Saskatchewan Apprenticeship and Trade Certification Commission

Welder

On-the-Job Training Guide

2020

Online: www.saskapprenticeship.ca

Recognition:
To promote transparency and consistency, portions of this document has been adapted from the 2014 Welder National Occupational Analysis (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 Welder 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 Welder 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 Welder 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 WELDER TRADE

Welders permanently join pieces of metal by applying heat, using filler metal or fusion processes. They join parts being manufactured, build structures, and repair damaged or worn parts. They use various welding processes to join structural steel and metal in vessels, piping and other components. They also use various cutting and gouging processes as well as fabricate parts, tools, machines and equipment used in the construction and manufacturing industries.

Welders may specialize in certain types of welding such as custom fabrication, ship building and repair, aerospace, pressure vessels, pipeline, structural welding, and machinery and equipment repair.

They may contract or be employed by companies such as fabrication shops, steel and platform manufacturers, petrochemical refineries, mechanical contractors, transportation contractors (heavy machinery, aircraft, shipbuilding, railcar repair), and specialized welding shops. Their work may be performed outdoors or indoors, and travel may be required to jobs in remote locations.

In order to meet high quality standards, welders require attributes such as good mechanical ability, manual dexterity, good vision, excellent hand-eye coordination, and the ability to concentrate on detail work. They should be able to work independently or as part of a team. They also require the ability to work efficiently and accurately, to visualize a finished product, to reason logically and to understand metallurgy.

Occupational hazards in this trade include: sparks, gases, hazardous fumes, burns, heavy lifting, repetitive stress and exposure to ultra-violet and infra-red radiation. Environmental conditions may include working at heights, in confined spaces, in trenches and in extreme temperatures

With experience, welders may advance to positions such as lead hand, welding supervisor, welding inspector and project manager.

Training Requirements: 5400 hours and 3 years, including two 7-week and one 8-week training sessions at Saskatchewan Polytechnic in Moose Jaw or Saskatoon.

Journeyperson to apprentice ratio for this trade is: 1:3

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

It is the employer's or journeyperson'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 and learning-friendly work environment
- provide mentored, hands-on practice in the use of tools and equipment
- demonstrate procedures relevant to the cutting, welding and gouging of various metals
- describe in detail a quality assurance program to be used by all apprentices
- further the apprentice's ability to interpret technical drawings and perform trade math
- introduce the apprentice to the procedures used for estimating materials and costing projects
- ensure the apprentice can evaluate the end product
- 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 journeyperson 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 Level❶	**Science Credit** at Grade Level
Welder	Grade 10	Grade 10

❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).

*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.

For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#

Individuals not meeting the entrance requirements will be subject to an assessment and any required training

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: www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. 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

Welders read documents to understand and learn. For example, they read WHMIS material to find out how to handle hazardous products, as well as equipment and safety manuals to understand safe operating procedures. They also read and interpret complex information found in codes and regulations.

DOCUMENT USE

Welders refer to checklists to follow proper work procedures and to track the progress of projects. They interpret the significance of information found on various documents. For example, they look for safety information on signs and project status on tags, they observe colours on pipes, lines and metals to determine their contents or grade, and they refer to markings such as stamps, metal plates, or tags. They complete forms and reports such as invoices, time sheets or daily logs to record information. Welders interpret symbols and numbers found on drawings to determine material requirements and measurements as well as the welding process to be used and the type, size, location and position of welds. They also review engineering notes found on drawings, or welding procedures specifications (WPS) and welding procedures data sheets (WPDS).

WRITING

For the most part, welders write text requiring less than one paragraph. For example, they fill in information in invoices, reports, time sheets and daily logs. However, they may have to complete accident and incident reports, or write safety guidelines, which require writing of more than one paragraph.

ORAL COMMUNICATION

Welders communicate with co-workers and others on a daily basis to give directions, ask for assistance, provide information and guidance, and discuss work assignments. They may give informal presentations or explain welding designs to customers. They may also coach and mentor apprentices by demonstrating and explaining work procedures and expectations.

Welders often work in noisy environments caused by machinery such as mobile equipment, grinders, hammers, sandblasters and moving metal, which affects communication. Therefore, welders use hand signals to communicate whenever necessary, particularly from a distance.

NUMERACY

Welders use money math to calculate the charge for materials and labour when preparing invoices. They also use measurement and calculation math. For example they measure degrees of angles, lengths of pipe and elevations. They use various formulas to calculate how to get the maximum number of pieces out of a length of pipe, the dimensions of structural members, the volume, diameter and circumferences of tanks when fabricating pieces for them, and offsets. They may work with the metric and imperial measurement systems and therefore must be able to convert between the two systems. Welders also use numerical estimation to estimate the quantity of consumables required, the weight of a load based on its size and density, and the cost of work based on material and labour requirements.

THINKING

Welders use problem solving skills to identify discrepancies in drawings. They troubleshoot problems with equipment and generate unique solutions depending on the situation.

Welders use decision making skills to decide whether they have enough information to start the task immediately or whether they need to gather more information first. They decide on the most efficient use of materials and how to control the temperature during the welding process to avoid metallurgical problems. They may also decide on the best way to approach a job in consultation with their supervisor and any work partners.

Welders use planning skills to organize and set up their work area, gather materials and equipment, and work on alternative tasks if equipment is not available.

WORKING WITH OTHERS

Welders mostly work independently within a team environment, which includes other welders, supervisors and other tradespeople such as steamfitters/pipefitters, to plan work, confirm calculations and to schedule the sharing of equipment. They may coach and receive assistance from apprentices. They may also be partnered with someone from another trade, such as a steamfitter/pipefitter, to coordinate their tasks on projects so that steps are completed in the correct order.

DIGITAL TECHNOLOGY

Welders may use computers for research, data entry and viewing trade documents. They also use electronic communication software to communicate with customers and suppliers.

CONTINUOUS LEARNING

Welders may attend information and training seminars hosted by suppliers about new products. Employers also provide training specific to their company such as company policies, confined space entry, helicopter safety and H2S Alive. Welders must upgrade their knowledge and skills on an ongoing basis because of new innovations in consumables, and welding applications and processes. They may learn by researching technical information on the Internet, participating in formal training opportunities or informally on the job.

Welders are required by various codes to recertify or upgrade their qualifications within a specific period of time. Study and practice may be required in preparation for these tests.

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 Welder.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Welder trade is three.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Welder 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 to be implemented in 2016/2017, level two 2017/2018 and level three in 2018/2019.

WELDER TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2014 Welder National Occupational Analysis. 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. Implementation for harmonization will take place progressively. Level one to be implemented in 2016/2017, level two 2017/2018 and level three in 2018/2019.

A - COMMON OCCUPATIONAL SKILLS

A-1 Maintains tools and equipment	**1.01 Maintains hand, power, layout and measuring tools** 1	**1.02 Maintains stationary machinery** 1	**1.03 Maintains thermal cutting equipment** 1	**1.04 Maintains welding equipment** 1,2	
A-2 Uses access and material handling equipment	**2.01 Uses access equipment** 1	**2.02 Uses rigging, hoisting and lifting equipment** 1			
A-3 Performs safety-related activities	**3.01 Performs hazard assessments** 1	**3.02 Maintains safe work environment** 2	**3.03 Uses personal protective equipment (PPE) and safety equipment** 1		
A-4 Organizes work	**4.01 Uses documentation and reference material** 1	**4.02 Plans job tasks** 1,2	**4.03 Organizes materials** 1,2		
A-5 Performs routine trade activities	**5.01 Performs quality inspection** 2,3	**5.02 Marks welds, materials and parts** 2,3	**5.03 Controls temperature of weldments** 1,2,3	**5.04 Stores welding consumables** 1,2	**5.05 Selects welding processes and power source** 1,2,3
	5.06 Performs equipment start-up and shut-down 1,2,3	**5.07 Finishes final product** 1,2			

B – FABRICATION AND PREPARATION OF COMPONENTS FOR WEDLING

B-6 Performs layout	**6.01 Develops templates** **1,2**	**6.02 Transfers dimensions from drawings to materials** **1,2**	
B-7 Fabricates components	**7.01 Prepares materials** **1**	**7.02 Fits components for welding** **1,2**	**7.03 Assembles components** **1,2**

C – CUTTING AND GOUGING

C-8 Uses tools and equipment for non-thermal cutting and grinding	**8.01 Selects cutting and grinding tools** **1**	**8.02 Cuts using stationary band saws and power hacksaws** **1**	**8.03 Cuts using shears and ironworkers** **1**	**8.04 Cuts using hand tools** **1**	**8.05 Cuts using handheld power tools** **1**
C-9 Uses oxy-fuel gas cutting (OFC) process for cutting and gouging	**9.01 Selects OFC gas equipment** **1**	**9.02 Sets up OFC equipment** **1**	**9.03 Sets operating parameters for OFC equipment** **1**	**9.04 Performs cut and gouge using OFC equipment** **1**	
C-10 Uses plasma arc cutting (PAC) process for cutting and gouging	**10.01 Selects PAC equipment and consumables** **1**	**10.02 Sets up PAC equipment** **1**	**10.03 Sets operating parameters for PAC equipment** **1**	**10.04 Performs cut and gouge using PAC equipment** **1**	
C-11 Uses air carbon arc cutting (CAC-A) process for cutting and gouging	**11.01 Selects CAC-A equipment and consumables** **1**	**11.02 Sets up CAC-A equipment** **1**	**11.03 Sets up parameters for CAC-A equipment** **1**	**11.04 Performs cut and gouge using CAC-A equipment** **1**	

D – WELDING PROCESSES

D-12 Welds using shielded metal arc welding (SMAW) process	**12.01 Selects SMAW equipment and consumables** **1,3**	**12.02 Sets up SMAW equipment** **1,3**	**12.03 Sets operating parameters for SMAW** **1,3**	**12.04 Performs weld with SMAW equipment** **1,2,3**
D-13 Welds using flux cored arc welding (FCAW), metal cored arc welding (MCAW) and gas metal arc welding (GMAW) processes	**13.01 Selects FCAW, MCAW and GMAW gas, equipment and consumables** **1,2,3**	**13.02 Sets up FCAW, MCAW, and GMAW equipment** **1,2,3**	**13.03 Sets operating parameters for FCAW, MCAW and GMAW** **1,2,3**	**13.04 Performs weld using FCAW, MCAW, and GMAW equipment** **1,2,3**
D-14 Welds using gas tungsten arc welding (GTAW) process	**14.01 Selects GTAW gas, equipment and consumables** **2,3**	**14.02 Sets up GTAW equipment** **2,3**	**14.03 Sets operating parameters for GTAW** **2,3**	**14.04 Performs weld using GTAW equipment** **2,3**
D-15 Welds using submerged arc welding (SAW) process	**15.01 Selects SAW equipment and consumables** **2,3**	**15.02 Sets up SAW equipment** **2,3**	**15.03 Sets operating parameters for SAW** **2,3**	**15.04 Performs weld using SAW equipment** **2,3**

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE WELDER 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 — 7 weeks — 210 hours

Print Reading and Fabrication — 10 hours

- interpret basic shop drawings
- interpret basic welding symbols

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

- *teaching the apprentice how to measure welds*
- *mentoring the apprentice through a set of blueprints describing lines and symbols and explaining how to find needed information*
- *providing simple drawings for work to be performed*
- *pairing the apprentice with a journeyperson to interpret a drawing through the fabrication process, particularly the sequencing of operations*
- *allowing the apprentice to assist in the development of templates*

Industrial Mathematics — 21 hours

- perform arithmetic calculations using whole numbers, fractions and decimals
- calculate areas, volumes, and weights
- calculate material requirements

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

- *ensuring the apprentice can read a tape measure in both metric and imperial*
- *having the apprentice convert from imperial dimensions to metric dimensions, and back*
- *having the apprentice repetitively add imperial measurements, particularly fractions*
- *teaching the apprentice to convert decimal measurements to fractions, and back*
- *teaching the apprentice to calculate areas, volumes and weights*
- *having the apprentice complete actual work-related problems and perform small material quantity estimating*

Metallurgy and Material Designations — 10 hours

- interpret steel classification information
- identify structural shapes, pipe and plate

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

- *having the mentoring journeyperson describe the effect of different carbon contents in metals*
- *explaining the application of steel classification systems*
- *having various wall charts showing structural shapes and sizes*
- *requiring the apprentice to learn to identify all metal materials in the shop or yard*

Trade Safety — 12 hours

- describe fire-fighting equipment and procedures
- describe personal protective equipment and safety practices
- demonstrate safe shop work practices for housekeeping, equipment and tool use
- describe WHMIS
- interpret occupational health and safety regulations
- describe rigging and material handling procedures and equipment

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

- *providing comprehensive orientation for new employees*
- *clearly establishing housekeeping rules*
- *ensuring proper safety equipment is available*
- *providing training and review of the applicable sections of the OH&S Regulations*
- *having a functioning tool crib that details maintenance and use of tools and equipment*
- *ensuring the apprentice demonstrates proper fire safety through proper storage and disposal of flammable materials*
- *demonstrating the use and care of shop firefighting equipment*
- *having a common area for WHMIS materials and demonstrating the application of labels and the*
- *interpretation of MSD sheets*
- *providing the proper manuals for fabrication equipment and having the apprentice read them*
- *providing instructions and demonstrating the safe use of this equipment*
- *giving the apprentice simple tasks to perform to learn the use of the equipment*
- *having the apprentice assist in the maintenance of equipment*
- *describing care and use of lifting equipment and demonstrating knot tying techniques*
- *allowing the apprentice to work alongside someone skilled in proper rigging practices, then monitoring the abilities until trust is gained*

Shielded Metal Arc Welding – Theory — 13 hours

- describe the components and accessories of SMAW welding station
- describe operation of constant current power supply
- describe setup procedures
- describe maintenance and troubleshooting procedures
- describe SMAW safety concerns

Shielded Metal Arc Welding – Shop — 33 hours

- setup a SMAW welding station
- demonstrate safe SMAW work procedures
- weld 14 gauge, horizontal fillet using E6010/11
- weld 14 gauge, lap joint, vertical down
- weld one and three pass horizontal fillet on 1/4” ms using E7018.
- weld vertical up single and three pass fillet on ¼” ms using E7018

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

- *describing the different electrodes and their intended uses*
- *having the mentoring journeyperson demonstrate technique, then monitor progress of the apprentice*
- *allowing the opportunity for the apprentice to train on the different machines that are available*
- *letting the apprentice perform welds on practice materials prior to the actual work required*
- *allowing the apprentice to perform hands-on welding in various situations and positions*

Oxy-Fuel Processes – Theory **12 hours**

- describe oxy-fuel equipment and accessories
- describe setup, use and shut down procedures
- describe OFW, braze welding, soldering, brazing and OFC
- describe OFW and OFC safety concerns

Oxy-Fuel Processes – Shop **18 hours**

- demonstrate safe setup, use and shut down procedures
- weld gauge metal and flat
- perform braze welding and soldering
- cut plate to fit structural shape contour
- cut plate to bevel
- pierce and cut holes in plate

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

- *demonstrating different OAW techniques while explaining the equipment and its' intended uses*
- *monitoring until the apprentice is comfortable in the set-up and take-down of this equipment*
- *describing the different gases, fluxes and fillers used*
- *ensuring the apprentice can recognize the types of gas by label*
- *explaining the difference between brazing, braze welding and soldering*
- *ensuring the apprentice fully understands the safety associated with brazing (zinc oxide)*
- *providing scrap cast iron for practice*
- *allowing the apprentice time to complete selected OAW exercises under close supervision*
- *fully describing the different tips and their uses*
- *demonstrating different cutting techniques while explaining the equipment and its' intended uses*
- *allowing the apprentice to flame-cut various thicknesses of different metals and scrap plate – observe the progress and offer hints*
- *giving the apprentice time to practice piercing, cutting circles, bevels and straight cuts*
- *explaining the importance of tip cleaners, demonstrate their use and ensure they are available*
- *downloading the Welder Journeyperson Practical Examination candidate information from the*
- *apprenticeship website: www.saskapprenticeship.ca*
- *supervising the apprentice to attempt the oxyacetylene cutting test in this document*

Wire Feed Welding Processes – Theory **13 hours**

- describe the components and accessories of a GMAW welding station
- describe operation of a constant voltage power supply
- describe setup procedures
- describe maintenance and troubleshooting procedures
- identify GMAW safety concerns
- describe the function of all major components of a GMAW, MCAW and FCAW power source

Wire Feed Welding Processes – Shop **54 hours**

- setup a GMAW weld station
- set up weld joints
- weld 14 gauge T-joint downhand
- weld 14 gauge lap joint horizontal pulse
- weld 14 gauge butt joint downhand
- weld 3/8" V-groove butt joint in flat position
- weld 3/8" V-groove butt joint in vertical position
- weld single and three pass horizontal fillet on 3/8" T-joint using MCAW
- weld aluminum horizontal T joint
- weld single and three pass 3/8” horizontal fillet on flux core

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

- *describing the different setup requirements as compared to a GMAW setup*
- *describing the equipment specific to these processes and the process to change out all applicable parts*
- *having the mentoring journeyperson demonstrate technique, then monitor progress of the apprentice*
- *allowing the opportunity for the apprentice to train on the different machines that are available*
- *letting the apprentice perform welds on practice materials prior to the actual work required*
- *allowing the apprentice to perform hands-on welding in various situations and positions*

Thermal Cutting **14 hours**

- use oxy-fuel cutting to cut a nut from a bold and cut a sleeve from a shaft
- use air carbon arc cutting to remove a weld, prepare grooves and back gouge
- use plasma arc cutting and gouging process

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

- *demonstrating gouging techniques*
- *allowing the apprentice time to practice techniques*
- *giving hands-on exercises - use the journeyperson certification exam as practice*
- *giving opportunities to cut in various environments and positions*

Level Two 7 weeks 210 hours

Quality Assurance **12 hours**

- identify applicable codes and standards
- describe mill test result, heat numbers and material traceability
- describe weld procedure data sheets, electrode data sheets and procedure qualification records
- interpret welder qualification information

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

- *identifying agencies that set codes and standards*
- *identifying the codes that govern the welding in Canada for structural steel, boilers and pressure vessels, piping systems, etc.*
- *showing examples of mill test results, heat numbers and describing how these assist and the importance of material traceability*
- *describing welding procedure qualification*
- *describing welder performance qualification*

Print Reading and Fabrication **10 hours**

- interpret intermediate welding symbols
- interpret intermediate shop drawings
- use notching and mitre functions of iron worker
- use press brake
- describe weld positioners

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

- *reviewing numerous blueprint and specification pages for past and present jobs*
- *directing the apprentice to find information from a set of blueprints and monitor for difficulties*
- *ensuring the apprentice understands weld symbols*
- *providing the proper manuals for fabrication equipment and having the apprentice read them*

- *supervising hands-on time in the use of press brake and ironworker*

Metallurgy and Material Designation — 10 hours

- describe the physical, chemical and mechanical properties of selected metals
- identify steels by classification system
- identify use of different metals
- describe shop tests used to identify metals

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

- *explaining the physical and mechanical properties of metals and providing examples of where and why each is used*
- *providing textbooks and exercises to ensure the physical properties of metals are understood*
- *having resource materials on the topic of metallurgy available for the apprentice to review*
- *explaining how alloys affect properties of metals*
- *detailing rod selection for different alloying elements*
- *teaching the apprentice the procedures to identify materials - magnets, grinder spark test, etc.*

Wire Feed Welding Processes — 23 hours

- weld 3/8” MS horizontal, T-joint, 3 pass, using MCAW
- weld 1/4” MS, vertical, T-joint, 3 pass, using FCAW
- describe the welding gases and the CSA and AWS welding wire classification systems
- describe submerged arc welding

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

- *describing the different setup requirements as compared to a GMAW setup*
- *describing the equipment specific to these processes and the process to change out all applicable parts*
- *having the mentoring journeyperson demonstrate technique, then monitor progress of the apprentice*
- *allowing the opportunity for the apprentice to train on the different machines that are available*
- *letting the apprentice perform welds on practice materials prior to the actual work required*
- *allowing the apprentice to perform hands-on welding in various situations and positions.*

Shielded Metal Arc Welding - Theory — 18 hours

- select power sources
- interpret power source technical data
- describe the effect of adjusting all weld parameters
- select electrodes

Shielded Metal Arc Welding - Shop — 92 hours

- weld 3/8” MS, flat V-groove, butt joints – E6010 root, E7018 fill and cap
- weld 3/8" MS, Vertical V-groove butt joints - E6010 root, E7018 fill and cap
- weld 3/8" MS, Horizontal, V-groove butt joint - E6010

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

- *continuing to allow the apprentice to complete welds in all positions using a variety of electrodes*
- *explaining how differing the machine settings will vary operating characteristics*
- *giving the apprentice work on out-of-position welds*
- *allowing the apprentice to train on a variety of SMAW machines as available in the shop to see how machines operate differently*
- *allowing lots of repetitive hands-on welding - use the journeyperson certification exam as practice*

Gas Tungsten Arc Welding – Theory — 9 Hours

- describe features of a GTAW power source
- select shielding gas, tungsten, current type, polarity, and amperage
- identify safety concerns in GTAW

Gas Tungsten Arc Welding - Shop — 21 Hours

- weld gauge stainless steel lap joint horizontal fillet
- weld gauge stainless steel corner joint horizontal fillet
- weld gauge aluminum lap joint horizontal fillet
- weld gauge aluminum corner joint horizontal fillet

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

- *explaining and demonstrating different GTAW processes and procedures*
- *describing the different gases and consumables*
- *allowing the apprentice to perform welds on practice materials prior to the actual work required*
- *allowing the apprentice time to practice techniques*

Welding Mathematics 2 — 14 hours

- apply manipulations to basic formulas to match modifications to basic shapes and objects
- perform equivalent Imperial and Metric calculations and conversions involving weight-volume, weight-length, and vice-versa
- perform advanced welding related problems involving ratios, proportions and percent
- perform advanced lineal and non-lineal problems involving irregular and odd shapes and objects

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

- *ensuring the apprentice can read a tape measure in both metric and imperial*
- *having the apprentice convert from imperial dimensions to metric dimensions, and back*
- *having the apprentice repetitively add imperial measurements, particularly fractions*
- *teaching the apprentice to convert decimal measurements to fractions, and back*
- *teaching the apprentice to calculate areas, volumes and weights*
- *having the apprentice complete actual work-related problems and perform small material quantity estimating*

Level Three — 8 weeks — 240 hours

Print Reading and Fabrication — 17 hours

- interpret advanced welding symbols
- interpret basic piping drawings
- determine material and weld requirements from shop drawings
- use rolls to form material
- fabricate project

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

- *having the apprentice estimate jobs from blueprints*
- *providing the proper manuals for fabrication equipment and having the apprentice read them*
- *providing instructions and demonstrating the safe use of this equipment*
- *giving the apprentice simple tasks to perform to learn the use of the equipment*
- *having the apprentice assist in the maintenance of equipment*
- *having the apprentice determine the sequence of operations for projects*

- *continuing to have the apprentice fabricate parts requiring interpretation of detailed blueprints and specifications*
- *monitoring the apprentice for the proper level of ability - should be able to complete projects with a minimum of supervision*

Metallurgy **10 hours**

- describe tempering, normalizing and annealing
- determine the mechanical properties of metals
- describe pre-heat, interpass and post-heat considerations

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

- *having weld procedures in place*
- *having resource materials available relating to welding metallurgy for the apprentice to review*
- *having the apprentice weld steel that has a high carbon content*
- *describing the procedures to and having the apprentice perform tempering, normalizing and annealing*
- *explain and demonstrate how to pre and post-treat materials*

Special Welding and Cutting Processes **18 hours**

- perform cutting procedures on plate - 30 degree bevel, contour cut and hole
- use air carbon arc cutting to remove backing plate
- perform specialized welding processes - SAW, SW, PAW, TW and RW

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

- *allowing the apprentice to work with less supervision at this point*
- *assign the apprentice duties to perform using the various cutting processes*
- *providing resource material for those processes not available and allowing the apprentice to ask questions*

SMAW Plate/Pipe Process – Theory **25 hours**

- describe weld faults
- describe joint preparation for plate
- describe joint preparation for pipe

SMAW Plate Process – Shop **95 hours**

- weld 3/8” MS, vertical V-groove butt joints – E6010 root, E7018 fill and cap
- weld 3/8” MS, horizontal, V-groove butt joint – E6010
- perform 4GF test using 7018

SMAW Pipe Process – Shop **20 hours**

- weld 6 inch schedule 80 pipe in the 2G – 5G position, E6010/7018

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

- *having piping available for practice welding*
- *allowing the apprentice opportunities to weld on non- pressure piping*
- *explaining testing procedures for pipe welding*
- *allowing practice time to perform this process repetitively - use the journeyperson certification exam as practice*

Wire Feed Welding Processes – Theory — 12 hours

- describe the function of all major components of a GMAW, FCAW and MCAW power source
- identify the applications of each process
- identify all weld parameters

Wire Feed Welding Processes – Shop — 21 hours

- weld 3/8” MS, flat V-groove butt joint using GMAW joint
- weld 3/8” MS vertical V-groove butt joint using FCAW

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

- *describing the equipment specific to these processes and the process to change out all applicable parts*
- *having the mentoring journeyperson demonstrate technique, then monitor progress of the apprentice*
- *allowing the opportunity for the apprentice to train on the different machines that are available*
- *letting the apprentice perform welds on practice materials prior to the actual work required*
- *allowing the apprentice to perform hands-on welding in various situations and positions*

Gas Tungsten Arc Welding (GTAW) — 12 hours

- weld 3/8” MS flat open root butt joints in the horizontal position using the GTAW process

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

- *ensuring the apprentice can convert metric to imperial for volume, capacity and mass as they pertain to water*
- *assisting the apprentice to calculate rolling and jumper offsets*
- *having the apprentice demonstrate the calculation of pipe sizes and flow rates*

Welding Mathematics 3 — 10 hours

- advanced welding-related calculations involving layouts, rollouts, fitting and loading/lift problems
- calculation management involving compound combinations of welding related materials
- calculation management involving a small project involving diagrams or partial blueprint

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

- *having the apprentice convert from imperial dimensions to metric dimensions, and back*
- *having the apprentice repetitively add imperial measurements, particularly fractions*
- *teaching the apprentice to convert decimal measurements to fractions, and back*
- *teaching the apprentice to calculate areas, volumes and weights*
- *having the apprentice complete actual work-related problems and perform small material quantity estimating from diagrams*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

Saskatchewan Apprenticeship & Trade Certification Commission
2140 Hamilton St Regina SK S4P 2E3
Tel: (306) 787-2444
Fax: (306) 787-5105
Toll Free: 1-877-363-0536
Website: www.saskapprenticeship.ca

District Offices
Estevan (306) 637-4930
La Ronge (306) 425-4385
Moose Jaw (306) 694-3735
North Battleford (306) 446-7409
Prince Albert (306) 953-2632
Saskatoon (306) 933-8476
Swift Current (306) 778-8945
Yorkton (306) 786-1394