PROGRAM PROGRAMME
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RED SEAL OCCUPATIONAL STANDARD

Boilermaker

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Canada

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BOILERMAKER

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this Red Seal Occupational Standard (RSOS) as the Red Seal 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) sponsors the Red Seal Program, which, under the guidance of the CCDA, develops a national occupational standard for each of the Red Seal trades.

Standards have the following objectives:

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

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 Regulated Occupations Directorate
Employment and Social Development Canada
140 Promenade du Portage, Phase IV, 6th Floor
Gatineau, Quebec K1A 0J9
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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:

Jeffrey T. Jarosz	Alberta
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Jonathan White	Ontario

This standard was prepared by the Apprenticeship and Regulated Occupations Directorate of ESDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the standards development team of the Trades and Apprenticeship Division and of Apprenticeship British Columbia, the host jurisdiction for this trade.

STRUCTURE OF THE OCCUPATIONAL STANDARD

To facilitate understanding of the occupation, this standard contains the following sections:

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

Essential Skills Summary: An overview of how each of the 9 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: a graph which depicts the national percentages of exam questions assigned to the major work activities

Task Matrix and Examination Weightings: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard and their respective exam weightings

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

Essential Skills: The most relevant essential skills for this sub-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

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 Variables: elements that provide a more in-depth description of a term used in the performance criteria, evidence of attainment, learning outcomes, or learning objectives

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

Appendix B – Tools and Equipment: a non-exhaustive list of tools and equipment used in this trade

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

A complete version of the occupational standard, which provides additional detail for the trade activities, skills and knowledge can be found at www.red-seal.ca

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 a boilermaker whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Boilermaker	✓	✓	✓		✓		✓	✓	✓				
Construction Boilermaker				✓		✓				✓			

Boilermakers construct, fabricate, weld, assemble, install, erect, alter, maintain, repair, dismantle, demolish and test steam generators, boilers, economizers, air heaters, de-aerators, induction 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 and assemblies, 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, ship yards, 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.

Their work is performed indoors or outdoors and may be at extreme heights or underground. The work environment of boilermakers can expose them to hazards and conditions such as vibration, excessive noise, fumes, asbestos and other toxic environments, confined spaces, extreme temperatures, and radiation.

Key attributes for people entering this trade are: good hand-eye coordination, mechanical aptitude and manual dexterity. Boilermakers must possess the full range of knowledge, abilities and skills required of the trade including an understanding of mechanical drawings along with mathematical aptitudes. They also require strength and stamina to work with heavy components and equipment. It is common in this

trade to travel for work opportunities; therefore, boilermakers must adapt to frequently changing work environments. It is also 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

Tools and Equipment

The use of tools such as automated welding equipment, automated cutting and fitting equipment and advanced lifting/hoisting systems means that some fabrication procedures are becoming more efficient and safer.

Technology and Work Processes

New technologies such as automated welding and advanced non-destructive testing / non-destructive evaluation (NDT/NDE) technologies (e.g. digital x-rays, austenitic ultrasonic testing, phased array) require boilermakers to know new testing, fitting and preparation techniques.

There is a trend towards using rope access systems to perform inspections.

New technologies in tube extraction provide greater efficiency during repair and maintenance processes.

Due to new crane and transport technology, many larger components and vessels are delivered to the site as complete modules rather than being assembled on site. More of the boilermakers' fabrication is now done in a shop environment.

Safety and Environmental Considerations

New components and technology to reduce emissions are increasingly being installed in facilities such as power plants, gas plants, coal plants and smelters. Boilermakers are responsible for the fabrication, field construction, erection, installation, maintenance and repair of these components.

New technology that has been introduced to improve work safety includes personnel monitoring through radio frequency technology.

There is new legislation emerging for the use of green energy as well as safety. Corporate policy to address reducing liability issues is increasingly common.

Employers and employees are jointly responsible for the safety of all in the workplace. Jurisdictional requirements and legislation is being more stringently enforced. Due to safety regulation, in area where hazards exist, employees may be required to wear a personal Global Positioning System (GPS) tracking device.

Training and Upgrading

There is a greater emphasis and requirement for additional licenses, certificates and training for specific trade qualifications such as welding, rigging, machinery operation and safety. Specialized training for specific tasks such as hydraulic bolt torqueing and hydraulic stud tensioners as well as increased rigging skills is becoming common.

Because boilermakers are responsible for working on energy-producing systems, it is very important that they are adaptable and keep up-to-date with changes and new technology that may emerge in this area. A very specific skill set is required for nuclear power refurbishments. Due to the increase in power demands, specialized training for renewable energy, nuclear power, hydro-electric power plants and gas-fired generation will be required. With the increase in volume of oil and gas as a supplier of industrial work, there is a possible change in training requirements.

Also, with changes in specific sectors such as mining and carbon capture, boilermakers may require a specialized skill set.

ESSENTIAL SKILLS SUMMARY

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

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

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

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

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

The essential skills profile for the boilermaker trade indicates that the most important essential skills are **document use, numeracy** and **oral communication**.

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

READING

Boilermakers read and interpret summaries of toolbox meetings, short notes from co-workers about work activities and directions on product labels. They also read 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 handbooks, crane and rigging handbooks and training manuals.

DOCUMENT USE

Boilermakers locate information in various tables, bills of lading, work procedures, code books, load charts, SDS and equipment catalogues. 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, health and safety report forms as well as hazard or near-miss report forms.

NUMERACY

Boilermakers schedule their daily work activities. They determine the total weight of materials to be hoisted and use formulas to calculate the working load limit (safe work load) of various wire and fibre ropes. They also measure tube wall thicknesses and calculate tube expansion using formulas. They measure angles to cut tubing or pipe to specifications. They use geometry such as bisecting angles and constructing circles using chords to lay out materials for vessels. Boilermakers use data analysis math to ensure code requirements are met by cross referencing measurements on drawings with industry specifications. They also estimate tube/pipe lengths to perform rough cuts, materials needed for a job and the weight of a load to be lifted. They may also estimate how many workers and hours are required to complete a job. Boilermakers work with both the imperial and metric measurement systems, and therefore must be able to convert between the two systems.

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. Communication is also challenging because boilermakers often work in confined spaces or in towers, out of hearing range. This necessitates the use of hand signals or two-way radios.

THINKING

Boilermakers use critical thinking skills to perform diagnostics, trouble-shooting 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 (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 carbon capture, utilization and storage (CCUS), as well as the production and export of low-carbon hydrogen.

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

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

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

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

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

- the Montreal Protocol for phasing out R22 refrigerants.

- energy efficiency programs such as ENERGY STAR.

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

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

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

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

INDUSTRY EXPECTED PERFORMANCE

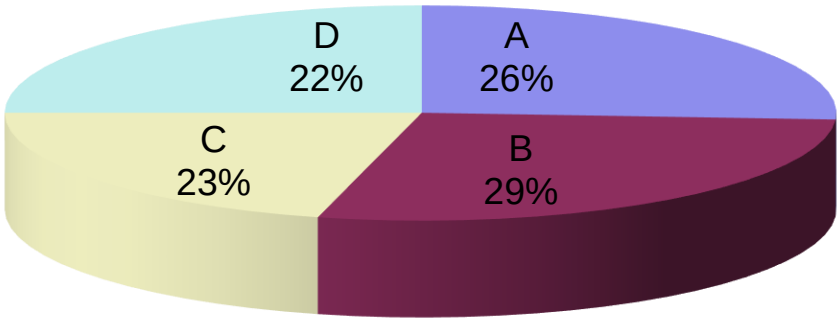
All tasks must be performed according to the applicable jurisdictional codes, regulations and standards. All health and safety standards must be respected and observed. Work should be done safely, efficiently and to a high quality with minimal material waste and with respect to the environment. All requirements of the manufacturer specifications and client expectations 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 keep pace with industry and promote continuous learning in their trade through mentoring of apprentices and fellow journeypersons.

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 language of business as well as language of instruction in apprenticeship programs.

PIE CHART

OF RED SEAL EXAMINATION WEIGHTINGS



MWA A	Performs Common Occupational Skills	26%
MWA B	Performs Rigging And Hoisting	29%
MWA C	Completes New Construction	23%
MWA D	Performs Repairs, Maintenance, Upgrading And Testing	22%

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. Interprovincial examinations typically have between 100 and 150 questions.

BOILERMAKER
TASK MATRIX

A - PERFORMS COMMON OCCUPATIONAL SKILLS — 26%

Task A-1 **Performs safety-related functions** **17%**	**A-1.01 Uses personal protective equipment (PPE) and safety equipment**	**A-1.02 Maintains safe work environment**	**A-1.03 Monitors confined spaces**
Task A-2 **Uses tools, equipment and work platforms** **28%**	**A-2.01 Uses hand tools**	**A-2.02 Uses power tools**	**A-2.03 Uses shop equipment**
	A-2.04 Uses cutting and welding tools and equipment	**A-2.05 Uses work platforms and access equipment**	**A-2.06 Uses aerial work platforms**
Task A-3 **Organizes work** **20%**	**A-3.01 Organizes project tasks and procedures**	**A-3.02 Uses drawings and specifications**	**3.03 Handles materials and components**
	A-3.04 Demobilizes site		
Task A-4 **Uses communication and mentoring techniques** **8%**	**A-4.01 Uses communication techniques**	**A-4.02 Uses mentoring techniques**	
Task A-5 **Performs cutting and welding activities** **27%**	**A-5.01 Cuts material**	**A-5.02 Prepares joints for fitting**	**A-5.03 Fits joints**
	A-5.04 Performs tack welds	**A-5.05 Performs basic welding**	**A-5.06 Performs advanced welding**

B - PERFORMS RIGGING AND HOISTING — 29%

Task B-6 **Plans lift** **31%**	**B-6.01 Determines load**	**B-6.02 Performs pre-lift analysis**	**B-6.03 Selects rigging and hoisting equipment**
	B-6.04 Secures lift area		
Task B-7 **Rigs load** **29%**	**B-7.01 Inspects rigging equipment**	**B-7.02 Fabricates rigging equipment**	**B-7.03 Attaches rigging equipment to load**
Task B-8 **Hoists load** **27%**	**B-8.01 Inspects hoisting equipment**	**B-8.02 Assembles hoisting equipment**	**B-8.03 Performs hoisting operations**
	B-8.04 Secures load before rigging removal		
Task B-9 **Performs post-lift activities** **13%**	**B-9.01 Conducts post-lift inspection**	**B-9.02 Disassembles hoisting equipment**	**B-9.03 Maintains rigging equipment**

C - COMPLETES NEW CONSTRUCTION **23%**

Task C-10 **Performs fabrication** **38%**	**C-10.01 Lays out components for fabrication**	**C-10.02 Cuts components for fabrication**	**C-10.03 Forms components for fabrication**
	C-10.04 Constructs components		
Task C-11 **Assembles and fits vessels and components** **37%**	**C-11.01 Aligns vessels and components**	**C-11.02 Fits vessels and components**	

Task C-12 **Fastens components** **25%**	**C-12.01 Bolts components**	**C-12.02 Expands tubes**	**C-12.03 Lays up fibreglass**

D - PERFORMS REPAIRS, MAINTENANCE, UPGRADING AND TESTING

22%

Task D-13 **Services vessels and components** **66%**	**D-13.01 Inspects vessels and components for defects**	**D-13.02 Prepares vessels and components for servicing**	**D-13.03 Repairs vessels and components**
	D-13.04 Performs preventative maintenance and upgrades	**D-13.05 Tests materials, vessels and components**	
Task D-14 **Removes vessels and components** **34%**	**D-14.01 Dismantles vessels and components**	**D-14.02 Removes materials**	

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 (three).

3. Total Training Hours During Apprenticeship Training

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

4. Sequencing Topics and Related Sub-tasks

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

Level 1	Level 2	Level 3
	Safety-Related Functions	Safety-Related Functions
	Communication and Mentoring	
Safety-Related Functions 1.01 Uses PPE and safety equipment 1.02 Maintains safe work environment 1.03 Monitors confined spaces		
Tools, Equipment and Work Platforms 2.01 Uses hand tools 2.02 Uses power tools 2.03 Uses shop equipment 2.04 Uses cutting and welding tools and equipment 2.05 Uses work platforms and access equipment 2.06 Uses aerial work platforms	**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 work platforms and access equipment 2.06 Uses aerial work platforms	**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 work platforms and access equipment 2.06 Uses aerial work platforms

Level 1	Level 2	Level 3
Organizes Work 3.01 Organizes project tasks and procedures 3.02 Uses 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 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 drawings and specifications 3.03 Handles materials and components
Communication and Mentoring Techniques 4.01 Uses communication techniques		**Communication and Mentoring Techniques** 4.01 Uses communication techniques 4.02 Uses mentoring techniques
Cutting and Welding Activities 5.01 Cuts materials 5.02 Prepares joints for fitting 5.03 Fits joints 5.04 Performs tack welds 5.05 Performs basic welding	**Cutting and Welding Activities** 5.01 Cuts materials 5.02 Prepares joints for fitting 5.03 Fits joints 5.05 Performs basic welding	**Cutting and Welding Activities** 5.02 Prepares joints for fitting 5.03 Fits joints 5.05 Performs basic welding
Rigging and Hoisting 6.01 Determines load. 6.03 Selects rigging and hoisting equipment 6.04 Secures lift area 7.01 Inspects rigging equipment 7.03 Attaches rigging equipment to load 8.01 Inspects hoisting equipment 8.03 Performs hoisting operations. 9.01 Conducts post-lift inspection 9.02 Disassembles hoisting equipment 9.03 Maintains rigging and hoisting equipment	**Rigging and Hoisting** 6.01 Determines load 6.03 Selects rigging and hoisting equipment 7.01 Inspects rigging equipment 7.03 Attaches rigging equipment to load 8.01 Inspects hoisting equipment 8.02 Assembles hoisting equipment 8.03 Performs hoisting operations 8.04 Secures load before rigging removal 9.01 Conducts post-lift inspection 9.02 Disassembles hoisting equipment	**Rigging and Hoisting** 6.01 Determines load 6.02 Performs pre-lift analysis 6.03 Selects rigging and hoisting equipment 7.02 Fabricates rigging equipment 8.02 Assembles hoisting equipment 8.03 Performs hoisting operations 9.02 Disassembles hoisting 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
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 (Introduction) 13.02 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

Level 1	Level 2	Level 3
	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	**Vessels and Components (Removal)** 14.01 Dismantles vessels and components 14.02 Removes materials

MAJOR WORK ACTIVITY A

Performs common occupational skills

TASK A-1 Performs safety-related functions

TASK DESCRIPTOR

Boilermakers must be familiar with the care and use of personal protective equipment (PPE) and safety equipment. Maintaining a safe work environment is the responsibility of all workers. 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.

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

Essential Skills Oral Communication, Continuous Learning, Working with Others

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-1.01.01P	select ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are selected according to task
A-1.01.02P	inspect ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are inspected before each use to verify operating condition and that they are free from damage
A-1.01.03P	clean respirator equipment	respirator equipment is cleaned to ensure it is hygienic
A-1.01.04P	perform fit test for respirators (full and half masks)	fit test for respirators (full and half masks) is performed to ensure a proper seal
A-1.01.05P	use Self-Contained Breathing Apparatus (SCBA) and Supplied Air Breathing Apparatus (SABA)	SCBA and SABA are used according to jurisdictional regulations and manufacturers' specifications
A-1.01.06P	attach fall arrest equipment to anchor points	fall arrest equipment is attached to anchor points according to Occupational Health and Safety (OH&S)

A-1.01.07P	store ***PPE*** and ***safety equipment***	***PPE*** and ***safety equipment*** are stored in dry and clean location to keep them free from contaminants
A-1.01.08P	identify and remove from service worn, damaged and defective ***PPE*** and ***safety equipment***	worn, damaged and defective ***PPE*** and ***safety equipment*** are identified and removed from service

RANGE OF VARIABLES

PPE includes: respirators, hard hats, safety glasses, Canadian Standards Association (CSA) approved boots, welding helmets, goggles/shields, safety harnesses, fire retardant clothing, hearing protection equipment, head protection, gloves, first aid kit, radioactive protective equipment

safety equipment includes: fire extinguishers, fall arrest system, barrier tape, fresh air breathing equipment, air movers, safety showers, eyewash stations, wind socks, confined space rescue equipment

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-1.01.01L	demonstrate knowledge of ***PPE*** and ***safety equipment***, their ***applications***, maintenance, storage and procedures for use	identify types of ***PPE*** and ***safety equipment***
		describe ***applications*** and limitations of ***PPE*** and ***safety equipment***
		describe ***PPE*** and ***safety equipment*** operations
		describe the procedures used to inspect, maintain and store ***PPE*** and ***safety equipment***
		identify training requirements for ***PPE*** and ***safety equipment***
		identify ***on-site safety locations*** and requirements
A-1.01.02L	demonstrate knowledge of regulatory requirements pertaining to ***PPE*** and ***safety equipment***	identify and interpret the regulatory requirements and responsibilities
		describe the roles and responsibilities of employers and employees with respect to the selection and use of ***PPE*** and ***safety equipment***
		describe workplace safety and health regulations related to the use of ***PPE*** and ***safety equipment***

RANGE OF VARIABLES

PPE includes: respirators, hard hats, safety glasses, CSA-approved boots, welding helmets, goggles/shields, safety harnesses, fire retardant clothing, hearing protection equipment, head protection, gloves, first aid kit, radioactive protective equipment

safety equipment includes: fire extinguishers, fall arrest system, barrier tape, fresh air breathing equipment, air movers, safety showers, eyewash stations, wind socks, confined space rescue equipment

applications include: hazardous locations, height, confined spaces

on-site safety locations include: first aid stations, safety showers, eye wash stations, muster points

A-1.02 Maintains safe work environment

Essential Skills Oral Communication, Document Use, Thinking

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-1.02.01P	recognize ***hazards***	***hazards*** are identified
A-1.02.02P	identify ventilation requirements and select ***ventilation equipment***	ventilation requirements are identified and ***ventilation equipment*** is selected according to task at hand
A-1.02.03P	set up ***work environment protection***	***work environment protection*** is set up according to site-specific requirements and task at hand
A-1.02.04P	perform housekeeping tasks	housekeeping tasks are performed to prevent tripping hazards, falling objects and slips
A-1.02.05P	interpret safety and environmental regulations	safety and environmental regulations are interpreted to ensure compliance
A-1.02.06P	complete ***safety analysis cards***	***safety analysis cards*** are completed to document tasks to be performed, risks involved and mitigation strategies
A-1.02.07P	participate in daily safety (toolbox) talks	participation in safety (toolbox) talks is documented
A-1.02.08P	execute hazard mitigation strategies	hazard mitigation strategies are executed according to ***safety analysis cards*** to prevent personal injuries
A-1.02.09P	segregate and dispose of waste materials	waste materials are segregated and disposed of according to site-specific guidelines
A-1.02.10P	participate in site orientation and safety training	site orientation and safety training is completed

A-1.02.11P	handle and store hazardous materials	hazardous materials are handled and stored according to Workplace Hazardous Materials Information System (WHMIS) procedures, OH&S and specialized training
A-1.02.12P	perform duties as a spotter	duties of a spotter are performed when operating and transporting mobile equipment on site
A-1.02.13P	perform spark watch	spark watch is performed during and after ***hot work*** according to task at hand
A-1.02.14P	monitor supplied breathing air	supplied breathing air is monitored to maintain uninterrupted supply
A-1.02.15P	participate in behavioural based safety programs	behavioural based safety programs are followed

RANGE OF VARIABLES

hazards include: fire hazards, electrical shocks, gaseous environment, flying debris, arc flashes, plant operations, mobile equipment on-site, overhead cranes, spills, heavy metal particulates, asbestos, radiation

ventilation equipment includes: air movers, fans

work environment protection includes: hoarding, fire blankets, flash screens, barrier tape, barriers, lockouts, high lines

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-1.02.01L	demonstrate knowledge of ***regulatory requirements*** pertaining to maintaining a safe work environment	describe federal, provincial/territorial and municipal health and safety acts and regulations
		identify the location of Safety Data Sheet (SDS) documents
		define and describe what is meant by a WHMIS labels and distinguish between supplier and workplace labels and other means of identification
		describe the roles and responsibilities of employer, supplier and worker described in WHMIS
		identify certification requirements
		explain how WHMIS applies to and is implemented in the workplace
A-1.02.02L	demonstrate knowledge of documentation pertaining to workplace safety	describe ***safety analysis cards***, their purpose and application

A-1.02.03L	demonstrate knowledge of the Occupational Health and Safety Act, Regulation and Code	describe the Workers' Compensation Board, jurisdictional and OH&S injury reporting requirements
A-1.02.04L	demonstrate knowledge of safe work practices	describe company safety policies and procedures
		describe good housekeeping practices
		describe site-specific emergency procedures
		identify common causes of accidents in the work environment
A-1.02.05L	demonstrate knowledge of safe handling of ***hazardous materials***	identify safe disposal and recycling procedures for ***hazardous materials***
A-1.02.06L	demonstrate knowledge of workplace ***hazards***	identify workplace ***hazards***
		identify fire hazards existing in the work environment
		identify classes of fires and the extinguishing medium in each case
		describe operation of fire-extinguishing equipment for extinguishing various classes of fires
		identify reactive chemicals
		identify hazardous gases
		describe prevention methods of ***hazards***

RANGE OF VARIABLES

regulatory requirements include: Transportation of Dangerous Goods (TDG), WHMIS, OH&S

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

hazardous materials include: asbestos, silica, ceramic fibers

hazards include: fire hazards, electrical shocks, gaseous environment, flying debris, arc flashes, plant operations, mobile equipment on-site, overhead cranes, spills, chromium, manganese, vanadium, asbestos, radiation

A-1.03 Monitors confined spaces

Essential Skills	Document Use, Working with Others, Oral Communication

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-1.03.01P	verify entry permit	entry permit is verified prior to personnel entering confined space
A-1.03.02P	communicate with emergency personnel	emergency personnel are informed and kept up-to-date
A-1.03.03P	recognize and report emergency situations	emergency situations are recognized and reported according to situation and site policy
A-1.03.04P	direct evacuation of confined spaces	evacuation of confined spaces is directed according to rescue plan
A-1.03.05P	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 as required by the entry permit
A-1.03.06P	monitor and document atmospheric conditions of confined spaces	atmospheric conditions of confined spaces are monitored and documented according to entry permit
A-1.03.07P	maintain constant contact with personnel in confined spaces	constant contact with personnel in confined spaces is maintained using various ***methods***
A-1.03.08P	secure confined space during inactivity	confined space is ***secured*** according to site policy

RANGE OF VARIABLES

methods include: two-way radios, line-of-sight, verbal communication, air horns, closed-circuit video
securing confined spaces includes: signage, tape, barricades, barriers, locks, hole covers

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-1.03.01L	demonstrate knowledge of legislation and regulations pertaining to confined space entry	identify legislation and regulations pertaining to confined space entry
A-1.03.02L	demonstrate knowledge of confined spaces	identify ***locations*** requiring the monitoring of confined spaces
		define confined spaces
		identify potential ***hazards of confined spaces*** and entry into them

	identify ***types of gases*** and their properties
	describe site-specific requirements for monitoring confined spaces
	identify ***confined space monitoring equipment***
	describe considerations to ***preplan*** confined space entry
	explain confined space rescue procedures
	identify methods for ***securing confined spaces***
	identify de-energization and lock out procedures

RANGE OF VARIABLES

locations include: vessels, trenches, boilers, tanks, duct work, precipitators, stacks

hazards include: improper isolation of confined space, lack of ventilation, inert gases, leaking oxy-fuel hoses and valves, triggering explosions, sludge in confined space, lack of respiratory protection, presence of toxic or flammable material, improper rescue procedures, lack of natural ventilation, oxygen deficiency or enrichment, exceeding lower and upper explosive limits

hazards of confined spaces include: various gases and surrounding conditions

types of gases include: chlorine, carbon monoxide, hydrogen sulfide, nitrogen, argon, oxygen, acetylene, propane, sulphur dioxide

confined space monitoring equipment includes: air horns, radios, flashlights, identification vests, gas monitors, rescue plans

preplan includes: atmospheric testing and monitoring, procedures, code of practice, safety equipment and clothing, ground-fault interrupters, explosion-proof lighting, rescue equipment

securing confined spaces includes: signage, tape, barricades, barriers, locks, hole covers

TASK A-2 Uses tools, equipment and work platforms

TASK DESCRIPTOR

Boilermakers must use and maintain hand, power, cutting and welding tools and shop 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 tools

Essential Skills Numeracy, Thinking, Continuous Learning

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.01.01P	clean, adjust and store ***hand tools***	***hand tools*** are cleaned, adjusted and stored in order to keep them in good operating condition
A-2.01.02P	identify wear, damage and ***defects*** of ***hand tools***	wear, damage and ***defects*** are identified in order to repair or replace ***hand tools***
A-2.01.03P	sharpen chisels, wedges, chipping hammers and prick/centre punches	chisels, wedges, chipping hammers and prick/centre punches are sharpened according to task at hand
A-2.01.04P	change worn or dull ***components***	worn or dull ***components*** are changed according to task at hand and site-specific requirements
A-2.01.05P	tag and remove from service worn, damaged and defective tools and equipment	worn, damaged and defective tools and equipment are tagged according to company policy and removed from service according to manufacturers' specifications

RANGE OF VARIABLES

hand tools - See Appendix (Tools and Equipment)
defects include: cuts, breaks, burns
components include: blades, thread taps and dies

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.01.01L	demonstrate knowledge of ***hand tools***, their applications and procedures for use	identify types of ***hand tools***, their applications and operating and maintenance procedures
		identify types of measuring tools, their applications, and operating and maintenance procedures
		explain the setup of transits
		explain the process to transfer elevation points using a water level
		describe the process of precision measuring using a micrometer (Metric and Imperial)
		identify types of layout tools, their applications, and operating and maintenance procedures
		describe the use of threading equipment for the production and repair of internal and external threads
A-2.01.02L	demonstrate knowledge of inspection procedures	describe the procedures used to inspect and tag ***hand tools***
		identify criteria for replacement, repair or removal of ***hand tools***

RANGE OF VARIABLES

hand tools - See Appendix (Tools and Equipment)

A-2.02 Uses power tools

Essential Skills Document Use, Thinking, Continuous Learning

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.02.01P	clean, lubricate, adjust and store ***power tools***	***power tools*** are cleaned, lubricated, adjusted and stored according to manufacturers' specifications in order to keep them in good operating condition
A-2.02.02P	identify wear, damage and ***defects*** of ***power tools*** and their ***components***	wear, damage and ***defects*** of ***power tools*** and their ***components*** are identified according to manufacturers' specifications, and replaced
A-2.02.03P	change worn or dull ***components***	worn or dull ***components*** are changed according to manufacturers' specifications
A-2.02.04P	top up fluids for hydraulic equipment	fluids for hydraulic equipment are topped up according to manufacturers' specifications
A-2.02.05P	tag and remove from service worn, damaged and defective ***power tools*** and their ***components***	worn, damaged and defective ***power tools*** and their ***components*** are tagged according to company policy and removed from service according to manufacturers' specifications

RANGE OF VARIABLES

power tools include: grinders, pneumatic torque wrenches, milling guns, drills, reamers, tube expanders, hydraulic expanders, impact wrenches, hammer drills, pipe threading and cutting equipment, hydraulic jacks and rams, hydraulic torque wrenches, hydraulic tensioners

defects include: cuts, breaks, burns, bends

components include: blades, bits, taps and dies

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-2.02.01L	demonstrate knowledge of ***power tools*** and ***components***, their applications and procedures for use	identify types of ***power tools*** and ***components*** their applications and operating and maintenance procedures
		identify ***hazards*** related to the use of ***power tools***
		describe installation procedures for grinding discs or stones
		describe the ***applications of grinders***

		describe the use of threading equipment for the production and repair of internal and external threads
A-2.02.02L	demonstrate knowledge of inspection procedures	describe the procedures used to inspect ***power tools*** and ***components***
		identify criteria for replacement, repair or removal of ***power tools***

RANGE OF VARIABLES

power tools include: grinders, pneumatic torque wrenches, milling guns, drills, reamers, tube expanders, hydraulic expanders, impact wrenches, hammer drills, pipe threading and cutting equipment, hydraulic jacks and rams, hydraulic torque wrenches, hydraulic tensioners

components include: blades, bits, taps and dies

hazards include: airline rupture, hydraulic line ruptures, electrical faults, pinch points, projectiles, improper grinding disc selection

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

A-2.03 Uses shop equipment

Essential Skills Document Use, Reading, Numeracy

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.03.01P	clean, lubricate and adjust ***shop equipment***	***shop equipment*** is cleaned, lubricated and adjusted according to manufacturers' specifications in order to keep in good operating condition
A-2.03.02P	identify wear, damage and ***defects*** of ***shop equipment*** and ***components***	wear, damage and ***defects*** of ***shop equipment*** and ***components*** are identified according to manufacturers' specifications
A-2.03.03P	tag worn, damaged and defective ***shop equipment*** and ***components*** and remove from service	worn, damaged and defective ***shop equipment*** and ***components*** are tagged according to company policy and removed from service
A-2.03.04P	change damaged, worn or dull ***components***	damaged, worn or dull ***components*** are changed according to manufacturers' specifications

A-2.03.05P	monitor ***shop equipment***	***shop equipment*** is monitored for fluid levels according to manufacturers' specifications and performance according to task at hand
A-2.03.06P	top up fluids for ***shop equipment***	fluids for ***shop equipment*** are topped up according to manufacturers' specifications

RANGE OF VARIABLES

shop equipment includes: burning tables, radial drill presses, brake presses, shears, power rolls, ironworkers, positioning equipment, pedestal grinders, bandsaws

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.03.01L	demonstrate knowledge of ***shop equipment***, their applications and procedures for use	identify types of ***shop equipment***, their applications and operating and maintenance procedures
		identify ***hazards*** related to the use of ***shop equipment***
		describe the power roll operations, and identify calculations that need to be made for forming
		describe roll and brake capacity and allowances and proper direction to roll or bend
		describe power press brake operations for forming
		describe the methods of positioning dies for specific operations
		identify types of stationary drills and components, their applications and operating and maintenance procedures
A-2.03.02L	demonstrate knowledge of inspection procedures	describe the procedures used to inspect shop equipment
		identify criteria for replacement, repair and locking out ***shop equipment***

RANGE OF VARIABLES

shop equipment includes: burning tables, radial drill presses, brake presses, shears, power rolls, ironworkers, positioning equipment, pedestal grinders, bandsaws

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

A-2.04 Uses cutting and welding tools and equipment

Essential Skills Thinking, Document Use, Continuous Learning

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.04.01P	clean, adjust and store ***cutting and welding tools and equipment***	***cutting and welding tools and equipment*** are cleaned, adjusted and stored according to manufacturers' specifications in order to keep them in good operating condition
A-2.04.02P	identify worn, damaged and defective ***cutting and welding tools and equipment***	worn, damaged and defective ***cutting and welding tools and equipment*** are identified according to manufacturers' specifications
A-2.04.03P	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 tagged according to company policy and removed from service according to manufacturers' specifications
A-2.04.04P	change worn or consumed ***components***	worn or consumed ***components*** are changed according to task at hand
A-2.04.05P	check hoses, cables, connectors and ground clamps	hoses, cables, connectors and ground clamps are checked for ***defects***
A-2.04.06P	repair defective hoses, cables, connectors and ground clamps	defective hoses, cables, connectors and ground clamps are repaired according to manufacturers' specifications and task at hand

RANGE OF VARIABLES

cutting and welding tools and equipment include: welding machine, power supply, oxy-fuel system, plasma arc cutting (PAC) system, high pressure water cutting system, oxygen lance, carbon arc cutting-air (CAC-A) (gouger)

components include: cutting and heating tips, electrode holders, collets, gas lenses, hoses, cables

defects include: cuts, breaks, burns

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.04.01L	demonstrate knowledge of ***cutting and welding tools and equipment***, their applications and procedures for use	identify types of ***cutting and welding tools and equipment***, their applications, and operating and maintenance procedures
		identify ***hazards*** related to cutting and welding practices
		identify types of cutting processes
		identify types of welding processes
A-2.04.02L	demonstrate knowledge of certification requirements	identify certification requirements for ***cutting and welding tools and equipment***
A-2.04.03L	demonstrate knowledge of inspection procedures	describe the procedures used to inspect ***cutting and welding tools and equipment***
		identify criteria for replacement or repair of ***cutting and welding tools and equipment***

RANGE OF VARIABLES

cutting and welding tools and equipment include: welding machine, power supply, oxy-fuel system, plasma arc cutting (PAC) system, high pressure water cutting system, oxygen lance, arc air gouger, carbon arc cutting-air (CAC-A) (gouger)

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

A-2.05 Uses work platforms and access equipment

Essential Skills Thinking, Reading, Document Use

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-2.05.01P	determine scaffold and platform requirements	scaffold and platform requirements are determined according to job scope and safety regulations
A-2.05.02P	interpret and follow scaffold tags	scaffold tags are interpreted and followed to assess whether scaffolding is ready and safe for use and to determine fall arrest requirements

A-2.05.03P	secure ***work platforms*** and ***access equipment***	***work platforms*** and ***access equipment*** are secured according to safety regulations
A-2.05.04P	install ***safety features***	***safety features*** are installed according to safety regulations, jurisdictional regulations and company policies
A-2.05.05P	identify, tag and remove from service worn, damaged and defective ***work platforms*** and ***access equipment***	worn, damaged and defective ***work platforms*** and ***access equipment*** are identified, tagged and removed from service according to company policies and OH&S

RANGE OF VARIABLES

work platforms and ***access equipment*** include: ladders, suspended scaffolding, needle beams, modular platforms, tank scaffolding

safety features include: toe boards, guard rails, guy wires, fall protection equipment, safety gates

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-2.05.01L	demonstrate knowledge of ***work platforms*** and ***access equipment***, their applications, limitations and procedures for use	identify types of ***work platforms*** and ***access equipment*** and describe their characteristics, limitations and applications
		describe the set-up of ***work platforms***
		describe the procedures used to erect and dismantle ***work platforms and access equipment***
		describe the procedures used to inspect, maintain and store ***work platforms*** and ***access equipment***
A-2.05.02L	demonstrate knowledge of safe work practices pertaining to ***work platforms*** and ***access equipment***	identify hazards and describe safe work practices pertaining to ***work platforms*** and ***access equipment***
A-2.05.03L	demonstrate knowledge of regulatory requirements pertaining to ***work platforms*** and ***access equipment***	identify certification for the use of ***work platforms*** and ***access equipment***
		identify and interpret federal, provincial/territorial, municipal and site-specific regulations pertaining to ***work platforms*** and ***access equipment***

RANGE OF VARIABLES

work platforms and ***access equipment*** include: ladders, suspended scaffolding, needle beams, modular platforms, tank scaffolding

A-2.06 Uses aerial work platforms

Essential Skills	Oral Communication, Document Use, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-2.06.01P	select ***aerial work platforms***	***aerial work platforms*** are selected according to job scope
A-2.06.02P	inspect ***aerial work platforms***	***aerial work platforms*** are inspected according to checklist to verify ***components*** and their operation
A-2.06.03P	assess work site environment	ground conditions are assessed, overhead hazards are identified and corrective measures have been taken
A-2.06.04P	attach safety harnesses	safety harnesses are attached to anchor points on ***aerial work platforms*** according to manufacturers' specifications
A-2.06.05P	assemble swing stages	swing stages are assembled according to manufacturers' and engineered specifications
A-2.06.06P	install lifelines for bosun's chairs and swing stages	lifelines are installed for bosun's chairs and swing stages to a secure anchor point according to engineered specifications

RANGE OF VARIABLES

aerial work platforms include: scissor lifts, telescoping man lifts, swing stages, articulating booms

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

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-2.06.01L	demonstrate knowledge of ***aerial work platforms***, their applications, limitations and procedures for use	identify types of ***aerial work platforms*** and describe their characteristics, limitations and applications
		describe the operating procedures and safe work practices pertaining to ***aerial work platforms***
		identify and describe the use of anchor points

		identify work site environment conditions and the impact on ***aerial work platform*** setup and operation
		describe a rescue plan and back-up features for ***aerial work platform*** operation failure
A-2.06.02L	demonstrate knowledge of regulatory requirements pertaining to ***aerial work platforms***	identify and interpret federal, provincial/territorial, municipal and site-specific regulations pertaining to ***aerial work platforms***
		identify the training and certification requirements for the use of ***aerial work platforms***

RANGE OF VARIABLES

aerial work platforms include: scissor lifts, telescoping man lifts, swing stages, articulating booms

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.

A-3.01 Organizes project tasks and procedures

Essential Skills Document Use, Reading, Oral Communication

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-3.01.01P	identify activities of project	project activities are identified according to scope of work
A-3.01.02P	identify material requirements	material requirements are identified according to job specification and mill test report
A-3.01.03P	prioritize sequence of activities in operation	sequence of activities in operation are prioritized according to timelines, and availability of materials and equipment

A-3.01.04P	coordinate tasks with co-workers and other trades	tasks are coordinated with co-workers and other trades
A-3.01.05P	set up work areas, ***materials and equipment***	work areas, ***materials and equipment*** are set up according to plans and specifications
A-3.01.06P	adapt to changing ***job conditions***	changing ***job conditions*** are identified and measures are taken in order to complete the operation
A-3.01.07P	estimate time requirement to complete each operation	time requirements to complete each operation are estimated
A-3.01.08P	complete/interpret ***documentation***	***documentation*** required for task is completed/interpreted according to site policy
A-3.01.09P	inspect and inventory tools and equipment	tools and equipment are inspected and inventoried
A-3.01.10P	organize and store tools and equipment	tools and equipment are organized and stored according to housekeeping practices and company policies

RANGE OF VARIABLES

materials and equipment include: shipping containers, tools, tool trailers, cranes, material, machinery

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-3.01.01L	demonstrate knowledge of the elements involved in planning and organizing job tasks and procedures	identify ***sources of information*** relevant to organizing job tasks and procedures
		describe the ***considerations*** to plan and organize job tasks and procedures
		describe the sequence of job tasks and procedures
		identify all tools, equipment and materials required for job tasks
		identify requirements to coordinate with other trades
		estimate the time required to complete each task
		describe the function of project scheduling tools

RANGE OF VARIABLES

sources of information include: drawings, specifications, client requirements, codes

considerations include: available space, schedule/sequence, permits, hazards assessment, personnel, tools and equipment, materials and supplies, storage location

A-3.02 Uses drawings and specifications

Essential Skills Document Use, Thinking, Numeracy

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-3.02.01P	locate and interpret ***information*** on ***drawings*** and ***specifications***	***information*** on ***drawings*** and ***specifications*** is located and interpreted to perform work activity
A-3.02.02P	interpret ***drawings***	***drawings*** are interpreted to determine ***details of construction***
A-3.02.03P	create a sketch	sketch is created to clarify technical information
A-3.02.04P	convert between metric and imperial measurements	conversion between metric and imperial measurements has been completed and compared for accuracy

RANGE OF VARIABLES

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

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

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

details of construction include: materials required, assembly techniques, welding processes

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-3.02.01L	demonstrate knowledge of ***drawings***, their use and interpretation	identify types of ***drawings***
		identify the common parts of a ***drawing*** and the ***information*** contained within
		describe procedures for finishing a ***component*** from an interpreted drawing

		describe how to create a bill of materials for a ***component*** from ***information*** found on a drawing
		outline an order of assembly to complete a ***component***
		identify the various types of ***specifications***
		identify ***symbols*** found on technical drawings
		determine types, sizes, shapes, and grades of ***materials*** required from the drawings
		identify ***technological tools*** for drawings and specifications
A-3.02.02L	demonstrate knowledge of calculations relevant to drawings	calculate conversions between metric and imperial systems

RANGE OF VARIABLES

drawings include: fabrication, assembly, structural, detail, engineered lift drawings, erection, as-builts
information includes: scale, not to scale, colour code, legend, title blocks, current revisions, bill of materials, IFC stamp
components include: saddles, nozzles, skirts, shells, ladders, internals, heads
specifications include: measurements, weights, tolerances, grades of material, welding criteria
symbols include: welding, steel designation, fasteners, tubes, plates, studs, fibreglass, nuts, bolts
materials include: tubes, plates, studs, fibreglass, nuts, bolts, expanded metals
technological tools include: computer aided design (CAD), tablets, digital photography

A-3.03 Handles materials and components

Essential Skills Oral Communication, Document Use, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-3.03.01P	use ***material handling tools and lifting devices***	***material handling tools and lifting devices*** are used according to task at hand
A-3.03.02P	identify materials and components	materials and components are identified according to task at hand
A-3.03.03P	determine weights of components and materials	weights of components and materials are determined by calculating and referring to material documentation

A-3.03.04P	store materials and components	materials and components are stored in a protected location to prevent ***contamination***
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 of loading/unloading***

RANGE OF VARIABLES

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

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

materials include: tube and pipe, plates, welded bar grating, expanded metals

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

hazards of loading/unloading include: uneven weight distribution, capacity of hoisting equipment, over-sized loads

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-3.03.01L	demonstrate knowledge of type, properties and handling requirements of ***materials*** and ***components***	describe space constraints
		identify types of ***metals***
		identify ***materials*** and ***components***
		interpret the designations for pipe and tube
		identify various types, grades and size of bolts, studs and screws
		identify ***standard fittings***, their sizing, designation, function and pressure rating
A-3.03.02L	demonstrate knowledge of safe handling practices for ***materials*** and ***components***	describe safety requirements for handling ***material*** and ***components***
		describe safety requirements for storing gas cylinders and hazardous materials

RANGE OF VARIABLES

materials include: tube and pipe, plates, welded bar grating, expanded metals

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

metals include: white cast iron, gray cast iron, carbon steels, alloy steels, stainless steel, copper, aluminum, clad steel

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

A-3.04 Demobilizes site

Essential Skills	Document Use, Oral Communication, Working with Others

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

SKILLS

	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 by returning to owner
A-3.04.03P	restore work area to operational state	work area is restored to operational state

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-3.04.01L	demonstrate knowledge of the procedure to demobilize a site	describe inventory practices for demobilizing a site
		describe steps necessary to restore a site to its operational state

TASK A-4 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 amongst 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-4.01 Uses communication techniques

Essential Skills Oral Communication, Thinking, Working with Others

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-4.01.01P	demonstrate communication practices individually or in a group	instructions and messages are understood by both parties involved, communication is verified and repeated back
A-4.01.02P	listen using ***active listening*** practices	steps of ***active listening*** are utilized
A-4.01.03P	receive and respond to feedback	response to feedback indicates understanding and corrective measures are taken
A-4.01.04P	explain and provide feedback	explanation and feedback is provided and task is carried out as directed
A-4.01.05P	encourage questions to improve communication	questions enhance understanding, on-the-job training and goal setting
A-4.01.06P	participate in safety and information meetings	meetings are attended, information is relayed to the workforce, and information is understood and applied

RANGE OF VARIABLES

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-4.01.01L	demonstrate knowledge of trade terminology	define terminology used in the trade
A-4.01.02L	demonstrate knowledge of effective communication practices	describe the importance of using effective verbal and non-verbal communication with ***people in the workplace***
		identify ***sources of information*** to effectively communicate
		identify communication and ***learning styles***
		describe effective listening and speaking skills
		identify ***personal responsibilities and attitudes*** that contribute to on-the-job success
		identify the value of diversity in the workplace
		identify communication that constitutes ***harassment*** and ***discrimination***

RANGE OF VARIABLES

people in the workplace include: other tradespeople, colleagues, apprentices, supervisors, clients, authorities having jurisdiction, manufacturers

sources of information include: regulations, codes, occupational health and safety requirements, authorities having jurisdiction requirements, drawings, specifications, company and client documentation

learning styles include: visual (seeing it), auditory (hearing it), kinesthetic (doing it)

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

harassment includes: objectionable conduct, comment or display made either on a one-time or continuous basis that demeans, belittles, or causes personal humiliation or embarrassment to the recipient or others

discrimination is prohibited based on race, national or ethnic origin, colour, religion, age, sex, sexual orientation, marital status, family status, disability or conviction for which a pardon has been granted

A-4.02 Uses mentoring techniques

Essential Skills Oral Communication, Thinking, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-4.02.01P	identify and communicate learning objective and point of lesson	apprentice or learner can explain the objective and point of the lesson
A-4.02.02P	demonstrate performance of a skill to an apprentice or learner	***steps required to demonstrate a skill*** are performed
A-4.02.03P	identify conditions required for an apprentice to practice a skill	***practice conditions*** are set up so that the skill can be practiced safely by the apprentice
A-4.02.04P	assess apprentice or learner's ability to perform tasks with increasing independence	performance of apprentice improves with practice to a point where skill can be done with little supervision
A-4.02.05P	give supportive and corrective feedback	apprentice adopts best practice after having been given supportive or corrective feedback
A-4.02.06P	support apprentices in pursuing technical training opportunities	technical training is completed within timeframe prescribed by apprenticeship authority
A-4.02.07P	support equity group apprentices	workplace is harassment and discrimination-free
A-4.02.08P	implement probationary period for learners to assess their suitability to the trade	apprentice is given feedback that helps them identify their own strengths and weaknesses and suitability for the trade

RANGE OF VARIABLES

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

practice conditions means: guided, limited independence, full independence

KNOWLEDGE

	Learning Outcomes	Learning Objectives
A-4.02.01L	demonstrate knowledge of strategies for learning skills in the workplace	describe the importance of individual experience
		describe the shared responsibilities for workplace learning

		determine one's own learning preferences and explain how these relate to learning new skills
		describe the importance of different types of skills in the workplace
		describe the importance of ***essential skills*** in the workplace
		identify different ***learning needs*** and strategies to meet ***learning needs***
		identify ***strategies to assist in learning a skill***
A-4.02.02L	demonstrate knowledge of ***strategies for teaching*** workplace skills	identify different roles played by a workplace mentor
		describe the ***steps*** involved in teaching skills
		explain the importance of identifying the point of a lesson
		identify how to choose an appropriate time to present a lesson
		explain the importance of linking the lessons
		identify the components of the skill (the context)
		describe considerations in setting up opportunities for skill practice
		explain the importance of providing feedback
		identify techniques for giving effective feedback
		describe a skills assessment
		identify methods of assessing progress
		explain how to adjust a lesson to different situations

RANGE OF VARIABLES

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

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

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

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

TASK A-5 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-5.01 Cuts material

Essential Skills Thinking, Document Use, Numeracy

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-5.01.01P	select cutting tools and equipment	cutting tools and equipment are selected according to material type and task at hand
A-5.01.02P	set up cutting tools, equipment and work area	cutting tools, equipment and work area are set up according to specifications
A-5.01.03P	identify ***cutting issues***	***cutting issues*** are identified according to specifications
A-5.01.04P	take ***corrective measures***	***corrective measures*** are taken according to ***requirements***
A-5.01.05P	perform cut	cut is performed according to specifications
A-5.01.06P	clean up after the cut	sharp edges and slag are removed after the cut

RANGE OF VARIABLES

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

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.01.01L	demonstrate knowledge of ***materials*** to be cut	select and prepare ***material*** to be cut
		identify processes associated with cutting alloy steels or ferrous or non-ferrous metals
A-5.01.02L	demonstrate knowledge of cold-cutting processes, their associated equipment and accessories	identify the different ***cold-cutting techniques***
		describe ***cold-cutting techniques*** and common cutting faults
		describe the process of manual cutting on material of various thickness
		describe cutting/threading of pipe using manual and mechanical process
A-5.01.03L	demonstrate knowledge of hot-cutting processes, their associated equipment and accessories	identify the different ***hot-cutting techniques***
		describe the process to perform flame cutting
		describe the process to light a torch
		list the different types of ***flames***
		explain and demonstrate the set-up of oxy-fuel equipment
		explain the procedure to check for leaks
		identify the characteristics of oxygen and fuel gas cylinders
		explain the construction and purpose of a manifold system
		identify and select fuel gases for manual and automatic flame cutting of carbon steel
		identify and describe regulator types, purposes, and their correct adjustments and care
		describe the assembly, installation and maintenance of hoses, fittings and flashback arrestors
		explain and demonstrate the setting of oxy-fuel pressures, balancing and flame adjustments
		list the causes of backfires and flashbacks
		describe the design, maintenance, selection and operation of oxy-fuel tips

	describe the set-up and operation of CAC-A (carbon arc cutting-air) equipment (gouger)
	describe the set-up and operation of plasma arc cutting equipment

RANGE OF VARIABLES

material includes: metals (alloy steels, ferrous or non-ferrous metals, carbon steels), fiberglass, composites
cold-cutting techniques include: shear, milling, band saw, hack saw, carbide tooth blade
hot-cutting techniques include: flame cutting, plasma arc, CAC-A (gouger), abrasive disc
flames include: oxidizing, carbonizing, neutral

A-5.02 Prepares joints for fitting

Essential Skills Thinking, Document Use, Numeracy

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-5.02.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to material type and task at hand
A-5.02.02P	set up ***joints***	***joints*** are prepared according to drawings and ***specifications***
A-5.02.03P	prepare material	material is prepared using ***methods*** according to ***specifications***
A-5.02.04P	dam and purge components	components are dammed and purged according to type of metal and task at hand
A-5.02.05P	clean joint	joint is cleaned prior to fit-up to protect integrity of weld and prevent weld defects

RANGE OF VARIABLES

tools and equipment include: grinders, bevellers, oxy-acetylene torches, milling guns, files
joints include: groove type (U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)
specifications include: weld procedures, ASME code, API code, ASTM code, drawings, material
methods include: grinding, shaping, beveling, cleaning

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.02.01L	demonstrate knowledge of processes of preparing joints for fitting	identify welded joint preparation and joint tolerances from drawings
		determine if metal conditions require cleaning
		describe the process to lay out and fit up joints
A-5.02.02L	demonstrate knowledge of regulatory requirements pertaining to components	identify codes and standards related to components

A-5.03 Fits joints

Essential Skills Thinking, Document Use, Numeracy

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-5.03.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to material type and task at hand
A-5.03.02P	determine alignment tolerances	alignment tolerances are determined according to ***specifications***
A-5.03.03P	set gap between fitted ***joints***	gap between fitted ***joints*** is set according to ***specifications***
A-5.03.04P	set offset	***joint*** is offset to control distortion
A-5.03.05P	fit-up ***joints***	***joints*** are fit-up according to welding procedure

RANGE OF VARIABLES

tools and equipment include: 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 include: weld procedures, ASME code, API code, ASTM code, drawings, material

joints include: groove type (U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.03.01L	demonstrate knowledge of joint fitting techniques and procedures	identify various types of ***joints***
		describe fitting methods and procedures
		describe procedures for ***joint*** spacing (gap)
A-5.03.02L	demonstrate knowledge of regulatory requirements pertaining to fitting components	identify codes and standards related to fitting components

RANGE OF VARIABLES

joints include: groove type (U, V, J, bevel), B-C-T-E-L (butt, corner, tee, edge, lap)

A-5.04 Performs tack welds

Essential Skills	Working with Others, Oral Communication, Document Use

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-5.04.01P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to material type and task at hand
A-5.04.02P	select types of consumables	consumables are selected according to material type and ***specifications***
A-5.04.03P	pre- and post-heat materials	materials are pre- and post-heated according to material type and ***specifications***
A-5.04.04P	place tack welds	tack welds are placed according to task at hand and ***specifications***
A-5.04.05P	remove tack welds	tack welds are removed according to ***specifications***
A-5.04.06P	interpret welding symbols	tacks are performed according to welding symbols

RANGE OF VARIABLES

tools and equipment include: chipping hammers, electrodes, welding PPE, ground clamps, C-clamps, welding machines

specifications include: weld procedures, ASME code, API code, ASTM code, drawings, material

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.04.01L	demonstrate knowledge of process to perform tack welds	identify parent material to be tacked
		describe the procedures for ***tacking operations***
		identify welding codes and symbols
A-5.04.02L	demonstrate knowledge of regulatory requirements pertaining to tack welds	identify codes and standards related to tacking components

RANGE OF VARIABLES

tacking operations include: 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-5.05 Performs basic welding

Essential Skills	Document Use, Thinking, Continuous Learning

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
A-5.05.01P	interpret welding processes, welding symbols and documentation	welding processes, welding symbols and documentation are interpreted according to ***specifications***
A-5.05.02P	select and use various welding consumables	types and sizes of welding consumables are selected and used according to material type and procedure being used
A-5.05.03P	set up and use ***related welding equipment***	***related welding equipment*** is set up and used according to ***specifications***
A-5.05.04P	ground welding equipment	welding equipment is ground to the work
A-5.05.05P	perform basic welding techniques	basic welds are performed according to ***specifications***

RANGE OF VARIABLES

specifications include: weld procedures, ASME code, API code, ASTM code, drawings, manufacturers', Canadian Welding Bureau (CWB), material

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.05.01L	demonstrate knowledge of basic welding processes, their associated equipment and accessories	identify ***welding processes*** to be applied
		describe the elements and sequence of ***welding processes***
		identify ***arc welding machines***
		identify ***welding machine accessories***
		explain electrode classification and rod coating (flux)
		explain the relationship between rod diameter and amperage settings
		identify common ***weld faults***
		list the functions of slag
		identify polarity settings and their applications
		describe grounding techniques and methods
		describe the storage requirements of low hydrogen electrodes
		explain welding procedures to minimize distortion
		explain pre- and post- heat processes
A-5.05.02L	demonstrate knowledge of welding codes and symbols	identify welding codes and symbols
		interpret symbols for groove welds
A-5.05.03L	demonstrate knowledge of regulatory requirements pertaining to ***welding processes***	identify codes and standards related to ***welding processes***

RANGE OF VARIABLES

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

arc welding machines include: AC transformer, AC/DC rectifier, components of an AC and DC generator, inverter power source

welding machine accessories include: various types and sizes of electrode holders and cables, cable lugs, quick connectors, ground clamps, remotes, wire feeders

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

A-5.06 Performs advanced welding

Essential Skills	Document Use, Thinking, Continuous Learning

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

SKILLS

	Performance Criteria	Evidence of Attainment
A-5.06.01P	perform advanced welding techniques	advanced welds are performed according to ***specifications***
A-5.06.02P	select and use various welding consumables for alloy and ***specialty metals***	types and sizes of welding consumables are selected and used according to material type and procedure being used
A-5.06.03P	interpret welding procedures, symbols and documentation for specialized welding	symbols, specialized welding procedures and documentation are interpreted according to ***specifications***
A-5.06.04P	set up and use ***advanced welding equipment***	***advanced welding equipment*** is set up and used according to ***specifications***
A-5.06.05P	identify the different processes related to groove joint welding	groove joints are welded according to ***specifications***

RANGE OF VARIABLES

specifications include: weld procedures, ASME code, API code, ASTM code, drawings, material

specialty metals include: inconel, stainless, chromoly, aluminum, titanium

advanced welding equipment includes: submerged arc welding (SAW), automated welding, GTAW

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
A-5.06.01L	demonstrate knowledge of advanced welding procedures, their associated equipment and accessories	identify advanced ***welding process*** to be applied
		describe the elements and sequence of ***welding processes***
		describe the damming and purging process and identify when it applies
		describe polarity settings and their applications
A-5.06.02L	demonstrate knowledge of electrode classifications	explain the effects of alloy additions to the coating for arc welding electrodes
A-5.06.03L	demonstrate knowledge of welding codes and symbols	interpret welding symbols and documentation
		interpret symbols for grooves
		interpret supplementary symbols
A-5.06.04L	demonstrate knowledge of regulatory requirements pertaining to welding procedures	identify codes and standards related to advanced welding procedures

RANGE OF VARIABLES

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

MAJOR WORK ACTIVITY B

Performs rigging and hoisting

TASK B-6 Plans lift

TASK DESCRIPTOR

Boilermakers plan lifts to ensure that safe rigging and hoisting practices are followed to avoid personal injury and equipment damage.

B-6.01 Determines load

Essential Skills Numeracy, Document Use, Thinking

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-6.01.01P	identify load to be hoisted	load to be hoisted is identified according to task at hand
B-6.01.02P	check load	load is checked for shape, ***unknown weight factors and material integrity***
B-6.01.03P	calculate total weight of load	total weight of load is calculated by measuring load and using formulas and reference materials
B-6.01.04P	verify total weight of load	total weight of load is verified against fabrication drawings or bill of lading
B-6.01.05P	estimate and calculate centre of gravity	centre of gravity is estimated by visual inspection of weight distribution and is calculated by using formulas
B-6.01.06P	select and use ***tools and equipment***	***tools and equipment*** are selected according to task at hand

RANGE OF VARIABLES

unknown weight factors and material integrity include: product residue, build-up of foreign matter, corrosion

tools and equipment include: tape measures, calculators, reference cards, charts

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.01.01L	demonstrate knowledge of load requirements	list ***properties of load*** to be lifted that need to be considered
B-6.01.02L	demonstrate knowledge of calculations and ***related factors*** to determine load weight	identify formulas to determine load weight
		calculate load weight
		identify ***related factors*** for calculations and load weight

RANGE OF VARIABLES

properties of load to be lifted include: dimensions, shape, weight, centre of gravity
related factors include: reference materials, catalogs, drawings, bills of lading

B-6.02 Performs pre-lift analysis

Essential Skills Thinking, Numeracy, Document Use

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-6.02.01P	determine final location and orientation of load	final location and orientation of load is determined according to erection drawings and marks matched on equipment and structure
B-6.02.02P	determine ***type of lift***	***type of lift*** is determined to identify equipment needed for task
B-6.02.03P	perform a walk-through inspection	a walk-through inspection is performed to determine travel path and rigging requirements considering ***rigging factors***
B-6.02.04P	identify location for hoisting equipment	location for hoisting equipment is identified considering ***hoisting factors***
B-6.02.05P	confirm load securing methods	load securing methods are confirmed in final location based on erection drawings and engineered specifications
B-6.02.06P	identify ***equipment required for rigging attachment and removal***	***equipment required for rigging attachment and removal*** is identified according to job requirements and load access

B-6.02.07P	determine ***communication methods***	***communication methods*** are determined according to line of sight and site-specific requirements
B-6.02.08P	identify personnel needed to perform rigging tasks	personnel needed to perform rigging tasks are identified according to tasks at hand
B-6.02.09P	determine head room, fleet angles, anchor points, block loading and parts of line including friction	head room, fleet angles, anchor points, block loading and parts of line including friction are determined to select rigging and hoisting equipment required for task at hand
B-6.02.10P	determine if lift requires a permit	lift requirements for permit are determined

RANGE OF VARIABLES

type of lift includes: simple, tandem, critical

rigging factors include: obstacles, head room, opening size, hazards

hoisting factors include: ground conditions, crane swing radius, obstacles, load charts, hazards

equipment required for rigging attachment and removal includes: man lifts, scissor lifts, man baskets, scaffolding

communication methods include: hand signals, two-way radios

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-6.02.01L	demonstrate ability to perform pre-lift analysis	describe inspection of area surrounding lift
		list ***signaling methods*** used during rigging and lifting
		list delegation of responsibilities for ***personnel***
		describe the dry run procedures
B-6.02.02L	demonstrate understanding of rigging and hoisting	identify ***type of lifts*** and procedures
		identify ***lift hazards***
		explain effects of sling angle when preparing for hoisting/lifting operations
B-6.02.03L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting/lifting and moving equipment	interpret jurisdictional regulations pertaining to rigging, hoisting/lifting and moving equipment

RANGE OF VARIABLES

signaling methods include: verbal, two-way radios, hand signals

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

type of lift includes: simple, tandem, critical

lift hazards include: overhead obstacles, boom interference, ground conditions, swing path, powerlines

B-6.03 Selects rigging and hoisting equipment

Essential Skills Thinking, Numeracy, Document Use

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-6.03.01P	identify ***characteristics of the load***	***characteristics of the load*** are identified to ensure load control when selecting ***rigging equipment***
B-6.03.02P	select slings and hardware	slings and hardware are selected according to working load limits (WLL), rigging configuration and sling tension
B-6.03.03P	protect the ***rigging and hoisting equipment*** and the load	***rigging and hoisting equipment*** and the load are protected during lift to avoid rigging equipment and load damage
B-6.03.04P	select ***hoisting equipment***	***hoisting equipment*** is selected based on ***factors***

RANGE OF VARIABLES

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

rigging equipment includes: slings, blocks, hardware, hooks, rollers, softeners, below the hook lifting devices (i.e., spreader, equalizer beams)

hoisting equipment includes: cranes, Tirfors™, tuggers, chain falls, come-alongs, jacks

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

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-6.03.01L	demonstrate knowledge of rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures	define terminology associated with rigging, hoisting/lifting and moving equipment
		identify types of ***rigging***, ***hoisting***/lifting and moving equipment and accessories, and describe their applications, limitations and procedures
		identify the ***factors*** to consider when selecting rigging, hoisting/lifting and moving equipment
		define and describe ***wire rope characteristics***
		describe and demonstrate the testing and strength reductions of knots and splices

		define and describe the construction, grades and applications of natural fibre and synthetic ropes
		interpret ***rigging tag information***
B-6.03.02L	demonstrate knowledge of regulatory requirements pertaining to rigging, hoisting/lifting and moving equipment	interpret jurisdictional regulations pertaining to rigging, hoisting/lifting operations and moving equipment
B-6.03.03L	demonstrate knowledge of calculations required to select rigging, hoisting/lifting and moving equipment	explain effects of sling angles when preparing for hoisting/lifting operations
		calculate rigging, hoisting/lifting and moving equipment capacities
		interpret crane charts
		identify swing zone and swing clearance
		identify and interpret applicable tables and charts for slings and attachments
		interpret manufacturers' specifications or the specifications certified by a professional engineer
		define and describe WLL formulas, factors and reductions for natural fibre, synthetic fibre and wire ropes

RANGE OF VARIABLES

rigging equipment includes: slings, blocks, hardware, hooks, rollers, softeners, below the hook lifting devices (i.e., spreader, equalizer beams)

hoisting equipment includes: cranes, Tirfors™, tuggers, chain falls, come-alongs, jacks

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

wire rope characteristics include: 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 includes: date, size, capacity, material

B-6.04 Secures lift area

Essential Skills	Writing, Working with Others, Oral Communication

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-6.04.01P	inform non-essential personnel of the lift	non-essential personnel are informed of the lift and are kept clear of the lifting area
B-6.04.02P	perform walk-around inspection	walk-around inspection is performed to clear hoist area of personnel not associated with the lift
B-6.04.03P	establish a safety perimeter	a safety perimeter is established by installing barricades, barrier tape, tags and signs appropriate to size of lift and by assigning personnel to monitor lift perimeter

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-6.04.01L	demonstrate knowledge of rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures for use	define terminology associated with rigging, hoisting/lifting and moving equipment
B-6.04.02L	demonstrate knowledge of safety practices related to rigging, hoisting/lifting and moving operations	describe the ***procedures used to ensure the work area is safe for lifting***
		identify hazards and describe ***sources for safe work practices*** pertaining to rigging, hoisting/lifting and moving operations
B-6.04.03L	demonstrate knowledge of jurisdictional regulations pertaining to rigging, hoisting/lifting and moving equipment	interpret jurisdictional regulations pertaining to rigging, hoisting/lifting and moving equipment

RANGE OF VARIABLES

procedures used to ensure the work area is safe for lifting include: installing and tagging barriers, assessing ground conditions, ensuring that work area is not congested or obstructed for emergency access, limiting approach, obtaining required permits

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

TASK B-7 Rigs load

TASK DESCRIPTOR

Rigging is an integral part of the boilermaker trade. Rigging equipment is used so that loads or personnel can be hoisted in a safe and secure manner.

B-7.01 Inspects rigging equipment

Essential Skills	Thinking, Document Use, Reading

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.01.01P	conduct a pre-use visual inspection	pre-use visual inspection of rigging equipment is conducted to identify ***damage***
B-7.01.02P	identify damaged equipment	damaged equipment is identified, tagged and removed from service
B-7.01.03P	conduct an inspection of all in-use rigging equipment	inspection of all in-use rigging equipment is conducted to ensure it is secured and fastened according to manufacturers' specifications
B-7.01.04P	interpret ***rigging tag information***	***rigging tag information*** is interpreted to verify WLL

RANGE OF VARIABLES

damage includes: kinks, broken wires, arc mark, tears, cuts, cracks, rust, corrosion, chemical burns, bird caging, contamination, wear, overload, illegible/missing tag

rigging tag information includes: date, size, capacity, manufacturer

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-7.01.01L	demonstrate knowledge of inspection procedures pertaining to rigging equipment	identify rigging equipment, their components, applications, limitations and procedures for use
		describe a walk-around inspection of a rigging system
		identify removal criteria for damaged rigging equipment, components or attachment points

		describe inspection requirements for rigging equipment
B-7.01.02L	demonstrate knowledge of jurisdictional regulations pertaining to the inspection of rigging equipment	identify jurisdictional regulations and manufacturers' specifications for inspection and removal of rigging equipment

B-7.02 Fabricates rigging equipment

Essential Skills Reading, Document Use, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.02.01P	lay out for fabrication	fabrication is laid out according to lug charts, fabrication drawings and engineered specifications
B-7.02.02P	build, construct or assemble rigging equipment	rigging equipment is built, constructed or assembled according to manufacturers' and engineered specifications
B-7.02.03P	inspect fabricated equipment	fabricated equipment is inspected according to engineered specifications and jurisdictional regulations prior to use

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-7.02.01L	demonstrate knowledge of the process to fabricate rigging equipment	identify different ***fabrication methods***
		describe limitations to fabricating rigging equipment
		identify ***rigging equipment that can be fabricated*** according to engineered specifications
		interpret jurisdictional regulations regarding fabrication of rigging equipment

RANGE OF VARIABLES

fabrication methods include: cutting, welding

fabrication methods do not include: makeshift rigging which is fabricated rigging that is not engineer approved

rigging equipment that can be fabricated includes: lifting lugs, spreader bars

B-7.03 Attaches rigging equipment to load

Essential Skills Document Use, Thinking, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-7.03.01P	access rigging points	rigging points are accessed using ***access equipment*** according to task at hand
B-7.03.02P	assemble and connect main rigging	main rigging is assembled and connected to the load according to rigging plan
B-7.03.03P	use secondary rigging	secondary rigging is used to transfer loads when required
B-7.03.04P	identify and use ***adjustment rigging equipment***	***adjustment rigging equipment*** is identified and used to maintain load control
B-7.03.05P	identify and attach ***control devices***	***control devices*** are identified and attached to maintain load control
B-7.03.06P	select and use ***knots, bends and hitches***	***knots, bends and hitches*** are selected and used based on lift requirements to ensure control of load

RANGE OF VARIABLES

access equipment includes: scissor lifts, man lifts, ladders, manbaskets, scaffolds

adjustment rigging equipment includes: chain falls, come-alongs, turn buckles, Tirfors™

control devices include: tag lines, holdbacks, guy wires, Tirfors™

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-7.03.01L	demonstrate knowledge of the procedures to attach rigging equipment to a load	list and describe requirements and specifications involved in rigging
		describe function, advantages and limitations of various ***hitches and configurations***
		define types and functions of ***knots, bends and hitches***
		identify the purpose and demonstrate the ability to tie ***knots, bends and hitches***
		describe splicing of natural fibre and synthetic fibre ropes
		perform back splice, side splice and short splice
		define, describe and demonstrate the ability to apply ***material handling attachments***
		identify attachment points
		identify jacking points and equipment
		identify rolling equipment and placement

RANGE OF VARIABLES

hitches and configurations include: basket, choker, bridle hitch, vertical hitch

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

material handling attachments include*:* hooks and shackles, wire rope clips, eyebolts, chains, additional industry attachments

TASK B-8 Hoists load

TASK DESCRIPTOR

Hoisting a load is lifting the equipment or components into place according to a lift plan. In many cases, it is a team effort involving operators, signallers, riggers and supervisors. It is important that boilermakers participate in hoisting operations for safety and to ensure that personnel, equipment and components are protected during the operation.

B-8.01 Inspects hoisting equipment

Essential Skills	Thinking, Document Use, Reading

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-8.01.01P	verify inspection certification	inspection certification is verified to ensure that dates are valid
B-8.01.02P	identify damaged or worn ***hoisting equipment***	damaged or worn ***hoisting equipment*** that needs to be replaced is identified prior to assembly
B-8.01.03P	conduct a walk-around inspection	a walk-around of ***hoisting equipment*** is conducted to ensure rigging is installed and the hoisting equipment is fully prepared for the lift

RANGE OF VARIABLES

hoisting equipment includes: cranes, Tirfors™, tuggers, chain falls, come-alongs, jacks, blocks

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-8.01.01L	demonstrate knowledge of process to inspect ***hoisting equipment***	list and describe the elements of a walk-around inspection in a hoisting system
		describe the procedures used to inspect hoisting equipment
		identify hoisting equipment, their components, applications, limitations and procedures for use

RANGE OF VARIABLES

hoisting equipment includes: cranes, Tirfors™, tuggers, chain falls, come-alongs, jacks, blocks

B-8.02 Assembles hoisting equipment

Essential Skills Reading, Thinking, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-8.02.01P	set up hoisting equipment ***components***	hoisting equipment ***components*** are set up according to manufacturers' and engineered specifications
B-8.02.02P	identify the order of c***omponent*** assembly	order of ***component*** assembly is identified according to task at hand
B-8.02.03P	select and use tools and equipment	tools and equipment are selected and used to assemble ***hoisting equipment*** according to task at hand and lift plan
B-8.02.04P	identify ***procedures*** and requirements	***procedures*** and requirements for assembly are identified according to equipment being used, manufacturers' specifications and company procedures

RANGE OF VARIABLES

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

hoisting equipment includes: cranes, blocks, strand jacks, tuggers, jack and roll equipment

procedures include: spooling cable on a drum, preparing ground, reeving a block, assembling crane components, mounting tuggers

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-8.02.01L	demonstrate knowledge of the ***procedures*** used to assemble ***hoisting equipment***	describe the basic ***procedures*** for the placement, assembly and installation of ***hoisting equipment*** and ***components***
		identify ***hoisting equipment***, their ***components***, applications, limitations and procedures for use
		interpret load charts, lift radius and boom length

RANGE OF VARIABLES

procedures include: spooling cable on a drum, preparing ground, reeving a block, assembling crane components, mounting tuggers

hoisting equipment includes: cranes, blocks, strand jacks, tuggers, jack and roll equipment

components include: boom, tracks, counterweight, reeving, outrigger boxes, gantry, jib

B-8.03 Performs hoisting operations

Essential Skills Working with Others, Oral Communication, Thinking

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-8.03.01P	participate in a pre-lift meeting	participants are involved in pre-lift meetings in order to understand their roles and responsibilities
B-8.03.02P	use hoisting ***communication methods***	***communication methods*** are used when hoisting
B-8.03.03P	coordinate activities	activities between rigging personnel and the equipment operator or operators involved in hoisting are coordinated according to lift plan
B-8.03.04P	operate ***hoisting equipment***	***hoisting equipment*** is operated according to lift plan and manufacturers' specifications
B-8.03.05P	control load	load is controlled by using tag lines, holdbacks and secondary rigging
B-8.03.06P	recognize hazards	hazards are recognized and lift irregularities are corrected

RANGE OF VARIABLES

communication methods include: hand signals, two-way radios, verbal

hoisting equipment includes: cranes, forklifts, hoists, come-alongs, tuggers, Tirfors™, chainfalls

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-8.03.01L	demonstrate knowledge of hoisting procedures and their associated equipment, applications, limitations and procedures for use	describe hoisting and load moving procedures
		list the topics discussed in pre-lift meetings
		list and describe types, parts and configurations of mobile cranes
		describe uses and safe working practices for ***hoisting equipment***
		identify the function, advantage and limitations of various slings and sling arrangements
		identify slings and hitches used for hoisting materials
		describe the use and location for slings, tag lines and sling configurations on ***loads*** for hoisting
		determine the centre of gravity for different types of loads
B-8.03.02L	demonstrate knowledge of the use of hoisting communication	list and demonstrate hand signals used for moving equipment and hoisting
		describe methods and precautions in using hand signals
		describe and demonstrate voice communications on a two-way radio
		list precautions used in voice communication
B-8.03.03L	demonstrate knowledge of engineered lifts	interpret engineered lift drawings
		identify the requirements and regulations for a tandem and critical lift, and hoisting personnel
B-8.03.04L	demonstrate knowledge of safety practices related to rigging, hoisting/lifting and moving operations	identify hazards and describe safe work practices pertaining to rigging, hoisting/lifting and moving

RANGE OF VARIABLES

hoisting equipment includes: forklifts, hoists, come-alongs, tuggers, Tirfors™, chainfalls

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

B-8.04 Secures load before rigging removal

Essential Skills Oral Communication, Thinking, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-8.04.01P	confirm orientation of a load	fabrication and erection drawings, match marks and other reference points are used to confirm orientation of a load before detaching from hoisting equipment
B-8.04.02P	ensure stability of load	stability of load is ensured by using shims, wedges, cribbing, guy wires and lines, and other fastening equipment
B-8.04.03P	prepare the load for removal of rigging	load is prepared for removal of rigging by using bolts, nuts, welding, bull pins and other similar equipment
B-8.04.04P	use grounding procedures	grounding and load isolation procedures are used while load is attached to hoisting equipment, when welding is required
B-8.04.05P	temporarily suspend loads	loads for subsequent placement are temporarily suspended using lashing or ***other equipment***

RANGE OF VARIABLES

other equipment to suspend loads includes: chain falls, come alongs, Tirfors™, strong backs, key plates, beam clamps

KNOWLEDGE

	Learning Outcomes	Learning Objectives
B-8.04.01L	demonstrate knowledge of the procedures to secure a load before rigging removal	identify the function, advantage and limitations of various slings and sling arrangements
		identify and describe the location of sling configurations on loads for hoisting
		identify and describe ***procedures*** to secure a load
B-8.04.02L	demonstrate knowledge of jurisdictional regulations pertaining to rigging	interpret jurisdictional regulations pertaining to rigging

RANGE OF VARIABLES

procedures include: dunnage, cribbing, guylines, lashing

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

Essential Skills Oral Communication, Working with Others, Thinking

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-9.01.01P	inspect area	area is inspected for hazards, obstructions, damages and other anomalies
B-9.01.02P	eliminate any hazards	any hazards identified during the post-lift inspection are eliminated by taking ***actions***
B-9.01.03P	assess, tag and report any damaged equipment	damaged equipment is assessed, tagged and reported to the supervisor
B-9.01.04P	inspect rigging equipment	rigging equipment is inspected and damaged equipment is removed from service
B-9.01.05P	advise others when area is clear	others are advised that area is clear by removing barriers

RANGE OF VARIABLES

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-9.01.01L	demonstrate the ability to conduct post-lift inspections	list and describe the elements of inspections done after each lift
		list and describe the elements of inspections done after job completion

B-9.02 Disassembles hoisting equipment

Essential Skills Thinking, Oral Communication, Working with Others

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
B-9.02.01P	coordinate work	work is coordinated when other equipment is required to complete task at hand
B-9.02.02P	identify the order of c***omponent*** disassembly	order of ***component*** disassembly is identified according to task at hand
B-9.02.03P	select and use tools and equipment	tools and equipment are selected and used according to hoisting equipment being disassembled
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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-9.02.01L	demonstrate knowledge of the procedure to disassemble hoisting equipment and its associated components	describe the disassembly of ***hoisting equipment***
		identify ***hoisting equipment*** requiring disassembly
		describe the procedures for crane boom removal and disassembly

	identify ***crane components***
	describe storage procedures and conditions
	identify rigging and ***hoisting equipment*** required to do disassembly
	describe break-down procedures and sequences

RANGE OF VARIABLES

hoisting equipment includes: tuggers, mobile cranes, strand jacks, jacks, tower cranes, gantry cranes
crane components include: matting, counterweights, gantries, boom sections, jib, pads and mats

B-9.03 Maintains rigging equipment

Essential Skills Reading, Document Use, Writing

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

SKILLS

	Performance Criteria	Evidence of Attainment
B-9.03.01P	clean and lubricate rigging equipment	rigging equipment is cleaned and lubricated according to manufacturers' specifications to ensure that the parts run freely and to prevent corrosion
B-9.03.02P	store rigging equipment	rigging equipment is stored according to manufacturers' specifications in dry locations and out of the elements
B-9.03.03P	perform inspection of equipment	inspections are performed to recognize damaged and defective rigging equipment according to manufacturers' specifications
B-9.03.04P	tag and remove damaged or defective rigging equipment from service	damaged or defective rigging equipment is tagged and removed from service according to company policies

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
B-9.03.01L	demonstrate knowledge of procedures to maintain rigging equipment	describe maintenance requirements for rigging equipment
		describe storage procedures for rigging equipment
		identify jurisdictional regulations pertaining to maintaining rigging equipment
		describe the best practices for the care and handling of fibre and wire ropes

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

Essential Skills Numeracy, Document Use, Thinking

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
C-10.01.01P	select and locate material and components	material and components are selected and located according to drawings and specifications
C-10.01.02P	measure material	material is measured to ensure ***dimensions*** are according to drawings and specifications
C-10.01.03P	select and use ***tools***	***tools*** are selected and used according to task at hand
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
C-10.01.06P	make jigs and templates	jigs and templates are made according to task at hand 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

dimensions include: thickness, length, width, diameter, circumference, orientation, evaluation
tools include: measuring tools, straight edges, levels, marking tools, compass, dividers
identification methods include: match-marking, tagging, piece mark numbering, item list, heat number
material includes: metals, fiberglass, composites, stainless steel

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-10.01.01L	demonstrate knowledge of the procedure to lay out material and ***components*** for fabrication and the associated tools and equipment	identify, select and use measuring, checking and layout tools
		identify types of materials to be used and ***components*** being fabricated
		describe the various ***layout methods***
		avoid material waste through pre-planning
		describe how to develop a template using parallel lines and radial line development
C-10.01.02L	demonstrate knowledge of calculations required to lay out ***components***	calculate dimensions of squares, rectangles and circles for layout
		calculate orientation, alignment and projections
C-10.01.03L	demonstrate knowledge of drawing interpretation	layout and fabricate ***components*** from drawings
		read a drawing to determine the materials required and layout template or ***components***
		read a drawing and identify the ***components*** listed for fabrication
		list and describe the abbreviations applicable to layout and development

RANGE OF VARIABLES

components include: ladders, platforms, davits, headers, pipe turns, offsets, ducts, cylinders, cones, pressure vessel shells, support structures
layout methods include: parallel-line, triangulation, radial-line development, mathematical formulas, geometric construction

C-10.02 Cuts components for fabrication

Essential Skills Document Use, Numeracy, Thinking

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

SKILLS

	Performance Criteria	Evidence of Attainment
C-10.02.01P	select ***cutting method***	***cutting method*** is selected according to material type, dimensions, task at hand and specifications
C-10.02.02P	select tools and equipment	tools and equipment are selected according to task at hand
C-10.02.03P	set up cutting tools	cutting tools are set up according to specifications
C-10.02.04P	position and secure material	material to be cut is positioned and secured
C-10.02.05P	perform cut	cut is performed according to drawings and specifications
C-10.02.06P	measure components	components are measured to ensure accuracy

RANGE OF VARIABLES

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

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-10.02.01L	demonstrate knowledge of procedures used to cut components for fabrication and their associated tools and equipment	identify and describe cutting tools and equipment and list their uses and limitations
		describe cutting using manual and mechanical processes
		describe the process of cutting material of various thickness
		identify and describe oxy-fuel cutting equipment
		explain the set-up of oxy-fuel cutting equipment
		define the principle of the oxy-fuel gas cutting process
		identify the characteristics of oxygen and fuel gas cylinders

		explain the purpose of a manifold system
		identify and select fuel gases for manual and automatic oxy-fuel cutting of carbon steel
		identify and describe regulator types, purposes, and their adjustments and care
		describe the construction and maintenance of hoses, fittings and flashback arrestors
		explain and demonstrate the setting of oxy-fuel pressures, balancing and flame adjustments
		list the causes of backfires and flashbacks
		describe the design, maintenance, selection and operation of oxy-fuel tips
		describe the setup and operation of CAC-A (carbon arc cutting-air) equipment (gouger)
		describe the setup and operation of PAC (plasma arc cutting) equipment
		describe cutting processes involved in cutting alloy steels and non-ferrous metals
		perform pipe cutting to size using a pipe cutter or oxy-fuel cutting process
		explain the correct procedure to check for leaks
		identify ***cutting issues***
C-10.02.02L	demonstrate knowledge of procedures used to thread components for fabrication and their associated tools and equipment	identify and describe threading tools and equipment and list their uses and limitations
		describe threading of pipe using manual and mechanical processes

RANGE OF VARIABLES

cutting issues include: 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

Essential Skills	Thinking, Numeracy, Working with Others

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

SKILLS

	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 by using ***forming methods*** according to specifications
C-10.03.04P	check components	components are checked for dimension and tolerance according to specifications
C-10.03.05P	finish fabricated material	fabricated material is finished by buffing, cleaning and grinding

RANGE OF VARIABLES

shop equipment includes: brakes, rolls, dies
forming methods include: rolling, bending, braking, controlled heating

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-10.03.01L	demonstrate knowledge of procedures to form components and their associated tools and equipment	identify the tools and equipment required to fabricate components
		describe methods used to identify fabricated components and assemblies
		identify ***forming methods***
C-10.03.02L	demonstrate knowledge of drawing interpretation	interpret dimensions, symbols and abbreviations on drawings

RANGE OF VARIABLES

forming methods include: rolling, bending, braking, controlled heating

C-10.04 Constructs components

Essential Skills	Working with Others, Thinking, Continuous Learning

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

SKILLS

	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 at hand and specifications
C-10.04.02P	align and orient components	components are aligned and oriented to fit according to match-mark, drawings and specifications
C-10.04.03P	secure components	components are secured to ensure correct alignment and to maintain their shape by using various ***securing methods***
C-10.04.04P	join components	components are assembled using ***joining methods***

RANGE OF VARIABLES

tools and equipment include: squares, levels, clamps, wrenches, welding machines
securing methods include: clamping, dogging, bracing, lashing, spiders, stiffeners
joining methods include: welding, bolting, riveting

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-10.04.01L	demonstrate knowledge of the procedures to construct components and their associated tools and equipment	interpret dimensions, symbols and abbreviations on drawings
		list ***fastening, securing and joining methods***
		identify required tools and equipment specific to fastening method and specifications

RANGE OF VARIABLES

fastening methods include: welding, bolting (torqueing, tensioning), rigging, riveting
securing methods include: clamping, dogging, bracing, lashing, spiders
joining methods include: welding, bolting, riveting

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

Essential Skills	Thinking, Document Use, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
C-11.01.01P	select ***alignment tools and equipment***	***alignment tools and equipment*** are selected according to industry practices
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

RANGE OF VARIABLES

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

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

vessels include: drums, exchangers, towers, tanks

components include: manway, cleanout doors, water or fluid draw-off elbow, draw-off sump, inlet outlet, overflow venting, walkway, stairway, ladders, nozzles, support structures

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-11.01.01L	demonstrate knowledge of the procedures to align ***vessels*** and ***components*** and their associated tools and equipment	identify ***alignment tools and equipment*** and their functions and limitations
		describe the layout and fit-up of bottom, shell, roof and openings

		describe the preparation, fit-up and alignment of horizontal and vertical seams
		describe orientation, elevation and projection methods and procedures
C-11.01.02L	demonstrate knowledge of drawing interpretation	interpret information from approved drawings and specifications
		identify reference points according to approved drawings and specifications

RANGE OF VARIABLES

vessels include: drums, exchangers, towers, tanks

components include: manway, cleanout doors, water or fluid draw-off elbow, draw-off sump, inlet outlet, overflow venting, walkway, stairway, ladders, nozzles, support structures

alignment tools and equipment include: transits, water levels, plumb bobs, dogs, lugs, shims, key plates, strongbacks, key channels, wedges, u-bars

C-11.02 Fits vessels and components

Essential Skills	Document Use, Numeracy, Working with Others

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

SKILLS

	Performance Criteria	Evidence of Attainment
C-11.02.01P	inventory and assemble components	components are inventoried and assembled according to approved drawings and specifications
C-11.02.02P	check components	components are checked for fit and function by measuring and pre-assembly
C-11.02.03P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task at hand
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 engineer-approved drawings and specifications
C-11.02.05P	attach components	components are attached using ***attachment methods***

RANGE OF VARIABLES

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

attachment methods include: bolting, clipping, tacking, welding, expansion of tubes, riveting, chemical bonding

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-11.02.01L	demonstrate knowledge of the procedures to fit vessels and components and their associated ***tools and equipment***	identify and describe assembly requirements and procedures
		describe fitting methods and procedures
		list ***tools and equipment*** used to fit vessels and components and their functions and limitations

RANGE OF VARIABLES

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

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. A small component of this task may include working with fiberglass.

C-12.01 Bolts components

Essential Skills Document Use, Working with Others, Numeracy

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
C-12.01.01P	select bolts	bolt types, grades and sizes for application are selected according to approved drawings and specifications
C-12.01.02P	prepare components	components are prepared prior to fastening using ***preparation methods***
C-12.01.03P	select approved gasket	approved gasket is selected according to specifications

C-12.01.04P	select approved lubrication	approved lubrication is selected according to specifications
C-12.01.05P	install ***hardware***	***hardware*** is installed according to job specifications
C-12.01.06P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to job requirements
C-12.01.07P	ensure final fit	final fit is ensured before tightening bolts on vessels and components
C-12.01.08P	torque or tension bolts	bolts are torqued or tensioned according to specifications

RANGE OF VARIABLES

preparation methods include: approved lubrication, cleaning, buffing

hardware includes: gaskets, bolts, nuts, washers, studs, rivets

tools and equipment include: torque wrenches, impact wrenches, pneumatic torque guns, hydraulic torque wrenches, tensioning and torqueing equipment, hammer wrenches

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-12.01.01L	demonstrate knowledge of the techniques used to bolt components and their associated ***tools and equipment***	identify types, ***grades*** and sizes of bolts
		identify types of gaskets and flanges
		identify types of lubricants
		identify types of ***torqueing and tensioning equipment***
		describe bolting and torqueing sequence

RANGE OF VARIABLES

tools and equipment include: torque wrenches, impact wrenches, pneumatic torque guns, hydraulic torque wrenches, tensioning and torqueing equipment, hammer wrenches

grades are specified by: CSA, ASTM, American Iron and Steel Institute (AISI), American National Standards Institute (ANSI), ASME

torqueing and tensioning equipment includes: pneumatic torque wrench, hydraulic torque wrench, electric torque wrench, hydraulic tensioning system, pumps

C-12.02 Expands tubes

Essential Skills	Document Use, Numeracy, Working with Others

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

SKILLS

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

RANGE OF VARIABLES

expansion tools and equipment include: rolling guns, mandrels, rolls
measuring instruments include: outside micrometers, inside micrometers, gauges, telescopic gauges

KNOWLEDGE

	Learning Outcomes	Learning Objectives
C-12.02.01L	demonstrate knowledge of the techniques used to expand tubes and their associated tools and equipment	define expansion theory and describe techniques to expand tubes
		define ***terms*** associated with tube hole arrangement
		describe the process of tube rolling
		identify types of baffles and describe their function and installation procedures
		identify tube sheet layouts and state their preference of application
		describe different types of ***exchanger heads***

		list and describe ***factors to consider in tube expanding*** procedures for condensers and exchangers
		list the basic steps associated with tube installation
		state the recommended tube expansion sequences with reference to tube sheet layout, its area and shape
		describe how to measure the inside diameter of a tube
		determine the recommended percentage wall reduction for ferrous and non-ferrous materials
		list recommended lubricants
		identify the optimum length of expanded seat
		describe the reason for grooved seats
		list and describe the uses and limitations of ***tube equipment***
		identify the ***factors affecting the quality of an expanded joint***
		describe the operational relationship of the mandrel and rolls
		describe the purpose of bell rolls
		describe the purpose and process of tube beading
		identify and define the propulsive type of expander
		explain the principle involving explosive tube expansions
		describe tube flaring using flaring tools
C-12.02.02L	demonstrate knowledge of calculations required when expanding a tube	calculate the expanded diameter (final ID) of a tube

RANGE OF VARIABLES

terms include: circumferential pitch, ligament space, removal space, longitudinal pitch, diagonal pitch

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

factors to consider in tube expanding include: tube sheet layout, number of tubes, type of metals, length of tubes, diameter of tube (OD), material wall thickness (MWT) tube sheet or header thickness, expansion required, lubrication

tube equipment includes: tube guide, compressor, air motor, electric motor tube end mills, tube expanders, fly cutters, tube cutters, tube cleaners, tube removal tools, micrometers, gauges, torque wrench

factors affecting the quality of an expanded joint include: surface of hole, roundness of hole, cleanliness of hole, expansion past the inner edge of tube sheet, overheating, roller speed, mechanical properties of tube and tube sheet, lubrication or lack of it, overexpansion

C-12.03 Lays up fiberglass

Essential Skills	Document Use, Thinking, Continuous Learning

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

SKILLS

	Performance Criteria	Evidence of Attainment
C-12.03.01P	select and use ***tools and equipment***, and ***PPE***	***tools, equipment*** and ***PPE*** are selected and used according to jurisdictional regulations and SDS
C-12.03.02P	prepare surface	surface is prepared by grinding, sanding and cleaning
C-12.03.03P	mix fiberglass resins	fiberglass resins are mixed according to manufacturers' and job specifications, and environmental considerations
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
C-12.03.06P	store and dispose of fiberglass materials	fiberglass materials are stored and disposed of according to SDS

RANGE OF VARIABLES

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

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

lay-up techniques include: rolling, brushing, spraying

malformations include: air bubbles, delamination, impurities

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
C-12.03.01L	demonstrate knowledge of the procedures used to lay up fiberglass and the associated tools and materials	describe ***procedures involved in fiberglass lay-up***
		identify ***types and grades of fiberglass materials***
		describe mixing and curing procedures
		identify accelerators, retarders and promoters
		identify certification requirements
		describe the handling and storage process for the chemicals required to assemble fiberglass pipe and vessels
		describe the process of drilling
		describe the process of bolting
		describe process for handling and mixing resins, catalysts and associated chemicals
		describe safety considerations for handling and mixing resins, catalysts and associated chemicals
		describe the process of cutting
		describe the process of grinding
		describe the process of laminating glass
		identify and describe the resins and fiberglass materials required for lay-up and repairs
		describe the uses of fiberglass in tanks, silos, stacks, scrubbers, breeching and piping
		define the purpose of ***fiberglass materials***
		describe the process to facilitate repairs on round and flat surfaces
		list and describe the tools and materials used for preparation and assembly

		list and describe ***measuring equipment***
		list and describe ***lay-up equipment***
C-12.03.02L	demonstrate knowledge of drawing interpretation	interpret specification drawings

RANGE OF VARIABLES

procedures involved in fiberglass lay-up include: tight fit-up, sanding saturate mat, stagger cut lengths, mix resin and catalyst, apply surface veil, remove air, sand entire weld, apply resin and air dry mix application method, hand lay-up, spray lay-up, cutting, fitting, surface preparation, hot patches

types and grades of fiberglass materials include: cloth, resins, fillers

fiberglass materials include: polyester resins, catalysts, promoters, surfacing veil, mat, woven roving, acetone, methylene chloride, air dry additive, filler

measuring equipment includes: paper or plastic mixing cups, mixing sticks, plastic bucket graduated for measuring resin, glass for measuring promoters and catalysts, mixing pails

lay-up equipment includes: surfacing veil, matting, woven roving

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 as needed as per code 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

Essential Skills	Document Use, Thinking, Oral Communication

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-13.01.01P	verify that ***permit requirements*** are met	***permit requirements*** are met before proceeding with the task at hand
D-13.01.02P	clean surfaces	surfaces are cleaned for inspection by grinding, chipping or buffing
D-13.01.03P	recognize common ***vessel defects***	visual inspection is performed to recognize common ***vessel defects*** according to specifications
D-13.01.04P	recognize common ***component defects***	visual inspection is performed to recognize common ***component defects*** as confirmed by engineered drawings
D-13.01.05P	request ***non-destructive testing*** to verify material integrity	material integrity is identified by ***non-destructive testing*** results
D-13.01.06P	report deficiencies and defects to the supervisor or quality control inspector	deficiencies and defects are reported to the supervisor or quality control inspector

RANGE OF VARIABLES

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

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

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.01.01L	demonstrate knowledge of inspection procedures to detect defects in ***vessels*** and ***components***	list common ***vessel defects*** and ***component defects***
		explain the causes of common ***vessel defects*** and ***component defects***
		describe inspection procedures of the ***vessels*** and ***components***
		identify ***material*** composition of a ***vessel*** or ***component***

RANGE OF VARIABLES

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

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

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

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

material includes: mild steel, stainless steel, galvanized steel, aluminum, alloy

D-13.02 Prepares vessels and components for servicing

Essential Skills Document use, Thinking, Working with Others

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

	SKILLS	
	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 specifications
D-13.02.02P	identify site ***modification requirements*** to be performed	site ***modification requirements*** to be performed are identified
D-13.02.03P	empty, depressurize, isolate and purge vessels	vessels are emptied, depressurized, isolated and purged before maintenance begins
D-13.02.04P	create access or openings to work area	access or openings to work area are created
D-13.02.05P	select tools, material and ***equipment***	tools, material and ***equipment*** are selected according to the task at hand
D-13.02.06P	set up tools, materials and ***equipment***	tools, materials and ***equipment*** are set up in a designated location
D-13.02.07P	pre-assemble components	components to be installed are pre-assembled according to engineer-approved drawings and specifications

RANGE OF VARIABLES

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

equipment includes: scaffolding, maintenance decks, temporary work platforms, needle beams, welding machines, compressors, air movers, tripods, cranes, trolley beams

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.02.01L	demonstrate knowledge of procedures used to prepare for service of vessels and components	identify vessels and components to be serviced
		list tools needed to complete the task at hand
		describe ***vessel isolation procedures***
		identify fasteners and ***fastening methods*** required to complete the task at hand
		interpret required changes as detailed in engineer-approved drawings and specifications of vessels and components

RANGE OF VARIABLES

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

fastening methods include: bolting, welding, expanding, riveting

D-13.03 Repairs vessels and components

Essential Skills	Working with Others, Thinking, Numeracy

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

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.03.01P	prepare parent material and repair pieces using ***tools and equipment***	work area is prepared for installation of new ***vessels*** and ***components*** by using ***preparation methods***
D-13.03.02P	install ***components***	***components*** are installed using ***hoisting/lifting and moving equipment*** according to ***job situation***
D-13.03.03P	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
D-13.03.04P	fasten ***components***	***components*** are fastened to existing ***vessels*** and ***components*** using ***fastening methods***
D-13.03.05P	reinstall ***components*** removed during repair preparation	***components*** removed during repair preparation are reinstalled

RANGE OF VARIABLES

***tools and* equipment** include: see appendix (tools and equipment)

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

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

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

hoisting/lifting and moving equipment includes: chainfall, come-along, Tirfor™, shackles, slings, crane, tugger, rope, gin wheel, lugs, engineered high line

job situation includes: material of vessel or component, size of repair area, work area accessibility, product stored in vessel, job specification, QC requirements

fitting tools include: dogs and wedges, screw dogs, bull pins, key plates, hickey bars, pinch bars, U-bars, drift pin, sledge hammer, finger bars, welder, level

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.03.01L	demonstrate knowledge of procedures to prepare ***vessels*** and ***components*** for repair	explain and select ***preparation methods***
D-13.03.02L	demonstrate knowledge of procedures to hoist material into place in order to repair ***vessels*** and ***components***	list ***hoisting/lifting and moving equipment*** and explain the advantages and drawbacks of each piece of equipment for a repair situation
D-13.03.03L	demonstrate knowledge of procedures to fit material to ***vessels*** and ***components*** for repair	describe ***fitting tools*** and methods used to fit new ***components*** for a repair and explain the advantages and drawbacks of each method for a repair situation
D-13.03.04L	demonstrate knowledge of procedures to fasten material to ***vessels*** and ***components*** for repair	describe ***fastening methods*** used to fasten new ***components*** for a repair and explain the advantages and drawbacks of each method for a repair situation

RANGE OF VARIABLES

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

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

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

hoisting/lifting and moving equipment includes: chainfall, come-along, Tirfor™, shackles, slings, crane, tugger, rope, gin wheel, lugs, engineered high line

fitting tools include: dogs and wedges, screw dogs, bull pins, key plates, hickey bars, pinch bars, U-bars, drift pin, sledge hammer, finger bars, welder, level

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

D-13.04 Performs preventative maintenance and upgrades

Essential Skills	Thinking, Oral Communication, Working with Others

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

	SKILLS	
	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 at hand
D-13.04.02P	remove ***contaminants*** and corrosion on ***vessels*** and ***components***	***contaminants*** and corrosion on ***vessels*** and ***components*** are removed using ***cleaning methods***

D-13.04.03P	plug tubes to isolate them from system	tubes are plugged to prevent further damage to the system
D-13.04.04P	install shielding materials to prevent excessive wear on vital ***components***	shielding materials are installed to prevent wear
D-13.04.05P	pull tube bundle from heat exchanger for cleaning and inspection	tube bundles are pulled, cleaned and inspected and defects identified
D-13.04.06P	repair defects	defects are repaired according to specifications
D-13.04.07P	reinstall or replace tube bundles	tube bundles are reinstalled or replaced
D-13.04.08P	tighten loose ***components*** and replace missing hardware according to job specifications	***components*** are in place and are tightened to specifications

RANGE OF VARIABLES

tools and equipment include: chipping guns, buffers, grinders, bundle puller

contaminants include: lead, asbestos, silica, kaol

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

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

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

KNOWLEDGE

	Learning Outcomes	Learning Objectives
D-13.04.01L	demonstrate knowledge of preventative maintenance and upgrade procedures	identify ***vessels*** and ***components*** to be maintained
		describe preventative maintenance procedures
		describe upgrading procedures
		describe ***cleaning methods*** and their advantages and drawbacks
		identify ***tube defects***
		identify compatible materials when selecting replacement hardware or ***components***

RANGE OF VARIABLES

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

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

cleaning methods include: scraping, buffing, chipping, high pressure washing (chemical, water), sandblasting, grinding, sweeping, vacuuming

tube defects include: wear, dents, bends, corrosion, leaks, cracks, legs, rupture

D-13.05 Tests materials, vessels and components

Essential Skills	Thinking, Document Use, Digital Technology

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

SKILLS

	Performance Criteria	Evidence of Attainment
D-13.05.01P	select and use *tools and equipment*	*tools and equipment* are selected and used according to test procedure
D-13.05.02P	perform visual test (VT)	VT is completed to confirm that work appears to be free of *surface 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 to confirm the existence and location of ***defects***, and ***internal weld or structure defects***

RANGE OF VARIABLES

tools and equipment include: wrenches, impact wrenches, gauges, air lines, manifolds, waterlines, purge cables, cleaning pigs, borescopes, pressure gauges, pumps, hydraulic torqueing and tensioning equipment

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

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

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

advanced testing procedures may include (depending on work location and training of tradesperson): liquid penetrant inspection (LPI), magnetic particle inspection (MPI), ultrasonic test (UT), radiographic test, phased array ultrasonic testing (PAUT), pneumatic test, hydrostatic test

defects include: cracks, undercut, pinholes, cold laps, thinning of material

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-13.05.01L	demonstrate knowledge of procedures to test materials, vessels and components	describe types of ***destructive testing (DT)***
		describe types of ***non-destructive testing (NDT)***
		explain the difference between DT and NDT
		identify ***vessels and components to be tested***
		identify inspection methods and procedures
		describe the process, application, end results, advantages and drawbacks of NDT

RANGE OF VARIABLES

destructive testing includes: tensile test, impact test, bend test

non-destructive testing includes: visual, magnetic particle, radiographic, ultrasonic, dye penetrant, hydrostatic, vacuum box, pneumatic

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

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

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

Essential Skills	Working with Others, Thinking, Document Use

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

	SKILLS	
	Performance Criteria	**Evidence of Attainment**
D-14.01.01P	prepare a plan for which ***vessels*** and ***components*** are to be dismantled	a plan for which ***vessels*** and ***components*** are to be dismantled has been made according to job requirements, site conditions and sequence
D-14.01.02P	select and use ***tools and equipment***	***tools and equipment*** are selected and used according to task at hand
D-14.01.03P	identify ***vessels*** and ***components*** to be salvaged	***vessels*** and ***components*** to salvage are numbered, match-marked or tagged
D-14.01.04P	prepare ***components*** for dismantling	***components*** are prepared for dismantling using ***procedures*** according to plan
D-14.01.05P	coordinate work with other trades	work with other trades is coordinated to ensure efficient and safe removal of ***components***
D-14.01.06P	unbolt, unfasten or cut ***vessels*** and ***components***	***vessels*** and ***components*** are unbolted, unfastened or cut according to plan and site conditions
D-14.01.07P	separate ***components*** to be salvaged (reused or recycled)	***components*** to be salvaged are placed in secure area for storage and cleaning

RANGE OF VARIABLES

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

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

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

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

	KNOWLEDGE	
	Learning Outcomes	**Learning Objectives**
D-14.01.01L	demonstrate knowledge of dismantling procedures related to ***vessels*** and ***components***	describe dismantling methods and procedures
		describe demolition methods and procedures
		identify ***vessels*** and ***components*** that can be re-used
		describe lifting, hoisting, handling and storage methods and procedures
D-14.01.02L	demonstrate knowledge of ***safe work practices*** related to the dismantling of ***vessels*** and ***components***	identify hazards and describe ***safe work practices*** when dismantling ***vessels*** and **components**
		list ***factors*** to consider when analyzing the integrity of ***components*** or attachment points

RANGE OF VARIABLES

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

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

safe work practices include: tie off tools, follow rigging plan, plan access to the work, establish lift zone around vessel, ensure isolation points of vessels or equipment to be removed

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

D-14.02 Removes materials

Essential Skills	Document Use, Working with Others, Thinking

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

SKILLS

	Performance Criteria	Evidence of Attainment
D-14.02.01P	plan material and scrap removal	material and scrap removal is planned according to material being removed, hazards, job requirements and site conditions
D-14.02.02P	select and use ***tools and equipment***	***tools and equipment*** to remove material are selected and used according to work plan
D-14.02.03P	select PPE to execute work plan	PPE to remove material is selected and used according to work plan
D-14.02.04P	sort and dispose of material	material to be removed is sorted and disposed of according to work plan and jurisdictional requirements

RANGE OF VARIABLES

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

KNOWLEDGE

	Learning Outcomes	Learning Objectives
D-14.02.01L	demonstrate knowledge of procedures related to the removal of materials	describe the process to plan the removal of material
		describe process and factors for sorting material to be removed
D-14.02.02L	demonstrate knowledge of regulatory requirements pertaining to the disposal of waste materials	dispose of waste material according to work plan and jurisdictional requirements

APPENDIX A
ACRONYMS

AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CAC-A	Carbon arc cutting- Air
CAD	Computer-aided design
CNC	Computer Numerical Controlled
CSA	Canadian Standards Association
DT	Destructive testing
FCAW	Flux cored arc welding
FLRA	Field level risk assessment
GMAW	Gas metal arc welding
GTAW	Gas tungsten arc welding
HA	Hazard assessments
IFC	Issued for Construction
JSA	Job safety analysis
LPI	Liquid penetrant inspection
MPI	Magnetic particle inspection
MWT	Material wall thickness
NDE	Non-destructive evaluation
NDT	Non-destructive test
OH&S	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
SAW	Submerged arc welding
SABA	Supplied Air Breathing Apparatus
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheet
SMAW	Shielded metal arc welding
TDG	Transportation of Dangerous Goods
UT	Ultrasonic test
VT	Visual test
WHMIS	Workplace Hazardous Materials Information System
WLL	Working load limits

APPENDIX B
TOOLS AND EQUIPMENT

Personal Protective Equipment and Safety Equipment

atmospheric testing equipment
coveralls (fire retardant, acid-resistant, plastic oversuit, disposable)
CSA protective footwear (site approved)
cutting goggles
dust masks
ear plugs and ear muffs
explosion-proof lights
fall arrest equipment (lanyards, harnesses, retractable lanyards, tripods)
fire extinguishers
grinding shields
ground fault interrupter
hard hat
head lamp
kevlar gauntlets and gloves
leather protective clothing and gloves
personal atmospheric monitoring device
respirator (half mask and full face)
safety glasses, safety goggles and mono goggles, spoggles
self-contained breathing apparatus (SCBA) and supplied air breathing apparatus (SABA)
side shields
smoke eaters and ventilation systems
tarpaulins
warning tape, tags, signs, barricades
welding lenses
welding screens
welding shields
whip checks and pins

Welding Equipment

anti-spatter spray
chipping hammer
electrode holders (whips/stingers)
electrode ovens (stationary/portable)
electrode pouch
files
fire-retardant blankets
ground clamps
hand wire brush (mild steel and stainless steel)
inspection mirror
leather welding shield
orbital welders
penlight and batteries
power sources (welding machines) with auxiliary equipment for welding processes such as SMAW, FCAW, GMAW, GTAW and SAW
pre-heating torch and equipment,
purge hoses
purge paper
regulators
remote amperage controls
stud welding equipment
temperature (“temp”) sticks
welding cable
welding cable “y” connectors
welding electrodes

Cutting Tools and Equipment

Hand Types

bolt cutters
files
hacksaw and blades
handsaw
metal-cutting chisels
metal-cutting snips
pipe/tube cutters
knife
scissors
tap and die sets
utility knife

Powered Types

abrasive cut-off saw
band saw
circular saw
grinders (air and electric)
nibblers
power shears
reciprocating saw
track saw
tube milling machine
abrasive water jet cutter
water jet cutter

Fuel Cutting Equipment

oxygen lance

Oxy-Fuel Cutting Equipment

adapters
burning and heating tips
flashback arrestors
friction lighters (strikers)
manifold systems
manual cutting torches
oxy-fuel cart
oxy-fuel couplings and wrenches
oxy-fuel cylinders
oxy-fuel hoses and repair kits
radiograph and related equipment
regulators
tip cleaners

Plasma-Arc Cutting Equipment

air line
compressed air source
power supply with cables and torch
regulators
replacement ceramic cups, gouging tips and tips

Carbon Arc Cutting-Air (CAC-A)

air-arc gouger
air and power supply
air line
carbon-cutting electrodes (round/flat)
replacement electrode holder
replacement insulators

Measuring Tools

angle and radius gauges
callipers/dividers
combination square
compass
compound tube gauge
drill point gauge
folding rule
framing squares
measuring tapes
micrometers
scale rule
sliding T-bevel
steel tapes
string line
telescoping gauge
vernier calliper
laser measuring tools

Marking and Layout Tools

ball peen hammer
chalk
chalk-line
contour marker
dividers
dye
engineer's level
felt pen
laser level
lumber crayon
paint brush
paint marker
piano wire
plumb bob
prick/center punch
protractor
scribe and awl
soapstone and holder
spirit level
squares
steel letter/number set
straight edge
trammel points
transit (theodolite)
water level
wrap-around

Hand Tools

Holding Tools

bar clamp
bench vice
C-clamp
end-cut pliers (nippers)
hammer wrench holder
lineman pliers
locking wrench pliers
needle-nose pliers
pipe vise
side-cutter pliers
sliding clamp (bessey clamp)
slip-joint pliers
water-pump (utility) pliers/channel lock pliers

Holding/Turning Tools

adjustable wrench
back-up (piper) wrench
box-end wrench
chain wrench
open-end wrench
pipe wrench
ratchet and socket wrench sets
screwdrivers

Holding/Turning Tools (continued)

combination wrench
hammer (slug) wrench
hex keys
industrial (pulling) wrench
spud wrench
strap wrench
torque wrench

Fitting Tools

4 lb. hammer
alignment pins
bull pin
clamping angles
claw hammer
dogs and screw dogs
drift pin
flange spreader
hickey bar
hose clamps
hydraulic jack
hydraulic ram
key plates and blank nuts
metal-cutting chisel
non-sparking hammer
pin punch
pry bar
shims and wedges
sledge hammers
soft-face hammer (lead-face)
steel, brass and wood wedges
strongbacks
wall-banger™

Hydraulic and Pneumatic Tools and Equipment

air chippers
air compressor
air grinders
air hammers
air movers
air manifolds/receiver
air supply hose
air utility hoist (air tugger)
drills
bundle puller
filters/oilers
hydraulic nut splitter
hydraulic and pneumatic tensioning equipment
hydraulic rams and jacks
hydrostatic test pump
hydraulic and pneumatic torque wrench
impact wrenches/sockets
milling machine
needle scalers
piper
pneumatic torque guns
regulator
sand blasting equipment
rolling motor

Electric-Powered Tools and Equipment

brake press
CNC tables
cut-off saw
circular saw
die grinder
drills/presses
hammer drill
impact wrench (electric and battery)
induction heat gun
ironworker
jigsaw
nibblers

Electric-Powered Tools and Equipment (continued)

electric screwdriver
electric supply panel
exhaust fans
extension cords
floodlights
grinders
punch
reciprocating saw
rolls
shears
string/trouble light

Rigging and Hoisting Equipment

air mats
beam clamps
beam trolleys
blocks (tackle, wire rope, snatch)
chain falls
come-along
cranes (truck-mounted, lattice-boom, hydraulic, tower, overhead)
equalizer plates
equalizer sheaves
fibre rope
headache ball
hooks/latches
jacks (hydraulic, screw, air bags)
industrial machine skates
links, swivels, rings, thimbles, eye bolts
load binders and steamboat ratchets
machine rollers
plate clamps
rigging belt
shackles
slings (wire rope, round sling, fibre material, chain, synthetic web, wire/chain mesh)
softeners
spreader and equalizer beams
strand jacks
swivel hoist ring
telescoping boom forklift
terminal end connections for wire rope (clips, sockets)
Tirfor™ jacks
tuggers
wire rope

Tube Removal/Expansion Tools and Equipment

air motor with adapter sleeves
beading tool
collapsing tools
expansion accessories (e.g., driving links, universals, gear drive)
expanders for boilers and heat exchangers
flaring/belling tools
hydraulic stub puller
induction heat gun
internal tube cutters (revolution tube cutter, fly cutter)
knockout toolsplitting chisels
torque controlled rolling motor
tube end mill
tube plugs
tube pulling spear
tube wall reducing tool
hydraulic expander

Tube Preparation/Installation Tools

bevel gun
die grinder with variety of stones
brass, lead and plastic hammer
files
flapper wheels/emery cloth
hand/power brushes (twist)
peening tool
serrating tool
tube cut-off saw
tube guide
tube hole reamer
track saw

Tools and Equipment for Fibreglass

aluminum-serrated rollers
barrel heater
brooms
carborundum grinding discs (16-36 grit)
catalyst dispenser
fibreglass material cutting tools
grinder with flexible disc back
heat lamps
kilo scale
masking tape
mohair rollers
paint brushes
pizza disc
plastic buckets
putty knife
resin spray gun/hoses
roll of cardboard
shovels
wooden mixing spatulas

Scaffolding and Access Equipment

aerial work platforms
aluminum framed platform
aluminum planks
boom lifts
bosun chair
electrical articulated boom lift
electrical scissor lifts
electrical vertical lifts
end frames
extension ladder
floats (angel's wings)
gas powered articulated boom lift
gas powered scissor lifts
ladder jack scaffolds
ladders
mechanical scaffolds
ramps
rolling scaffolds
sawhorses
scissor-lift
stationary scaffolds
stepladders
swing stages
temporary access/freight elevator
tube and clamps
rope access equipment

APPENDIX C
GLOSSARY

bag house	enclosure through which dust particles are collected as exhaust gases pass through a fabric filter
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
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
boom	the main component of a crane used to carry the hoisting tackle
breeching (gas flue)	a transition component from the convection box to the flue
catalyst	an additive that accelerates a chemical reaction
chain fall	a hand/pneumatic/ electric-operated chain hoist
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
come-along	ratchet-type tool with a chain and hook used for pulling
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
dog	a tool used with a wedge or screw to fit up components
ductwork	a passage for air and gas flow
ferrous	metals dominated by iron in their chemical composition (i.e., carbon and low alloy steels)
fibreglass	glass reinforcement material (i.e., chopped strand mat, woven roving)
hydrostatic test	a strength and tightness test of a closed pressure vessel by water pressure
lashing	a wire rope fastened to itself to temporarily hold a component in position or to safety it until it is fastened
metallurgy	involves the science of producing metals from elements and the reaction of these metals to many different activities and situations
non-ferrous	metals that contain little or no iron in their chemical composition (e.g., aluminum, copper)
outriggers	extendable beams attached to a crane base mounting that rest on supports at the outer ends and provide a means of stabilizing the crane
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
parts of line	the number of individual ropes or cables supporting a travelling block in a tackle system
penstock	conveys water from the reservoir to the generating unit such as in a hydro-electric dam
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 issuing from the orifice
pneumatic test	a strength and tightness test of a closed air pressure vessel by air pressure

precipitator	an electrostatic filter that separates particulate matter from exhaust gasses
promoter	an additive used with rapid-cure resins to reduce excessive exothermic heat build-up
purge	involves using one gas to displace another gas in an enclosed space or system
resin	a polyester (vinylester) solid usually dissolved in styrene, but when mixed with a catalyst, forms a rigid thermoset plastic
scrubber	an apparatus used to remove solids from gases by entrainment in water
shackle	an anchor-shaped or u-shaped component with a pin that is used in rigging
sling	a wire rope or other material with eyes spliced on each end
spreader bar	beam used for hoisting trusses or long loads; also used to equalize the weight and to keep the load, such as tank plate, from buckling
stack	a vertical conduit used to discharge combustion products to the atmosphere
stove	used to heat air to speed combustion
swing stage	a suspended scaffold
tackle	an assembly of ropes and sheaves arranged for lifting, lowering and pulling
tag line	a length of rope used to control a load during lifting or lowering
Tirfor™	manual or pneumatic pulling machine
tower crane	a power-operated fixed or slewing tower that provides elevation and support for its jib
tube expanding	the pressure-tight joint formed by enlarging a tube end in a tube seat
tugger	a pneumatic or electric winch used for hoisting in tight areas where a crane is impractical
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
vessel	a container designed to contain liquids, gases, or solids
water cutting	a process of using a jet of water under high pressure to sever through a variety of construction materials
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