forcée**	conduite acheminant l'eau du réservoir jusqu'à l'unité génératrice comme dans un barrage hydroélectrique
plasma-arc cutting	an arc cutting process that severs metal by melting a localized area with a constricted arc and removing the molten material with a high velocity jet of hot, ionized gas flowing from the torch nozzle	**découpage au jet de plasma**	procédé de découpage à l'arc au cours duquel le découpage est réalisé par fusion d'une zone restreinte à l'aide d'un arc confiné, puis par élimination du métal fondu grâce à un jet à haute vitesse de gaz ionisé projeté par le bec
pneumatic test	strength test that also tests the seal of a closed pressure vessel by air pressure	**essai pneumatique**	vérification de la résistance qui vérifie aussi l'étanchéité d'un récipient sous pression, par mise sous pression avec de l'air
precipitator	an electrostatic filter that separates particulate matter from exhaust gasses	**dépoussiéreur électrostatique**	filtre électrostatique qui sépare les particules du gaz d'échappement
promoter	an additive used with rapid-cure resins to reduce excessive exothermic heat build-up	**promoteur**	additif ajouté à certaines résines à polymérisation rapide pour réduire l'accumulation excessive de chaleur d'origine exothermique

purge	involves using one gas to displace another gas in an enclosed space or system	**purger**	utilisation d'un gaz pour débarrasser un espace clos d'un autre gaz qui s'y trouve
resin	a polyester (vinylester) solid usually dissolved in styrene, but when mixed with a catalyst, forms a rigid thermoset plastic	**résine**	polyester (ester vinylique) solide, normalement en solution dans le styrène, qui, en mélange avec un catalyseur, donne un plastique thermo durci rigide
scrubber	an apparatus used to remove solids from gases by entrainment in water	**épurateur-laveur**	appareil permettant de débarrasser les gaz des solides qu'ils contiennent, par entraînement dans l'eau
shackle	an anchor or chain type component with a pin that is used in rigging	**manille**	pièce de gréage en forme de U ou d'ancre, munie d'une cheville servant au gréage
sling	a wire rope or other material with eyes spliced on each end used for lifting and rigging applications	**élingue**	câble d'acier ou autre dispositif ayant des œils épissés à chaque extrémité, utilisé pour le levage et le gréage
spreader bar	bar used for hoisting trusses or long loads; to keep the load, such as a tank plate, from buckling	**palonnier**	poutre utilisée pour lever des bâtis ou des charges longues; également utilisée pour égaliser le poids et pour empêcher le flambage de la charge, par exemple une tôle de réservoir
stack	a vertical conduit used to discharge combustion products to the atmosphere	**cheminée**	conduit vertical servant à évacuer les produits de combustion dans l'atmosphère
stove	used to heat air to speed combustion	**fourneau**	appareil permettant de chauffer l'air pour accélérer la combustion
swing stage	a movable suspended scaffold	**échafaudage volant**	échafaudage suspendu et mobile

tackle	an assembly of ropes arranged for lifting, lowering and pulling	**mouflage**	ensemble de câbles et de poulies à gorge permettant de lever, d'abaisser et de tirer
tag line	a length of rope used to control a load during lifting or lowering	**câble stabilisateur**	corde utilisée pour contrôler une charge pendant le levage et la descente
tower crane	a power-operated fixed or slewing tower that provides elevation and support for its jib	**grue à tour**	grue mécanique à tour fixe ou pivotante assurant l'élévation et le support de sa flèche
tube expanding	the pressure-tight joint formed by expanding a tube end in a tube seat	**mandrinage d'un tube**	joint étanche formé par l'évasement de l'embout d'un tube dans sa contrepartie
tugger	a pneumatic or electric winch used for hoisting in tight areas where a crane is impractical	**treuil pneumatique**	treuil pneumatique ou électrique servant au levage dans des espaces restreints où il est peu pratique d'utiliser une grue
vacuum box test	a non-destructive test designed to find leaks in welded lap joints of a storage tank floor; soapy water is applied to the joint, then the air is removed from the sealed see-through box creating a vacuum and exposing the leaks	**essai par boîte à vide**	évaluation et essai non destructifs conçus pour détecter les fuites des joints soudés à recouvrement des planchers de réservoir de stockage; de l'eau savonneuse est versée sur le joint et l'air est ensuite extrait d'une boîte transparente scellée, créant ainsi un vide qui expose les fuites
vessel	a container designed to contain liquids, gases, or solids	**vaisseau**	contenant conçu pour contenir des liquides, des gaz ou des solides

water cutting	a process of using a jet of water and abrasives under high pressure to sever through a variety of construction materials	**découpage à l'eau**	procédé permettant de couper une gamme de matériaux de construction sous un jet d'eau et d'abrasifs à haute pression
water level	flexible clear tubing partially filled with water or glycol used to determine the elevation of an object in relation to a known elevation	**niveau à eau**	tuyau transparent souple partiellement rempli d'eau ou de glycol éthylène utilisé pour déterminer l'altitude d'un objet par rapport à une altitude connue
wire rope puller	manual or pneumatic wire pulling machine (e.g**.,** Tirfor[MC])	**treuil à mâchoire**	appareil de traction manuel ou pneumatique (p. ex., Tirfor[MC])