



Boilermaker

On-the-Job Training Guide

2022

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Recognition:

To promote transparency and consistency, portions of this document has been adapted from the 2016 Boilermaker Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca



STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Description of the Boilermaker trade: an overview of the trade's duties and training requirements.

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

Harmonization: a brief description on the pan-Canadian Harmonization Initiative for the Boilermaker trade.

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

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.

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

On-the-Job and In-school Training Content for the Boilermaker Trade: a chart which outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for topics of technical training.

DESCRIPTION OF THE BOILERMAKER TRADE

(An overview of the trade's description, duties and training requirements)

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, confined spaces, extreme temperatures, radiation, asbestos and other toxic environments.

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.

Training Requirements: To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to

total at least 1800 hours each year. Total trade time required is 5400 hours and at least 3 years in the Boilermaker trade. Three 8-week training sessions are delivered by Red River College in Winnipeg, MB. Journeyman to apprentice ratio for this trade is: 2:1

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentice's results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- expose apprentices to all appropriate tools, equipment and trade practices
- provide guided, hands-on practice in rigging and hoisting techniques
- provide and maintain safety equipment, and protective devices and clothing
- further the apprentice's ability to interpret technical drawings
- ensure that the apprentice can evaluate the end product.

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

Entrance Requirements for Apprenticeship Training

Your grade twelve transcript (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journeyman certification.

Individuals with "modified" or "general" classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or "upgraders" must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	Math Credit at the Indicated Grade Level ❶	Science Credit at Grade Level
❶ – Foundations; or P – Pre- calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.)		
<p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#</p> <p>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</p>		

ESSENTIAL SKILLS SUMMARY

(How each of the nine essential skills is applied in this trade)

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

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.

HARMONIZATION

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

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 the Boilermaker trade is 3.

3. Total Training Hours during Apprenticeship Training

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

4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization will take place progressively. Level one will be implemented in 2016/2017, level two 2017/2018, level three 2018/2019, with the last level four delivery taking place in 2019/2020.

BOILERMAKER TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2017 Boilermaker Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub-tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Currently Level One and Level Two are harmonized. Implementation for harmonization will take place progressively. Level one will be implemented in 2016/2017, level two 2017/2018, and level three 2018/2019.

A - PERFORMS COMMON OCCUPATIONAL SKILLS

Task A-1 Performs safety-related functions	A-1.01 Uses personal protective equipment (PPE) and safety equipment 1. (2 & 3 in context)	A-1.02 Maintains safe work environment 1. (2 & 3 in context)	A-1.03 Monitors confined spaces 1. (2 & 3 in context)	
Task A-2 Uses tools, equipment and work platforms	A-2.01 Uses hand tools 1	A-2.02 Uses power tools 1, 2, 3	A-2.03 Uses shop equipment 1, 2, 3	A-2.04 Uses cutting and welding tools and equipment 1, 2, 3
	A-2.05 Uses work platforms and access equipment 1, 2, 3	A-2.06 Uses aerial work platforms 1, 2, 3		
Task A-3 Organizes work	A-3.01 Organizes project tasks and procedures 1, 2, 3	A-3.02 Uses drawings and specifications 1, 2, 3	3.03 Handles materials and components 1, 2, 3	A-3.04 Demobilizes site 1, 2
Task A-4 Uses communication and mentoring techniques	A-4.01 Uses communication techniques 1, 2 in context	A-4.02 Uses mentoring techniques 2 in context, 3		

Task A-5 Performs cutting and welding activities	A-5.01 Cuts material 1, 2	A-5.02 Prepares joints for fitting 1, 2, 3	A-5.03 Fits joints 1, 2, 3	A-5.04 Performs tack welds 1
	A-5.05 Performs basic welding 1, 2, 3	A-5.06 Performs advanced welding 3		

B – PERFORMS RIGGING AND HOISTING

Task B-6 Plans lift	B-6.01 Determines load 1, 2, 3	B-6.02 Performs pre-lift analysis 3	B-6.03 Selects rigging and hoisting equipment 1, 2, 3	B-6.04 Secures lift area 1
Task B-7 Rigs load	B-7.01 Inspects rigging equipment 1, 2	B-7.02 Fabricates rigging equipment 3	B-7.03 Attaches rigging equipment to load 1, 2	
Task B-8 Hoists load	B-8.01 Inspects hoisting equipment 1, 2	B-8.02 Assembles hoisting equipment 2, 3	B-8.03 Performs hoisting operations 1, 2, 3	B-8.04 Secures load before rigging removal 2
Task B-9 Performs post-lift activities	B-9.01 Conducts post-lift inspection 1, 2	B-9.02 Disassembles hoisting equipment 1, 2, 3	B-9.03 Maintains rigging equipment 1	

C – COMPLETES NEW CONSTRUCTION

Task C-10 Performs fabrication	C-10.01 Lays out components for fabrication 1, 2, 3	C-10.02 Cuts components for fabrication 1, 2	C-10.03 Forms components for fabrication 2, 3	C-10.04 Constructs components 1, 2, 3
Task C-11 Assembles and fits vessels and components	C-11.01 Aligns vessels and components 2, 3	C-11.02 Fits vessels and components 2, 3		
Task C-12 Fastens components	C-12.01 Bolts components 1, 2	C-12.02 Expands tubes 2, 3	C-12.03 Lays up fiberglass 2	

D - PERFORMS REPAIRS, MAINTENANCE, UPGRADING AND TESTING

Task D-13 Services vessels and components	D-13.01 Inspects vessels and components for defects 2	D-13.02 Prepares vessels and components for servicing 1, 2, 3	D-13.03 Repairs vessels and components 2, 3	D-13.04 Performs preventative maintenance and upgrades 2, 3
	D-13.05 Tests materials, vessels and components 2, 3			
Task D-14 Removes vessels and components	D-14.01 Dismantles vessels and components 2, 3	D-14.02 Removes materials 3		

ON-THE JOB AND IN-SCHOOL TRAINING CONTENT FOR THE BOILERMAKER TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	280 hours
General Safety <ul style="list-style-type: none"> • trade safety awareness • common hazards • proper use of safety equipment • workers' compensation board • interpersonal and essential skills • emergency first aid and CPR 		47 hours
Mentors can assist the apprentice to prepare for this section of technical training by: <ul style="list-style-type: none"> • <i>the practise and promotion of safety in the workplace including proper use of PPE</i> • <i>assisting in the interpretation of safety legislation</i> • <i>demonstrating the safe use of scaffolds, walkways and ladders</i> 		
Basic Rigging <ul style="list-style-type: none"> • ropes • hoisting • wire ropes and attachments 		41 hours
Mentors can assist the apprentice to prepare for this section of technical training by: <ul style="list-style-type: none"> • <i>demonstrating the safe and proper use of crane and rigging equipment at the workplace</i> • <i>reviewing rigging, hoisting and turning of loads, and OH&S requirements for crane operation</i> • <i>offering hands-on opportunities to be a signalman</i> 		
Tools, Cutting and Welding <ul style="list-style-type: none"> • Hand and Power Tools • Basic materials • Materials preparation and assembly • Basic drafting • Introduction to layout 		67 hours
Mentors can assist the apprentice to prepare for this section of technical training by: <ul style="list-style-type: none"> • <i>training and supervising in the use of hand tools</i> • <i>offering hands-on opportunities to perform cutting, welding and related processes</i> • <i>providing awareness of company policies and procedures such as quality standards</i> 		
Materials Knowledge <ul style="list-style-type: none"> • Electric Arc Welding • Oxy-fuel Cutting 		65 hours

Mentors can assist the apprentice to prepare for this section of technical training by:

- *developing further their knowledge of metal identification and physical properties*
 - *explaining the selection of structural shapes, plate, expanded mesh, grating, hollow structural shapes, and specialty tubes*
 - *allowing apprentices to demonstrate identification and use of various materials*
-

Drawing Interpretation

75 hours

- Trade Mathematics One
- Metallurgy One
- Trade Related Components
- Identification of Pressure Vessels

Mentors can assist the apprentice to prepare for this section of technical training by:

- *encouraging apprentices to utilize drawings where possible and demonstrate proper interpretation.*
 - *exposing apprentices to trades math where possible*
 - *providing instruction regarding lines, projections, views and dimensioning*
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Level Two

8 weeks

280 hours

Tools, Cutting and Welding

114 hours

- Cutting, Welding and Related Processes
- Power Tools (Electric and Pneumatic)
- Instruments and Shop Equipment
- Metallurgy Two

Mentors can assist the apprentice to prepare for this section of technical training by:

- *offering hands-on opportunities in the related tools and shop equipment*
 - *providing instruction on awareness and identification various types of alloys used in industry*
 - *reviewing 90° and bevel cuts using manual oxy-fuel equipment*
 - *explaining how to cut structural shapes*
 - *providing instruction on using the motorized cutting carriage cut plate using plasma arc cutting*
-

Layout and Fitting

103 hours

- Drawing Interpretation One
- Layout and Fabricating
- Fibreglass Fitting
- Trade Mathematics Two

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the interpretation of intermediate drawings*
 - *identifying joint and weld types, welding symbols and technical abbreviations*
 - *explaining material take-off*
 - *encouraging apprentices to perform general layout reading and interpreting drawings*
-

General Rigging

55 hours

- Block and Tackle
- Wire Rope Drums, Aerial Access and Equipment, and Scaffolds
- Lifting Practices

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the safe and proper use of crane and rigging equipment at the workplace*
 - *explaining the selection of aerial work platforms and describing their characteristics, limitations and applications*
 - *reviewing rigging, hoisting and turning of loads, and OH&S requirements for crane operation*
 - *offering hands-on opportunities to be a signalman*
 - *offering hands-on on experience with rigging loads using general rigging techniques*
-

Materials and Related Knowledge

8 hours

- Heat Treatment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *fathering their knowledge of metal identification and physical properties*
-

Level Three

8 weeks

280 hours

Materials and Related Knowledge

47 hours

- Business Practices
- Orientation II: Journeywork
- Advanced Metallurgy
- Inspection / Testing of Materials

Mentors can assist the apprentice to prepare for this section of technical training by:

- *fathering their knowledge of metal identification and physical properties*
 - *explaining the selection of structural shapes, plate, expanded mesh, grating, hollow structural shapes, and specialty tubes*
 - *allowing apprentices to identify and use of various materials*
-

Advanced Rigging

35 hours

- Hoisting and Jacking Equipment and Engineered Lifts
- Advanced Block and Tackle
- Advanced Cranes

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing rigging, hoisting and turning of loads, and OH&S requirements for crane operation*
 - *demonstrating the safe use of wire rope, chains, attachments, and lifting and jacking devices*
 - *offering hands-on opportunities to be a signalman*
 - *offering hands-on experience with rigging loads using general rigging techniques*
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Layout and Fitting

50 hours

- Drawing Interpretation Two
- Trade Mathematics
- Layout
- Fitting

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the interpretation of intermediate drawings*
 - *identifying joint and weld types, welding symbols and technical abbreviations*
 - *explaining material take-off*
 - *encouraging apprentices to perform general layout reading and interpreting drawings*
-

Trade Related Components

50 hours

- Boilers
- Condensers and Exchangers
- Tanks
- Introductions to Other Heavy Industries
- Pre-IP Review: Examination Review

Mentors can assist the apprentice to prepare for this section of technical training by:

- *orient apprentices on components associated with different trade related equipment*
 - *offering apprentices the widest variety of work experience available*
-