

# Welder

# Guide to Course Content

2021



Online: [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca)

*Recognition:*

*To promote transparency and consistency, 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](http://www.red-seal.ca)*

# STRUCTURE OF THE GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this guide to course content 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.

**Elements of harmonization of apprenticeship training:** includes adoption of Red Seal trade name, number of levels of apprenticeship, total training hours (on-the-job and in-school) and consistent sequencing of technical training content. 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.

**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.

**Training Profile Chart:** a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

**Technical Training Course Content for the Welder trade:** a chart which outlines the model for SATCC technical training sequencing. For the harmonized level of training, a cross reference to the Harmonized apprenticeship technical training sequencing, at the learning outcome level, is provided.

**Appendix A: Post Harmonization Training Profile Chart:** a chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

The Red Seal Welder Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at [www.red-seal.ca](http://www.red-seal.ca)

# 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:** 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 trade.

There are three levels of technical training delivered by Saskatchewan Polytechnic in Moose Jaw, Regina, and Saskatoon.

Level One: 7 weeks

Level Two: 7 weeks

Level Three: 8 weeks

The information contained in this guide to course content details the technical training delivered for each level of apprenticeship. An apprentice spends approximately 15% of their apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

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

## Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (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 journey person 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 <sup>❶</sup>	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](http://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](http://www.red-seal.ca).

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## 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.

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## 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).

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## 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.

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## 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.

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## 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.

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## 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.

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## 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 co-ordinate their tasks on projects so that steps are completed in the correct order.

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## 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.

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## **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.

# ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

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**

Harmonization for the Welder trade has been fully implemented for each level of technical training. See the “Technical Training Course Content” section of this guide for more details.

White boxes are “Topics,” grey boxes are “In Context”. In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

<b>Level 1</b> (2016/2017 implementation)	<b>Level 2</b> (2017/2018 implementation)	<b>Level 3</b> (2018/2019 implementation)
Safety		
Tools and Equipment		
Stationary Machinery		
Access Equipment		
Hoisting, Lifting, and Rigging		
Communication and Trade Documentation		
Fabrication –A1	Fabrication –A1	
Oxy-Fuel Cutting		
Plasma Arc Cutting		
Electric Arc Cutting and Gouging		
Shield Metal Arc Welding (SMAW)	Shield Metal Arc Welding (SMAW)	Shield Metal Arc Welding (SMAW)
Gas Metal Arc Welding (GMAW)	Gas Metal Arc Welding (GMAW)	Gas Metal Arc Welding (GMAW)
Flux Core Arc Welding	Flux Core Arc Welding	Flux Core Arc Welding
Metal Core Arc Welding	Metal Core Arc Welding	Metal Core Arc Welding
	Gas Tungsten Arc Welding	Gas Tungsten Arc Welding
	Submerged Arc Welding	Submerged Arc Welding
	Working Planning	Working Planning
Quality Control	Quality Control	Quality Control
	Layout and Pattern Development	

# 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. Harmonization for the Welder trade has been fully implemented for each level of technical training.

## A - COMMON OCCUPATIONAL SKILLS

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

## B – FABRICATION AND PREPARATION OF COMPONENTS FOR WEDLING

<b>B-6 Performs layout</b>	<b>6.01 Develops templates</b>  <p style="text-align: center;">1,2</p>	<b>6.02 Transfers dimensions from drawings to materials</b>  <p style="text-align: center;">1,2</p>	
<b>B-7 Fabricates components</b>	<b>7.01 Prepares materials</b>  <p style="text-align: center;">1</p>	<b>7.02 Fits components for welding</b>  <p style="text-align: center;">1,2</p>	<b>7.03 Assembles components</b>  <p style="text-align: center;">1,2</p>

## C – CUTTING AND GOUGING

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

## D – WELDING PROCESSES

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

# TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One	Transcript Code	Hours
Print Reading	BPRT 105	10
Industrial Mathematics	MATH 125A	21
Metallurgy and Material Designations	METL 106	10
Trade Safety	SFTY 132	12
Shielded Metal Arc Welding	WLDR 111 – Theory	13
	WLDR 110 – Shop	33
Wire Feed Processes	WLDR 115 – Theory	13
	WLDR 116 – Shop	54
Oxy-Fuel Processes	WLDR 112 – Theory	12
	WLDR 1AA – Shop	18
Thermal Cutting	WELD 1BB	14
		210

Level Two	Transcript Code	Hours
Print Reading and Fabrication	BPRT 251	10
Industrial Mathematics	MATH 2AA	14
Quality Assurance	WELD 213	12
Metallurgy and Material Designation	WELD 215	11
Shielded Metal Arc Welding	WELD 252 – Theory	18
	WELD 253 – Shop	92
Gas Tungsten Arc Welding	WELD 254 – Theory	9
	WELD 255 – Shop	21
Wire Feed Processes	WELD 2AA	23
		210

Level Three	Transcript Code	Hours
Print Reading and Fabrication	BPRT 322	17
Industrial Mathematics	MATH 3AA	10
SMAW Plate/Pipe Process	WELD 311 – Theory	25
SMAW Plate Process	WELD 3AA – Shop	95
SMAW Pipe Process	WELD 3BB – Shop	20
Metallurgy	WELD 224	10
Wire Feed Processes	WELD 335 – Theory	12
	WELD 336 – Shop	21
Gas Tungsten Arc Welding	WELD 337	12
Special Welding and Cutting Processes	WELD 338	18
		240

# TECHNICAL TRAINING COURSE CONTENT

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized level of training, a cross reference to the National Occupational Analysis apprenticeship technical training sequencing, at the learning outcome level, is provided.

Harmonization for the Welder trade has been fully implemented for each level of technical training.

<b>Level One</b>	<b>7 weeks</b>	<b>210 hours</b>
<b>Print Reading and Fabrication</b>		<b>10 hours</b>
<ul style="list-style-type: none"><li>• interpret basic shop drawings</li><li>• interpret basic welding symbols</li></ul>		
<b>NOA topics covered in this section of training:</b>		
<b>A-5 Performs routine trade activities</b>		
<ul style="list-style-type: none"><li>• 5.07 – finishes final product</li></ul>		
<b>B-6 Performs layout</b>		
<ul style="list-style-type: none"><li>• 6.01 – develops templates</li><li>• 6.02 – transfers dimensions from drawings to materials</li></ul>		
<b>B-7 Fabricates components</b>		
<ul style="list-style-type: none"><li>• 7.01 – prepares materials</li><li>• 7.02 – fits components for welding</li><li>• 7.03 – assembles components</li></ul>		
<b>Industrial Mathematics</b>		<b>21 hours</b>
<ul style="list-style-type: none"><li>• perform arithmetic calculations using whole numbers, fractions and decimals</li><li>• calculate areas, volumes, and weights</li><li>• calculate material requirements</li></ul>		
<b>NOA topics covered in this section of training:</b>		
<b>No Specific Task in NOA</b>		
<b>Metallurgy and Material Designations</b>		<b>10 hours</b>
<ul style="list-style-type: none"><li>• interpret steel classification information</li><li>• identify structural shapes, pipe and plate</li></ul>		
<b>NOA topics covered in this section of training:</b>		
<b>A-4 Organizes Work</b>		
<ul style="list-style-type: none"><li>• 4.01 – uses documentation and reference material</li><li>• 4.03 – organizes materials</li></ul>		
<b>Trade Safety</b>		<b>12 hours</b>
<ul style="list-style-type: none"><li>• describe fire-fighting equipment and procedures</li><li>• describe personal protective equipment and safety practices.</li><li>• demonstrate safe shop work practices for housekeeping, equipment and tool use</li><li>• describe WHMIS</li></ul>		

- interpret occupational health and safety regulations
- describe rigging and material handling procedures and equipment

**NOA topics covered in this section of training:**

**A-1 Maintains Tools and Equipment**

- 1.01 – maintains hand, power, layout and measuring tools
- 1.02 – maintains stationary machinery

**A-2 Uses access and material handling equipment**

- 2.01 – uses access equipment
- 2.02 – uses rigging, hoisting and lifting equipment

**A-3 Performs safety-related activities**

- 3.01 – performs hazard assessments
- 3.02 – maintains safe work environment
- 3.03 – uses personal protective equipment (PPE) and safety equipment

**C-8 Uses tools and equipment for non-thermal cutting and grinding**

- 8.01 – selects cutting and grinding tools
- 8.02 – cuts using stationary band saws and power hacksaws
- 8.03 – cuts using shears and ironworkers
- 8.04 – cuts using hand tools
- 8.05 – cuts using handheld power tools

**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 1/4" ms using E7018

**NOA topics covered in this section of training:**

**A-1 Maintains tools and equipment**

- 1.04 – maintains welding equipment

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-12 Welds using shielded metal arc welding (SMAW) process**

- 12.01 – selects SMAW equipment and consumables
- 12.02 – sets up SMAW equipment
- 12.03 – sets operating parameters for SMAW
- 12.04 – performs weld with SMAW equipment

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**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

**NOA topics covered in this section of training:**

**A-1 Maintains tools and equipment**

- 1.03 – maintains thermal cutting equipment
- 1.04 – maintains welding equipment

**C-9 Uses oxy-fuel gas cutting (OFC) process for cutting and gouging**

- 9.01 – selects OFC gas and equipment
- 9.02 – sets up OFC equipment
- 9.03 – sets operating parameters for OFC equipment
- 9.04 – performs cut and gouge using OFC equipment

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**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

**NOA topics covered in this section of training:**

**A-1 Maintains tools and equipment**

- 1.04 – maintains welding equipment

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**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
- 13.02 – sets up FCAW, MCAW and GMAW equipment
- 13.03 – sets operating parameters for FCAW, MCAW and GMAW
- 13.04 – performs weld using FCAW, MCAW and GMAW equipment

### **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

#### **NOA topics covered in this section of training:**

##### **A-1 Maintains tools and equipment**

- 1.03 – maintains thermal cutting equipment

##### **C-10 Uses plasma arc cutting (PAC) processes for cutting and gouging**

- 10.01 – selects PAC equipment and consumables
- 10.02 – sets up PAC equipment
- 10.03 – sets operating parameters for PAC equipment
- 10.04 – performs cut or gouge using PAC equipment

##### **C-11 Uses air carbon arc cutting (CAC-A) process for cutting and gouging**

- 11.01 – selects CAC-A equipment and consumables
- 11.02 – sets up CAC-A equipment
- 11.03 – sets operating parameters for CAC-A equipment
- 11.04 – performs cut or gouge using CAC-A equipment

#### **Level One topics from the NOA that are taught in context:**

***No specific topic covered In Context***

***For details regarding the In Context Topic, see page 23***

## **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

#### **NOA topics covered in this section of training:**

##### **A- 5 Performs routine trade activities**

- 5.01 – performs quality inspection
- 5.02 – marks welds, materials and parts

### **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

**NOA topics covered in this section of training:**

**A-4 Organizes work**

- 4.02 – plans job tasks
- 4.03 – organizes materials

**A-5 Performs routine trade activities**

- 5.07 – finishes final product

**B-6 Performs layout**

- 6.01 – develops templates
- 6.02 – transfers dimensions from drawings to materials

**B-7 Fabricates components**

- 7.01 – prepares materials
- 7.02 – fits components for welding
- 7.03 – assembles components

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**Metallurgy and Material Designation**

**11 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

**NOA topics covered in this section of training:**

**A-4 Organizes work**

- 4.01 – uses documentation and reference material
- 4.03 – organizes materials

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**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

**NOA topics covered in this section of training:**

**A-1 Maintains tools and equipment**

- 1.04 – maintains welding equipment

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**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
- 13.02 – sets up FCAW, MCAW and GMAW equipment
- 13.03 – sets operating parameters for FCAW, MCAW and GMAW
- 13.04 – performs weld using FCAW, MCAW and GMAW equipment

**D-15 Welds using submerged arc welding (SAW) process**

- 15.01 – selects SAW equipment and consumables
- 15.02 – sets up SAW equipment
- 15.03 – sets operating parameters for SAW
- 15.04 – performs weld using SAW equipment

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**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

**NOA topics covered in this section of training:****A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-12 Welds using shielded metal arc welding (SMAW) process**

- 12.01 – selects SMAW equipment and consumables
- 12.02 – sets up SMAW equipment
- 12.03 – sets operating parameters for SMAW
- 12.04 – performs weld with SMAW equipment

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**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

**NOA topics covered in this section of training:****A-1 Maintains tools and equipment**

- 1.04 – maintains welding equipment

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-14 Welds using gas tungsten arc welding (GTAW) process**

- 14.01 – selects GTAW gas, equipment and consumables
- 14.02 – sets up GTAW equipment
- 14.03 – sets operating parameters for GTAW
- 14.04 – performs weld using GTAW equipment

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**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 problems using ratios, proportions and percent
- perform advanced lineal and non-lineal problems involving irregular and odd shapes and objects

**NOA topics covered in this section of training:**

**No Specific Task in NOA**

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**Level Two topics from the NOA that are taught in context:**

*No specific topic covered In Context*

*For details regarding the In Context Topic, see page 23*

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## **Level Three**

## **8 weeks**

## **240 hours**

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### **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

**NOA topics covered in this section of training:**

#### **A-4 Organizes work**

- 4.02 – plans job tasks
- 4.03 – organizes materials

#### **A-5 Performs routine trade activities**

- 5.07 – finishes final product

#### **B-6 Performs layout**

- 6.01 – develops templates
- 6.02 – transfers dimensions from drawings to materials

#### **B-7 Fabricates components**

- 7.01 – prepares materials
- 7.02 – fits components for welding
- 7.03 – assembles components

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### **Metallurgy**

**10 hours**

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

**NOA topics covered in this section of training:**

#### **A-4 Organizes work**

- 4.01 – uses documentation and reference material
- 4.03 – organizes materials

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### **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

**NOA topics covered in this section of training:**

#### **A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments

- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-15 Welds using submerged arc welding (SAW)**

- 15.01 – selects SAW equipment and consumables
- 15.02 – sets up SAW equipment
- 15.03 – sets operating parameters for SAW
- 15.04 – performs weld using SAW equipment

**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

**NOA topics covered in this section of training:**

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-12 Welds using shielded metal arc welding (SMAW) process**

- 12.01 – selects SMAW equipment and consumables
- 12.02 – sets up SMAW equipment
- 12.03 – sets operating parameters for SMAW
- 12.04 – performs weld with SMAW equipment

**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

**NOA topics covered in this section of training:**

**A-2 Maintains tools and equipment**

- 1.04 – maintains welding equipment

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.04 – stores welding consumables
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**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
- 13.02 – sets up FCAW, MCAW and GMAW equipment

- 13.03 – sets operating parameters for FCAW, MCAW and GMAW
- 13.04 – performs weld using FCAW, MCAW and GMAW equipment

**D-15 Welds using submerged arc welding (SAW) process**

- 15.01 – selects SAW equipment and consumables
- 15.02 – sets up SAW equipment
- 15.03 – sets operating parameters for SAW
- 15.04 – performs weld using SAW equipment

**Gas Tungsten Arc Welding (GTAW)**

**12 hours**

- weld 3/8" MS flat open root butt joints in the horizontal position

**NOA topics covered in this section of training:**

**A-5 Performs routine trade activities**

- 5.03 – controls temperature of weldments
- 5.05 – selects welding process and power source
- 5.06 – performs equipment start-up and shut-down

**D-14 Welds using gas tungsten arc welding (GTAW) process**

- 14.01 – selects GTAW gas, equipment and consumables
- 14.02 – sets up GTAW equipment
- 14.03 – sets operating parameters for GTAW
- 14.04 – performs weld using GTAW equipment

**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

**NOA topics covered in this section of training:**

**No Specific Task in NOA**

**Level Three topics from the NOA that are taught in context:**

***A-5 Performs routine trade activities***

***For details regarding the In Context Topic, see page 23***

# In Context Topics

In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

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## **A-5 Performs routine trade activities**

- 5.01 – performs quality inspection
- 5.02 – marks welds, material and parts

# APPENDIX A: POST HARMONIZATION TRAINING PROFILE CHART

This chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

Harmonization for the Welder trade has been fully implemented for each level of technical training.

SATCC Level One	Transcript Code	Hours	Pan-Canadian Harmonized Level One
Print Reading	BPRT 105	10	Safety-Related Functions
Metallurgy and Material Designations	METL 106	10	Quality Control
			Communication and Trade Documentation
Trade Safety	SFTY 132	12	Safety
			Tools and Equipment
			Stationary Machinery
			Access Equipment
			Hoisting, Lifting, and Rigging
Shielded Metal Arc Welding – Theory	WLDR 110	13	Welding - SMAW
Shielded Metal Arc Welding – Shop	WLDR 111	33	
Wire Feed Welding Processes – Theory	WLDR 115	13	Welding - GMAW
			Welding - FCAW
			Welding - MCAW
Wire Feed Welding Processes – Shop	WLDR 116	54	Welding - GMAW
			Welding - FCAW
			Welding - MCAW
Oxy-Fuel Processes – Theory	WLDR 112	12	Cutting – Oxy-Fuel Cutting
Oxy-Fuel Processes – Shop	WLDR 1AA	18	
Thermal Cutting	WLDR 1BB	14	Cutting – Plasma Arc Cutting
			Cutting – Electric Arc Cutting and Gouging
Industrial Mathematics	MATH 125A	21	(Exceed)
		210	

SATCC Level Two	Transcript Code	Hours	Pan-Canadian Harmonized Level Two
Print Reading and Fabrication	BPRT 251	10	Fabrication
			Layout and Pattern Development
			Work Planning
Quality Assurance	WELD 213	12	Quality Control
Shielded Metal Arc Welding – Theory	WELD 252	18	Welding - SMAW
Shielded Metal Arc Welding – Shop	WELD 253	92	
Gas Tungsten Arc Welding – Theory	WELD 254	9	Welding – GTAW
Gas Tungsten Arc Welding – Shop	WELD 255	21	
Wire Feed Processes	WELD 2AA	23	Welding – GMAW
			Welding – FCAW
			Welding – MCAW
			Welding – Submerged Arc Welding
Industrial Mathematics	MATH 2AA	14	(Exceed)
Metallurgy and Material Designation	WELD 215	11	(Exceed)
		210	

SATCC Level Three	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
			Quality Control (In Context)
SMAW Plate/Pipe – Theory	WELD 311	25	Welding – SMAW
SMAW Plate Process – Shop	WELD 3AA	95	
SMAW Pipe Process – Shop	WELD 3BB	20	
Wire Feed Processes – Theory	WELD 335	12	Welding – GMAW
			Welding – FCAW
			Welding - MCAW
Wire Feed Processes – Shop	WELD 336	21	Welding – GMAW
			Welding – FCAW
			Welding - MCAW
Gas Tungsten Arc Welding	WELD 337	12	Welding - GTAW
Special Welding and Cutting Processes	WELD 338	18	Welding - SAW
Print Reading and Fabrication	BPRT 322	17	Exceed
Industrial Mathematics	MATH 3AA	10	Exceed
Metallurgy	WELD 224	10	Exceed
		240	

### Exceed Topics

Throughout this guide to course content there are topics which exceed the minimum scope of work as set out in the Welder NOA. Industry in Saskatchewan has deemed certain topics to fall within the scope of work of the Welder trade in Saskatchewan and therefore require technical training to cover these topics.