

# **Interprovincial Program Guide**

**Welder**

**2011**

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The CCDA Executive Committee recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Welder.

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## Introduction

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Jurisdictions have long recognized the benefit of pooling resources in the development and maintenance of apprenticeship training standards. A successful example of this is the Interprovincial Standards Red Seal Program itself. Essential to the establishment of standards is the development of suitable training systems and programs which enable tradespeople to acquire certification based on these standards. While certification is the responsibility of Apprenticeship administrators throughout Canada, the development and delivery of technical training is the responsibility of jurisdictions.

In 1999, work to develop common training for apprenticeship programs within the Atlantic Provinces began. To date, 22 Curriculum Standards have been developed through the Atlantic Standards Partnership (ASP) project to assist programming staff and instructors in the design and delivery of technical training. Similarly, the Canadian Council of Directors of Apprenticeship (CCDA) embarked on a process for the development of national Interprovincial Program Guides (IPGs) for the Boilermaker, Carpenter and Sprinkler System Installer trades. At its January 2005 strategic planning session, the CCDA identified developing common training standards as one of key activities in moving towards a more cohesive apprenticeship system.

With the support of Human Resources and Skills Development Canada (HRSDC), several provinces and territories have partnered to build on the ASP and the CCDA processes to further develop IPGs to be used across the country. This partnership will create efficiencies in time and resources and promote consistency in training and apprentice mobility.

## User Guide

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According to the Canadian Apprenticeship Forum, the Interprovincial Program Guide (IPG) is: "a list of validated technical training outcomes, based upon those sub-tasks identified as common core in the National Occupational Analysis (NOA), and validated by industry in the provinces and territories as incorporating the essential tasks, knowledge and skills associated with a given trade."

Learning outcomes contained in the IPG represent the minimum common core content for the development of jurisdictional training standards and outlines. IPGs are developed based on the NOAs and extensive industry consultation. The IPG is intended to assist program development staff in the design of jurisdictional plans of training. Each jurisdiction has the flexibility to add additional content.

The IPG was deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. It details units of training, unit outcomes and objectives. It does not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The IPG does not dictate study materials, textbooks or learning activities to be used in delivery.

The IPG document includes a recommended leveling structure to facilitate mobility for apprentices moving from one jurisdiction to another. Because of difference in jurisdictional regulations and program durations, levels are offered as suggestions only.

### Structure

The IPG is divided into units. The unit codes are used as a means of identification and are not intended to convey the order of delivery. Prerequisites have not been detailed. Each unit consists of *Learning Outcomes* and *Objectives and Content*.

The *Learning Outcomes* are the specific performances that must be evaluated. Wording of the learning outcomes, "Demonstrate knowledge of...", acknowledges the broad spectrum of ways in which knowledge can be shown. It is at the discretion of each jurisdiction to determine the manner in which learning outcomes are evaluated; theoretically, practically or a combination of both.

## User Guide *(continued)*

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The *Objectives and Content* for the unit details the information to be covered in order to achieve the performances specified in the *Learning Outcomes*. These objectives can be either theoretical or practical in nature, based on the requirements identified through the industry consultation process. The learning activities used to cover the objectives are at the discretion of the jurisdiction; however, practically worded objective statements have been used where industry indicated a need for the apprentices to receive exposure to performing the task or skill outlined while attending technical training. For example, this exposure could be done through instructor demonstration or individual or group performance of the skill or task. This practical training will help to reinforce the theoretical component of the technical training.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided. The content listed within the IPG document is **not** intended to represent an inclusive list; rather, it is included to illustrate the intended direction for the objective. Content may be added or extended in jurisdictional training plans as required.

Jurisdictions are free to deliver the IPG units one at a time or concurrently, provided that all *Learning Outcomes* are met. The IPG does not indicate the amount of time to be spent on a particular unit as the length of time required to deliver the *Learning Outcomes* successfully will depend upon the learning activities and teaching methods used.



## **IPG Glossary of Terms**

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These definitions are intended as a guide to how language is used in the IPGs.

<b>ADJUST</b>	To put in good working order; regulate; bring to a proper state or position.
<b>APPLICATION</b>	The use to which something is put and/or the circumstance in which you would use it.
<b>CHARACTERISTIC</b>	A feature that helps to identify, tell apart, or describe recognizably; a distinguishing mark or trait.
<b>COMPONENT</b>	A part that can be separated from or attached to a system; a segment or unit.
<b>DEFINE</b>	To state the meaning of (a word, phrase, etc.).
<b>DESCRIBE</b>	To give a verbal account of; tell about in detail.
<b>EXPLAIN</b>	To make plain or clear; illustrate; rationalize.
<b>IDENTIFY</b>	To point out or name objectives or types.
<b>INTERPRET</b>	To translate information from observation, charts, tables, graphs, and written material.
<b>MAINTAIN</b>	To keep in a condition of good repair or efficiency.
<b>METHOD</b>	A means or manner of doing something that has procedures attached to it.
<b>OPERATE</b>	How an object works; to control or direct the functioning of.
<b>PROCEDURE</b>	A prescribed series of steps taken to accomplish an end.
<b>PURPOSE</b>	The reason for which something exists or is done, made or used.

## **IPG Glossary of Terms** *(continued)*

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<b>TECHNIQUE</b>	Within a procedure, the manner in which technical skills are applied.
<b>TEST</b>	v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality.  n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.
<b>TROUBLESHOOT</b>	To follow a systematic procedure to identify and locate a problem or malfunction and its cause.

## Essential Skills Profiles

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

Over the past several years, the Government of Canada has conducted research examining the skills people use at work. From this research, Essential Skills Profiles have been developed for various occupations.

For more information regarding Essential Skills and to access Essential Skills Profiles for specific occupations, visit Human Resources and Skills Development Canada's Essential Skills website at:

[www.hrsdc.gc.ca/eng/workplaceskills/essential\\_skills/general/home.shtml](http://www.hrsdc.gc.ca/eng/workplaceskills/essential_skills/general/home.shtml)

## Profile Chart

<b>OCCUPATIONAL SKILLS</b>			
WDF-005 Safety	WDF-010 Tools and Equipment	WDF-015 Stationary Machinery	WDF-025 Access Equipment
WDF-030 Communication and Trade Documentation	WDF-080 Work Planning	WDF-075 Drawings	WDF-090 Metallurgy
WLD-200 Quality Control			
<b>PREPARATION FOR WELDING PROCESSES</b>			
WDF-020 Hoisting, Lifting and Rigging	WDF-070 Fabrication Fundamentals	WDF-085 Introduction to Layout and Pattern Development	WLD-300 Jigs and Fixtures
<b>CUTTING AND GOUGING</b>			
WLD-115 Oxy-fuel	WLD-240 Electric Arc Cutting and Gouging	WLD-245 Plasma Arc Cutting and Gouging	
<b>WELDING PROCESSES</b>			
WDF-035 Introduction to Welding Processes	WDF-065 Weld Faults	WDF-040 SMAW I – Set up, Strike and Maintain an Arc	WDF-045 SMAW II – Fillet Weld, All Positions
WLD-205 SMAW III – Groove Weld Plate, All Positions	WLD-210 SMAW IV – Fillet and Groove Weld, Medium Carbon Steel	WLD-305 SMAW V – Pipe and Tubing, All Positions	WLD-325 SMAW VI – Alloy Steels
WDF-050 GMAW I – Set up and Maintain an Arc	WLD-100 GMAW II – Fillet Weld, All Positions	WLD-215 GMAW III – Groove Weld, All Positions	WLD-220 GMAW IV – Fillet and Groove Weld, Medium Carbon Steel
WLD-310 GMAW V – Pipe and Tubing, All Positions	WLD-330 GMAW VI – Aluminum Alloys	WLD-335 GMAW VII – Stainless Steel Alloys	WLD-225 GTAW I – Set up and Maintain an Arc
WLD-230 GTAW II – Fillet Weld, All Positions	WLD-235 GTAW III – Groove Weld, All Positions	WLD-340 GTAW IV – Fillet and Groove Weld, Medium Carbon Steel	WLD-320 GTAW V – Pipe and Tubing, All Positions

## Profile Chart *(continued)*

<b>WELDING PROCESSES <i>(continued)</i></b>			
WLD-345 GTAW VI – Ferrous and Non-Ferrous Alloys	WDF-055 FCAW I – Set up and Deposit a Weld	WLD-105 FCAW II – Fillet and Groove Weld Plate, All Positions	WLD-315 FCAW III – Pipe and Tubing, All Positions
WDF-060 MCAW I – Set up and Deposit a Weld	WLD-110 MCAW II – Fillet and Groove Weld, All Positions	WLD-350 Submerged Arc Welding	WLD-355 Resistance Welding
WLD-360 Stud Welding	WLD-365 Build Up of Metal Parts		

## Recommended Level Structure

**WDF = Common Units to Metal Fabricator (Fitter) and Welder IPGs.**

**WLD = Specific Units to Welder IPG.**

Level 1			Level 2		
Unit Code	Title	Page	Unit Code	Title	Page
WDF-005	Safety	24	WLD-200	Quality Control	50
WDF-010	Tools and Equipment	26	WDF-065	Weld Faults	52
WDF-015	Stationary Machinery	27	WLD-205	SMAW III – Groove Weld Plate, All Positions	53
WDF-020	Hoisting, Lifting and Rigging	28	WLD-210	SMAW IV – Fillet and Groove Weld, Medium Carbon Steel	54
WDF-025	Access Equipment	30	WLD-215	GMAW III – Groove Weld, All Positions	56
WDF-030	Communication and Trade Documentation	31	WLD-220	GMAW IV – Fillet and Groove Weld, Medium Carbon Steel	57
WDF-035	Introduction to Welding Processes	32	WLD-225	GTAW I – Set up and Maintain an Arc	59
WDF-040	SMAW I – Set up, Strike and Maintain an Arc	34	WLD-230	GTAW II – Fillet Weld, All Positions	61
WDF-045	SMAW II – Fillet Weld, All Positions	36	WLD-235	GTAW III – Groove Weld, All Positions	62
WDF-050	GMAW I – Set up and Maintain an Arc	37	WLD-240	Electric Arc Cutting and Gouging	63
WLD-100	GMAW II – Fillet Weld, All Positions	39	WLD-245	Plasma Arc Cutting and Gouging	65
WDF-055	FCAW I – Set up and Deposit a Weld	40	WDF-070	Fabrication Fundamentals	66
WLD-105	FCAW II – Fillet and Groove Weld Plate, All Positions	42	WDF-075	Drawings	68
WDF-060	MCAW I – Set up and Deposit a Weld	44	WDF-080	Work Planning	70
WLD-110	MCAW II – Fillet and Groove Weld, All Positions	46			
WLD-115	Oxy-fuel	47			

## Recommended Level Structure (continued)

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Level 3		
Unit Code	Title	Page
WDF-085	Introduction to Layout and Pattern Development	72
WLD-300	Jigs and Fixtures	73
WDF-090	Metallurgy	74
WLD-305	SMAW V – Pipe and Tubing, All Positions	76
WLD-310	GMAW V – Pipe and Tubing, All Positions	77
WLD-315	FCAW III – Pipe and Tubing, All Positions	78
WLD-320	GTAW V – Pipe and Tubing, All Positions	79
WLD-325	SMAW VI – Alloy Steels	80
WLD-330	GMAW VI – Aluminum Alloys	81
WLD-335	GMAW VII – Stainless Steel Alloys	83
WLD-340	GTAW IV – Fillet and Groove Weld, Medium Carbon Steel	84
WLD-345	GTAW VI – Ferrous and Non-Ferrous Alloys	86
WLD-350	Submerged Arc Welding	88
WLD-355	Resistance Welding	90
WLD-360	Stud Welding	92
WLD-365	Build up of Metal Parts	94

## 2009 NOA Sub-task to IPG Unit Comparison

NOA Sub-task		IPG Unit	
<b>Task 1 - Maintains and uses tools and equipment.</b>			
1.01	Uses personal protective equipment (PPE) and safety equipment.	WDF-005	Safety
1.02	Maintains hand tools.	WDF-010	Tools and Equipment
1.03	Maintains power tools.	WDF-010	Tools and Equipment
1.04	Maintains stationary machinery.	WDF-015	Stationary Machinery
1.05	Maintains layout and measuring tools.	WDF-010	Tools and Equipment
1.06	Maintains cutting and welding equipment.	WLD-115	Oxy-fuel
		WLD-245	Plasma Arc Cutting and Gouging
		WLD-240	Electric Arc Cutting and Gouging
		WDF-035	Introduction to Welding Processes
		WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-050	GMAW I – Set up and Maintain an Arc
		WLD-225	GTAW I – Set up and Maintain an Arc
		WDF-055	FCAW I – Set up and Deposit a Weld
WDF-060	MCAW I – Set up and Deposit a Weld		
1.07	Uses access equipment.	WDF-025	Access Equipment
<b>Task 2 - Organizes work.</b>			
2.01	Maintains safe work environment.	WDF-005	Safety
2.02	Uses documentation and reference material.	WDF-030	Communication and Trade Documentation
2.03	Interprets plans, drawings and specifications.	WDF-075	Drawings
2.04	Communicates with others.	WDF-030	Communication and Trade Documentation
2.05	Compiles a list of materials and supplies.	WDF-080	Work Planning
2.06	Plans project tasks.	WDF-080	Work Planning



NOA Sub-task		IPG Unit	
<b>Task 3 - Performs quality control.</b>			
3.01	Performs inspection.	WLD-200	Quality Control
3.02	Marks materials and parts.	WLD-200	Quality Control
3.03	Verifies layout.	WLD-200	Quality Control
3.04	Verifies measurements.	WLD-200	Quality Control
3.05	Performs heat treatment.	WDF-090	Metallurgy
3.06	Stores consumables.		Throughout
<b>Task 4 - Performs routine trade activities.</b>			
4.01	Performs hazard assessments.	WDF-005	Safety
4.02	Selects power source for welding processes.	WDF-035	Introduction to Welding Processes
4.03	Performs equipment start-up and shut down.	WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-050	GMAW I – Set up and Maintain an Arc
		WLD-225	GTAW I – Set up and Maintain an Arc
		WDF-055	FCAW I – Set up and Deposit a Weld
		WDF-060	MCAW I – Set up and Deposit a Weld
		WLD-360	Stud Welding
		WLD-355	Resistance Welding
		WLD-350	Submerged Arc Welding
<b>Task 5 - Handles materials.</b>			
5.01	Obtains materials.	WLD-200	Quality Control
5.02	Verifies bill of materials.	WDF-030	Communication and Trade Documentation
5.03	Organizes materials.	WDF-080	Work Planning
5.04	Uses rigging, hoisting and lifting equipment.	WDF-020	Hoisting, Lifting and Rigging
5.05	Operates material handling equipment.	WDF-020	Hoisting, Lifting and Rigging
<b>Task 6 - Performs layout.</b>			
6.01	Develops templates.	WDF-070	Fabrication Fundamentals
		WDF-085	Introduction to Layout and Pattern Development
6.02	Transfers dimensions from drawings to materials.	WDF-075	Drawings
		WDF-070	Fabrication Fundamentals
		WDF-085	Introduction to Layout and Pattern Development

NOA Sub-task		IPG Unit	
<b>Task 7 - Fabricates components.</b>			
7.01	Prepares materials.	WDF-070	Fabrication Fundamentals
7.02	Fits components.	WDF-070	Fabrication Fundamentals
7.03	Tacks components.	WDF-070	Fabrication Fundamentals
7.04	Assembles components.	WDF-070	Fabrication Fundamentals
7.05	Finishes final product.	WDF-070	Fabrication Fundamentals
<b>Task 8 - Uses mechanical and power tools for cutting and grinding.</b>			
8.01	Selects cutting and grinding tools.	WDF-010	Tools and Equipment
		WDF-015	Stationary Machinery
8.02	Cuts using stationary band saws and power hacksaws.	WDF-015	Stationary Machinery
8.03	Cuts using mechanical and hydraulic shears.	WDF-010	Tools and Equipment
8.04	Cuts using hand tools.	WDF-010	Tools and Equipment
8.05	Cuts using grinders.	WDF-010	Tools and Equipment
		WDF-015	Stationary Machinery
8.06	Cuts using circular saws.	WDF-010	Tools and Equipment
8.07	Cuts using reciprocating saws.	WDF-010	Tools and Equipment
<b>Task 9 - Uses oxy-fuel gas cutting process (OFC) for cutting and gouging.</b>			
9.01	Selects oxy-fuel gas and equipment.	WLD-115	Oxy-fuel
9.02	Sets up oxy-fuel equipment.	WLD-115	Oxy-fuel
9.03	Sets operating parameters for oxy-fuel equipment.	WLD-115	Oxy-fuel
9.04	Operates oxy-fuel equipment.	WLD-115	Oxy-fuel
<b>Task 10 - Uses plasma arc cutting process (PAC) for cutting and gouging.</b>			
10.01	Selects PAC gas, equipment and consumables.	WLD-245	Plasma Arc Cutting and Gouging
10.02	Sets up PAC equipment.	WLD-245	Plasma Arc Cutting and Gouging
10.03	Sets operating parameters for PAC.	WLD-245	Plasma Arc Cutting and Gouging
10.04	Operates PAC equipment.	WLD-245	Plasma Arc Cutting and Gouging
<b>Task 11 - Uses air carbon arc cutting (CAC-A) process.</b>			
11.01	Selects CAC-A equipment and consumables.	WLD-240	Electric Arc Cutting and Gouging
11.02	Sets up CAC-A equipment.	WLD-240	Electric Arc Cutting and Gouging
11.03	Sets operating parameters for CAC-A.	WLD-240	Electric Arc Cutting and Gouging

NOA Sub-task		IPG Unit	
11.04	Operates CAC-A equipment.	WLD-240	Electric Arc Cutting and Gouging
<b>Task 12 - Welds using oxy-acetylene welding process.</b>			
12.01	Selects oxy-acetylene equipment and consumables.	WLD-115	Oxy-fuel
12.02	Sets operating parameters for oxy-acetylene process.	WLD-115	Oxy-fuel
12.03	Operates oxy-acetylene equipment.	WLD-115	Oxy-fuel
<b>Task 13 - Welds using shielded metal arc welding process (SMAW).</b>			
13.01	Selects SMAW equipment and consumables.	WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-045	SMAW II – Fillet Weld, All Positions
		WLD-205	SMAW III – Groove Weld Plate, All Positions
		WLD-210	SMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-305	SMAW V – Pipe and Tubing, All Positions
		WLD-325	SMAW VI – Alloy Steels
13.02	Sets up SMAW equipment.	WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-045	SMAW II – Fillet Weld, All Positions
		WLD-205	SMAW III – Groove Weld Plate, All Positions
		WLD-210	SMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-305	SMAW V – Pipe and Tubing, All Positions
		WLD-325	SMAW VI – Alloy Steels
13.03	Sets operating parameters for SMAW.	WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-045	SMAW II – Fillet Weld, All Positions
		WLD-205	SMAW III – Groove Weld Plate, All Positions
		WLD-210	SMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-305	SMAW V – Pipe and Tubing, All Positions

NOA Sub-task		IPG Unit	
13.04	Operates SMAW equipment.	WLD-325	SMAW VI – Alloy Steels
		WDF-040	SMAW I – Set up, Strike and Maintain an Arc
		WDF-045	SMAW II – Fillet Weld, All Positions
		WLD-205	SMAW III – Groove Weld Plate, All Positions
		WLD-210	SMAW IV - Fillet and Groove Weld, Medium Carbon Steel
		WLD-305	SMAW V – Pipe and Tubing, All Positions
		WLD-325	SMAW VI – Alloy Steels
<b>Task 14 - Welds using flux cored arc welding process (FCAW), metal core arc welding process (MCAW) and gas metal arc welding process (GMAW).</b>			
14.01	Selects FCAW, MCAW and GMAW gas, equipment and consumables.	WDF-050	GMAW I – Set up and Maintain an Arc
		WLD-100	GMAW II – Fillet Weld, All Positions
		WLD-215	GMAW III – Groove Weld, All Positions
		WLD-220	GMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-310	GMAW V – Pipe and Tubing, All Positions
		WLD-330	GMAW VI – Aluminum Alloys
		WLD-335	GMAW VII – Stainless Steel Alloys
		WDF-055	FCAW I – Set up and Deposit a Weld
		WLD-105	FCAW II – Fillet and Groove Weld Plate, All Positions
		WLD-315	FCAW III – Pipe and Tubing, All Positions
		WDF-060	MCAW I – Set up and Deposit a Weld
WLD-110	MCAW II – Fillet and Groove Weld, All Positions		
14.02	Sets up FCAW, MCAW and GMAW equipment.	WDF-050	GMAW I – Set up and Maintain an Arc
		WLD-100	GMAW II – Fillet Weld, All Positions

NOA Sub-task		IPG Unit	
		WLD-215	GMAW III – Groove Weld, All Positions
		WLD-220	GMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-310	GMAW V – Pipe and Tubing, All Positions
		WLD-330	GMAW VI – Aluminum Alloys
		WLD-335	GMAW VII – Stainless Steel Alloys
		WDF-055	FCAW I – Set up and Deposit a Weld
		WLD-105	FCAW II – Fillet and Groove Weld Plate, All Positions
		WLD-315	FCAW III – Pipe and Tubing, All Positions
		WDF-060	MCAW I – Set up and Deposit a Weld
		WLD-110	MCAW II – Fillet and Groove Weld, All Positions
		14.03	Sets operating parameters for FCAW, MCAW and GMAW.
		WLD-100	GMAW II – Fillet Weld, All Positions
		WLD-215	GMAW III – Groove Weld, All Positions
		WLD-220	GMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-310	GMAW V – Pipe and Tubing, All Positions
		WLD-330	GMAW VI – Aluminum Alloys
		WLD-335	GMAW VII – Stainless Steel Alloys
		WDF-055	FCAW I – Set up and Deposit a Weld
		WLD-105	FCAW II – Fillet and Groove Weld Plate, All Positions
		WLD-315	FCAW III – Pipe and Tubing, All Positions
		WDF-060	MCAW I – Set up and Deposit a Weld

NOA Sub-task		IPG Unit	
		WLD-110	MCAW II – Fillet and Groove Weld, All Positions
14.04	Operates FCAW, MCAW and GMAW equipment.	WDF-050	GMAW I – Set up and Maintain an Arc
		WLD-100	GMAW II – Fillet Weld, All Positions
		WLD-215	GMAW III – Groove Weld, All Positions
		WLD-220	GMAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-310	GMAW V – Pipe and Tubing, All Positions
		WLD-330	GMAW VI – Aluminum Alloys
		WLD-335	GMAW VII – Stainless Steel Alloys
		WDF-055	FCAW I – Set up and Deposit a Weld
		WLD-105	FCAW II – Fillet and Groove Weld Plate, All Positions
		WLD-315	FCAW III – Pipe and Tubing, All Positions
		WDF-060	MCAW I – Set up and Deposit a Weld
		WLD-110	MCAW II – Fillet and Groove Weld, All Positions
<b>Task 15 - Welds using gas tungsten arc welding process (GTAW).</b>			
15.01	Selects GTAW gas, equipment and consumables.	WLD-225	GTAW I – Set up and Maintain an Arc
		WLD-230	GTAW II – Fillet Weld, All Positions
		WLD-235	GTAW III – Groove Weld, All Positions
		WLD-340	GTAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-320	GTAW V – Pipe and Tubing, All Positions
		WLD-345	GTAW VI – Ferrous and Non-Ferrous Alloys
15.02	Sets up GTAW equipment.	WLD-225	GTAW I – Set up and Maintain an Arc

NOA Sub-task		IPG Unit	
		WLD-230	GTAW II – Fillet Weld, All Positions
		WLD-235	GTAW III – Groove Weld, All Positions
		WLD-340	GTAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-320	GTAW V – Pipe and Tubing, All Positions
		WLD-345	GTAW VI – Ferrous and Non-Ferrous Alloys
15.03	Sets operating parameters for GTAW.	WLD-225	GTAW I – Set up and Maintain an Arc
		WLD-230	GTAW II – Fillet Weld, All Positions
		WLD-235	GTAW III – Groove Weld, All Positions
		WLD-340	GTAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-320	GTAW V – Pipe and Tubing, All Positions
		WLD-345	GTAW VI – Ferrous and Non-Ferrous Alloys
15.04	Operates GTAW equipment.	WLD-225	GTAW I – Set up and Maintain an Arc
		WLD-230	GTAW II – Fillet Weld, All Positions
		WLD-235	GTAW III – Groove Weld, All Positions
		WLD-340	GTAW IV – Fillet and Groove Weld, Medium Carbon Steel
		WLD-320	GTAW V – Pipe and Tubing, All Positions
		WLD-345	GTAW VI – Ferrous and Non-Ferrous Alloys
<b>Task 16 - Welds using submerged arc welding process (SAW).</b>			
16.01	Selects SAW equipment and consumables.	WLD-350	Submerged Arc Welding
16.02	Sets up SAW equipment.	WLD-350	Submerged Arc Welding
16.03	Sets operating parameters for SAW.	WLD-350	Submerged Arc Welding
16.04	Operates SAW equipment.	WLD-350	Submerged Arc Welding

NOA Sub-task		IPG Unit	
<b>Task 17 - Welds using other processes.</b>			
17.01	Uses stud welding process (SW).	WLD-360	Stud Welding
		WLD-355	Resistance Welding
17.02	Uses resistance welding (RW) processes (Spot (RSW) and Seam (RSEW)).	WLD-360	Stud Welding
		WLD-355	Resistance Welding
17.03	Operates automated welding equipment.	WLD-360	Stud Welding
		WLD-355	Resistance Welding



# **LEVEL 1**

## **WDF-005            Safety**

### **Learning Outcomes:**

- Demonstrate knowledge of safety equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to safety.

### **Objectives and Content:**

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications and limitations.
  - i) respiratory protection
  - ii) hearing protection
  - iii) eye protection
  - iv) fall protection
  - v) head protection
  - vi) foot protection
  - vii) hand protection
2. Describe the procedures used to care for and maintain PPE.
3. Identify hazards and describe safe work practices.
  - i) personal
  - ii) workplace
    - job hazard assessment procedures
    - lockout/tag out
    - confined space awareness
    - trenches and excavations
    - explosion and fire (hot work)
    - heights (fall protection and fall arrest)
    - ventilation/fumes
  - iii) environmental contamination (awareness of)
4. Identify and describe workplace safety and health regulations.
  - i) federal
    - Workplace Hazardous Material Information System (WHMIS)

- ii) provincial/territorial
  - occupational health and safety
- iii) municipal
- iv) work site specific (awareness of)

## **WDF-010            Tools and Equipment**

### **Learning Outcomes:**

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.

### **Objectives and Content:**

1. Interpret regulations pertaining to tools and equipment.
2. Identify types of hand tools and describe their applications and procedures for use.
3. Describe the procedures used to inspect, maintain and store hand tools.
4. Identify types of power tools and describe their applications and procedures for use.
  - i) electric
  - ii) hydraulic
  - iii) pneumatic
5. Identify power tool attachments and consumables and describe their applications and procedures for use.
6. Describe the procedures used to inspect, maintain and store power tools.
7. Identify types of layout and measuring tools and equipment and describe their applications and procedures for use.
8. Describe the procedures used to inspect, maintain and store layout and measuring tools and equipment.

## **WDF-015            Stationary Machinery**

### **Learning Outcomes:**

- Demonstrate knowledge of stationary machinery, their applications, maintenance and procedures for use.

### **Objectives and Content:**

1. Define terminology associated with stationary machinery.
2. Identify hazards and describe safe work practices pertaining to stationary machinery.
3. Identify types of stationary machinery and describe their characteristics and applications.
  - i) presses
  - ii) drill presses
  - iii) stationary grinders
  - iv) shears
  - v) saws
  - vi) press brakes
  - vii) ironworkers
4. Describe the procedures used to set up and operate stationary machinery.
5. Describe the procedures used to inspect and maintain stationary machinery.

**Learning Outcomes:**

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.
- Demonstrate knowledge of calculations required prior to hoisting and lifting operations.

**Objectives and Content:**

1. Define terminology associated with hoisting, lifting and rigging.
2. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging.
3. Identify regulations pertaining to hoisting, lifting and rigging.
4. Identify types of rigging equipment and accessories and describe their limitations, applications and procedures for use.
5. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.
  - i) jacks
  - ii) hoists
  - iii) cranes
    - overhead travelling cranes (OTC)
    - gantry
6. Describe the procedures used to inspect, maintain and store hoisting, lifting and rigging equipment.
7. Describe the procedures used to rig material/equipment for lifting.
8. Describe the procedures to attach and use tag lines.

9. Describe the procedures used to ensure the work area is safe for lifting.
  - i) supervision of lift
  - ii) securing work area
  - iii) communication
  
10. Identify and describe the procedures used to communicate during hoisting, lifting and rigging operations.
  - i) hand signals
  - ii) electronic communications
  - iii) audible and visual warnings
  
11. Identify the factors to consider when selecting rigging equipment.
  - i) load characteristics
  - ii) sling angle
  - iii) environment
    - chemical hazards
    - grounding requirements
    - weather conditions
  - iv) working load limit
  
12. Describe the procedures used to perform a lift.
  - i) pre-lift checks
  - ii) lifting load
  - iii) placement of load
  - iv) post-lift inspection

## **WDF-025          Access Equipment**

### **Learning Outcomes:**

- Demonstrate knowledge of access equipment, their applications, limitations and procedures for use.

### **Objectives and Content:**

1. Define terminology associated with access equipment.
2. Identify hazards and describe safe work practices pertaining to access equipment.
3. Identify regulations pertaining to access equipment.
4. Identify types of access equipment and describe their characteristics and applications.
  - i) scaffolding
  - ii) ladders
  - iii) man lifts
  - iv) elevated work platforms
5. Identify types of fall protection and fall arrest equipment and describe their applications and procedures for use.
6. Describe the procedures used to erect and dismantle access equipment.
7. Describe the procedures used to inspect and maintain access equipment.



**Learning Outcomes:**

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.

**Objectives and Content:**

1. Describe effective verbal and non-verbal communication.
2. Identify types of communication devices and describe their applications.
3. Identify types of trade related documentation and describe their applications and procedures for use.
  - i) manufacturers' specifications
  - ii) safety/hazard assessment forms
  - iii) mill certificates
  - iv) heat numbers
  - v) customer specifications
  - vi) codes and standards
  - vii) manuals/catalogues
  - viii) work orders
  - ix) requisitions/purchase orders
  - x) permits
  - xi) procedure sheets

**Learning Outcomes:**

- Demonstrate knowledge of welding processes and their applications.
- Demonstrate knowledge of welding equipment and accessories.

**Objectives and Content:**

1. Define terminology associated with welding.
2. Interpret information pertaining to welding found on drawings.
  - i) symbols
  - ii) abbreviations
3. Identify hazards and describe safe work practices pertaining to welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
4. Identify codes and standards pertaining to welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
5. Identify welding processes and describe their characteristics and applications.
  - i) shielded metal arc welding (SMAW)
  - ii) gas metal arc welding (GMAW)
  - iii) metal core arc welding (MCAW)
  - iv) flux core arc welding (FCAW)
  - v) gas tungsten arc welding (GTAW)
  - vi) stud welding
  - vii) resistance welding (RW)
  - viii) submerged arc welding (SAW)

6. Identify types of power sources for welding equipment and describe their applications and limitations.
  - i) AC transformer
  - ii) AC/DC rectifier
  - iii) DC generator
  - iv) engine driven
    - alternators
    - generators
  - v) inverters
  
7. Identify the types of beads and describe their characteristics and applications.
  - i) stringer
  - ii) weave
  
8. Identify types of welds and describe their characteristics and applications.
  - i) fillet
  - ii) groove
  - iii) surfacing
  - iv) plug or slot
  
9. Identify welding positions and describe their applications.
  - i) flat (1F or 1G)
  - ii) horizontal (2F or 2 G)
  - iii) vertical (3F or 3G)
  - iv) overhead (4F or 4G)
  - v) pipe fixed – horizontal (5F or 5G)
  - vi) pipe fixed – 45 degree plane (6F or 6G)
  
10. Identify welding test positions and describe their characteristics and restrictions.

## **WDF-040            Shielded Metal Arc Welding I – Set up, Strike and Maintain an Arc**

### **Learning Outcomes:**

- Demonstrate knowledge of shielded metal arc welding (SMAW) welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain SMAW welding equipment.
- Demonstrate knowledge of the procedures used to deposit a weld bead using SMAW welding equipment.

### **Objectives and Content:**

1. Define terminology associated with SMAW welding.
2. Identify hazards and describe safe work practices pertaining to SMAW welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage/handling
3. Identify codes and standards pertaining to SMAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Identify SMAW welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to set up and adjust SMAW welding equipment.
6. Describe the procedures used to strike and maintain an arc using SMAW welding equipment.

7. Describe the procedures and techniques used to deposit a weld bead using SMAW welding equipment.
  - i) arc length
  - ii) travel speed
  - iii) work and travel angles
  
8. Describe the procedures used to inspect and maintain SMAW welding equipment.
  
9. Strike and maintain an arc.

## **WDF-045            Shielded Metal Arc Welding II – Fillet Weld, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for shielded metal arc welding (SMAW) fillet welds.
- Demonstrate knowledge of the procedures used to perform fillet welds on low carbon steel in all positions using the SMAW process.

### **Objectives and Content:**

1. Define terminology associated with SMAW fillet welds.
2. Interpret information pertaining to SMAW fillet welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing SMAW fillet welds in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) power source
  - iv) welding position
  - v) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for SMAW fillet welds on low carbon steel.
5. Describe the procedures used to prepare base metals and joints for SMAW fillet welds.
6. Describe the procedures used to perform fillet welds on low carbon steel in all positions using the SMAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform fillet welds on low carbon steel in all positions.

**Learning Outcomes:**

- Demonstrate knowledge of gas metal arc welding (GMAW) welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain GMAW welding equipment.
- Demonstrate knowledge of the procedures used to deposit a weld bead using GMAW welding equipment.

**Objectives and Content:**

1. Define terminology associated with GMAW welding.
2. Identify hazards and describe safe work practices pertaining to GMAW welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
3. Identify codes and standards pertaining to GMAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Identify GMAW welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to assemble and disassemble GMAW welding equipment.
6. Describe the procedures used to establish and maintain an arc using GMAW welding equipment.

7. Identify the modes of transfer relating to GMAW welding and describe their characteristics and applications.
  - i) short circuiting
  - ii) globular
  - iii) spray
  - iv) pulse
  
8. Describe the procedures and techniques used to deposit a weld bead using GMAW welding equipment.
  - i) electrode extension
  - ii) travel speed
  - iii) work and travel angles
  - iv) flow rates
  
9. Describe the procedures used to inspect, maintain and troubleshoot GMAW welding equipment.
  
10. Establish and maintain an arc.



**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for gas metal arc welding (GMAW) fillet welds.
- Demonstrate knowledge of the procedures used to perform fillet welds on low carbon steel plate in all positions using the GMAW process.

**Objectives and Content:**

1. Define terminology associated with GMAW fillet welds.
2. Interpret information pertaining to GMAW fillet welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW fillet welds on low carbon steel in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GMAW fillet welds on low carbon steel plate.
5. Describe the procedures used to prepare base metals and joints for GMAW fillet welds.
6. Describe the procedures used to perform fillet welds on low carbon steel plate in all positions using the GMAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform fillet welds on low carbon steel plate in all positions.

**Learning Outcomes:**

- Demonstrate knowledge of flux core arc welding (FCAW) welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain FCAW welding equipment.
- Demonstrate knowledge of the procedures used to deposit a weld bead using FCAW welding equipment.

**Objectives and Content:**

1. Define terminology associated with FCAW welding.
2. Identify hazards and describe safe work practices pertaining to FCAW welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
3. Identify codes and standards pertaining to FCAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Identify FCAW welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to assemble and disassemble FCAW welding equipment.
6. Describe the procedures and techniques used to deposit a weld bead using FCAW welding equipment.
  - i) electrode extension
  - ii) travel speed

- iii) work and travel angles
  - iv) flow rates
7. Describe the procedures used to inspect, maintain and troubleshoot FCAW welding equipment.
  8. Establish and maintain an arc.

## **WLD-105            Flux Core Arc Welding II – Fillet and Groove Weld Plate, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare plate for flux core arc welding (FCAW).
- Demonstrate knowledge of the procedures used to perform welds on plate in all positions using the FCAW process.

### **Objectives and Content:**

1. Define terminology associated with FCAW fillet and groove welds.
2. Interpret information pertaining to FCAW fillet and groove welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing FCAW fillet and groove welds on plate.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for FCAW welding of plate.
5. Describe the procedures used to prepare plate for FCAW fillet and groove welds.
6. Describe the procedures used to perform fillet and groove welds on plate using the FCAW process.
  - i) temperature measuring devices
  - ii) pre-heating
  - iii) interpass temperature

- iv) post-heating
  - v) stress relieving
7. Describe the procedures used to prevent and correct weld faults.
  8. Perform welds on plate.

**Learning Outcomes:**

- Demonstrate knowledge of metal core arc welding (MCAW) welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain MCAW welding equipment.
- Demonstrate knowledge of the procedures used to deposit a weld bead using MCAW welding equipment.

**Objectives and Content:**

1. Define terminology associated with MCAW welding.
2. Identify hazards and describe safe work practices pertaining to MCAW welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
3. Identify codes and standards pertaining to MCAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Identify MCAW welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to assemble and disassemble MCAW welding equipment.
6. Describe the procedures and techniques used to deposit a weld bead using MCAW welding equipment.
  - i) electrode extension
  - ii) travel speed

- iii) work and travel angles
  - iv) flow rates
7. Describe the procedures used to inspect, maintain and troubleshoot MCAW welding equipment.
  8. Establish and maintain an arc.

## **WLD-110            Metal Core Arc Welding II – Fillet and Groove Weld, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals for metal core arc welding (MCAW).
- Demonstrate knowledge of the procedures used to perform welds using the MCAW process.

### **Objectives and Content:**

1. Define terminology associated with MCAW fillet and groove welds.
2. Interpret information pertaining to MCAW fillet and groove welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing MCAW fillet and groove welds.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify requirements and describe the procedures to store consumables used for MCAW welding.
5. Describe the procedures used to prepare base metals and joints for MCAW fillet and groove welds.
6. Describe the procedures used to perform fillet and groove welds using the MCAW process.
7. Describe the procedures used to prevent and correct weld faults.



## WLD-115      Oxy-fuel

### Learning Outcomes:

- Demonstrate knowledge of oxy-fuel equipment and accessories.
- Demonstrate knowledge of the procedures used to cut with oxy-fuel equipment.
- Demonstrate knowledge of the procedures used to gouge with oxy-fuel equipment.
- Demonstrate knowledge of the procedures used to weld with oxy-fuel equipment.
- Demonstrate knowledge of the procedures used to braze with oxy-fuel equipment.

### Objectives and Content:

1. Define terminology associated with oxy-fuel cutting, gouging and welding.
2. Identify hazards and describe safe work practices pertaining to oxy-fuel cutting, gouging and welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
3. Identify and interpret codes and regulations pertaining to oxy-fuel cutting, gouging and welding equipment and operations.
4. Identify oxy-fuel equipment and accessories and describe their applications and limitations.
  - i) cutting
  - ii) gouging
  - iii) welding
  - iv) brazing/braze-welding
  - v) heating

5. Identify types of flames and describe their application and the procedures for flame adjustment.
  - i) oxidizing
  - ii) carburizing
  - iii) neutral
6. Describe the procedures used to set up, adjust and shut down oxy-fuel equipment.
  - i) manufacturers' recommendations
7. Describe the procedures used to inspect and maintain oxy-fuel equipment.
8. Describe the procedures used to cut materials using oxy-fuel equipment.
  - i) free hand
  - ii) guided
    - straight edge
    - pattern
  - iii) automated/semi-automated
9. Identify common cutting faults and describe the procedures to prevent and correct them.
10. Describe the procedures used to gouge using oxy-fuel equipment.
11. Describe the procedures used to weld using oxy-fuel equipment.
12. Describe the procedures used to braze/braze-weld using oxy-fuel equipment.
13. Set up, operate and shut down oxy-fuel equipment.

## **LEVEL 2**

**Learning Outcomes:**

- Demonstrate knowledge of quality control measures used to verify compliance with design and code specifications.
- Demonstrate knowledge of inspection and testing methods and their applications.

**Objectives and Content:**

1. Define terminology associated with quality control.
2. Interpret codes and standards pertaining to quality control.
3. Interpret information pertaining to quality control found on drawings and specifications.
4. Identify tools and equipment relating to quality control and describe their applications and procedures for use.
5. Explain quality control, its purpose and applications.
6. Explain the methods used to identify and verify materials.
  - i) codes, standards and specifications
  - ii) mill certificates
  - iii) colour coding of materials
7. Identify methods of inspection and testing and describe their characteristics, limitations and applications.
  - i) destructive
  - ii) non-destructive
8. Describe the procedures used to verify compliance with design and code specifications.
  - i) perform visual inspections
  - ii) verify measurements
  - iii) perform post welding checks

- iv) mark materials and parts
  - v) verify layout
9. Describe the procedures used to document quality control measures.

## **WDF-065          Weld Faults**

### **Learning Outcomes:**

- Demonstrate knowledge of weld faults, their characteristics and effect on welds.

### **Objectives and Content:**

1. Define terminology associated with weld faults.
2. Interpret standards and documentation relating to welds and weld faults.
3. Identify tools and equipment used to identify weld faults and describe their applications and procedures for use.
4. Identify the classifications of weld faults and describe their characteristics.
  - i) dimensional defects
  - ii) structural discontinuities
  - iii) defective properties (weld metal and base metal)
5. Identify the causes of weld faults and describe their effect on welds.

## **WLD-205            Shielded Metal Arc Welding III – Groove Weld Plate, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for shielded metal arc welding (SMAW) groove welds.
- Demonstrate knowledge of the procedures used to perform groove welds on low carbon steel plate in all positions using the SMAW process.

### **Objectives and Content:**

1. Define terminology associated with SMAW groove welds.
2. Interpret information pertaining to SMAW groove welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing SMAW groove welds on low carbon steel plate.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) power source
  - iv) welding position
  - v) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for SMAW groove welds on low carbon steel plate.
5. Describe the procedures used to prepare base metals and joints for SMAW groove welds.
6. Describe the procedures used to perform groove welds on low carbon steel plate in all positions using SMAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform groove welds on low carbon steel plate in all positions.

## WLD-210

## Shielded Metal Arc Welding IV – Fillet and Groove Weld, Medium Carbon Steel

### Learning Outcomes:

- Demonstrate knowledge of the procedures used to prepare medium carbon steel plate and joints for shielded metal arc welding (SMAW) fillet and groove welds.
- Demonstrate knowledge of the procedures used to perform fillet and groove welds on medium carbon steel plate in all positions using the SMAW process.

### Objectives and Content:

1. Define terminology associated with SMAW fillet and groove welds on medium carbon steel plate.
2. Interpret information pertaining to SMAW fillet and groove welds on medium carbon steel plate found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing SMAW fillet and groove welds on medium carbon steel plate.
  - i) specification requirements
  - ii) base metals
    - composition
    - thickness
  - iii) power source
  - iv) welding position
  - v) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for SMAW fillet and groove welds on medium carbon steel plate.
5. Describe the procedures used to prepare medium carbon steel plate and joints for SMAW fillet and groove welds.
6. Describe the procedures used to perform fillet and groove welds on medium carbon steel plate using SMAW process.
  - i) temperature measuring devices
  - ii) pre-heating



- iii) interpass temperature
- iv) post-heating
- v) stress relieving

7. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for gas metal arc welding (GMAW) groove welds.
- Demonstrate knowledge of the procedures used to perform groove welds on low carbon steel plate in all positions using the GMAW process.

**Objectives and Content:**

1. Define terminology associated with GMAW groove welds.
2. Interpret information pertaining to GMAW groove welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW groove welds on low carbon steel plate in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GMAW groove welds on low carbon steel plate.
5. Describe the procedures used to prepare base metal and joints for GMAW groove welds.
6. Describe the procedures used to perform groove welds on low carbon steel plate in all positions using GMAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform groove welds on low carbon steel plate in all positions.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare medium carbon steel base metals and joints for gas metal arc welding (GMAW) fillet and groove welds.
- Demonstrate knowledge of the procedures used to perform fillet and groove welds on medium carbon steel in all positions using the GMAW process.

**Objectives and Content:**

1. Define terminology associated with GMAW fillet and groove welds on medium carbon steel.
2. Interpret information pertaining to GMAW fillet and groove welds on medium carbon steel found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW fillet and groove welds on medium carbon steel.
  - i) specification requirements
    - base metals
      - composition
      - thickness
  - ii) shielding gas selection
  - iii) power source
  - iv) welding position
  - v) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GMAW fillet and groove welds on medium carbon steel.
5. Describe the procedures used to prepare medium carbon steel base metals and joints for GMAW fillet and groove welds.

6. Describe the procedures used to perform GMAW fillet and groove welds on medium carbon steel.
  - i) temperature measuring devices
  - ii) pre-heating
  - iii) interpass temperature
  - iv) post-heating
  - v) stress relieving
  
7. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of gas tungsten arc welding (GTAW) equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain GTAW welding equipment.
- Demonstrate knowledge of the procedures used to deposit a weld bead using GTAW equipment.

**Objectives and Content:**

1. Define terminology associated with GTAW welding.
2. Identify hazards and describe safe work practices pertaining to GTAW welding.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
3. Identify codes and standards pertaining to GTAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Identify GTAW welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to assemble and disassemble GTAW welding equipment.
6. Describe the procedures used to establish and maintain an arc using GTAW welding equipment.

7. Describe the procedures and techniques used to deposit a weld bead using GTAW welding equipment.
  - i) with filler metal
  - ii) without filler metal
8. Describe the procedures used to inspect, maintain and troubleshoot GTAW welding equipment.
9. Establish and maintain an arc.

**WLD-230**

## **Gas Tungsten Arc Welding II – Fillet Weld, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for gas tungsten arc welding (GTAW) fillet welds.
- Demonstrate knowledge of the procedures used to perform fillet welds on low carbon steel sheet and plate in all positions using the GTAW process.

### **Objectives and Content:**

1. Define terminology associated with GTAW fillet welds.
2. Interpret information pertaining to GTAW fillet welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GTAW fillet welds in all positions.
  - i) specification requirements
  - ii) base metals
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GTAW fillet welds on low carbon steel sheet and plate.
5. Describe the procedures used to prepare base metals and joints for GTAW fillet welds.
6. Describe the procedures used to perform fillet welds on low carbon steel sheet and plate in all positions using the GTAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform fillet welds on low carbon steel sheet and plate.

## **WLD-235            Gas Tungsten Arc Welding III – Groove Weld, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals and joints for gas tungsten arc welding (GTAW) groove welds.
- Demonstrate knowledge of the procedures used to perform groove welds on low carbon steel sheet and plate in all positions using the GTAW process.

### **Objectives and Content:**

1. Define terminology associated with GTAW groove welds.
2. Interpret information pertaining to GTAW groove welds found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GTAW groove welds in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GTAW groove welds on low carbon steel sheet and plate.
5. Describe the procedures used to prepare base metals and joints for GTAW groove welds.
6. Describe the procedures used to perform groove welds on low carbon steel sheet and plate in all positions using GTAW process.
7. Describe the procedures used to prevent and correct weld faults.



**Learning Outcomes:**

- Demonstrate knowledge of electric arc cutting equipment and accessories.
- Demonstrate knowledge of the procedures used to cut with electric arc cutting equipment.
- Demonstrate knowledge of the procedures used to gouge with electric arc gouging equipment.

**Objectives and Content:**

1. Define terminology associated with electric arc cutting and gouging.
2. Identify hazards and describe safe work practices pertaining to electric arc cutting and gouging.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
  - vi) storage, handling and transportation
  - vii) noise
3. Describe the electric arc cutting and gouging processes and their applications.
  - i) air-carbon arc
  - ii) metal arc
  - iii) oxy-arc
4. Identify electric arc cutting and gouging equipment and accessories and describe their applications.
5. Describe the procedures used to set up, adjust and shut down electric arc cutting and gouging equipment.
6. Describe the procedures used to inspect and maintain electric arc cutting and gouging equipment.
7. Describe the procedures used to cut using electric arc cutting equipment.

8. Describe the procedures used to gouge using electric arc gouging equipment.
9. Perform air-carbon arc gouging.

**Learning Outcomes:**

- Demonstrate knowledge of plasma arc equipment and accessories.
- Demonstrate knowledge of the procedures used to cut with plasma arc equipment.  
Demonstrate knowledge of the procedures used to gouge with plasma arc equipment.

**Objectives and Content:**

1. Define terminology associated with plasma arc cutting and gouging.
2. Identify hazards and describe safe work practices pertaining to plasma arc cutting and gouging.
  - i) personal
  - ii) shop/facility
  - iii) fire and explosion
  - iv) equipment
  - v) ventilation/fumes
3. Describe the plasma arc cutting and gouging process and its applications.
4. Identify plasma arc equipment and accessories and describe their applications.
  - i) cutting
  - ii) gouging
5. Describe the procedures used to set up, adjust and shut down plasma arc equipment.
6. Describe the procedures used to inspect and maintain plasma arc equipment.
7. Describe the procedures used to cut using plasma arc equipment.
8. Describe the procedures used to gouge using plasma arc equipment.
9. Perform plasma arc cutting and gouging operations.

## **WDF-070            Fabrication Fundamentals**

### **Learning Outcomes:**

- Demonstrate knowledge of structural components, their characteristics and applications.
- Demonstrate knowledge of joints, their applications and the procedures used to prepare them for welding operations.

### **Objectives and Content:**

1. Define terminology associated with structural components.
2. Identify hazards and describe safe work practices pertaining to structural components.
3. Interpret codes, regulations and standards pertaining to structural components.
  - i) industry standards
  - ii) codes of practice
  - iii) government regulations
4. Interpret information pertaining to structural components found on drawings and specifications.
5. Identify types of structures and describe their characteristics.
6. Identify structural steel shapes and describe their designations, characteristics and applications.
  - i) sheet
  - ii) plate
  - iii) pipe
  - iv) flat
  - v) bar
  - vi) angle
  - vii) channel
  - viii) beams
  - ix) hollow structural sections

7. Identify types of joints and describe their characteristics and applications.
  - i) corner
  - ii) tee
  - iii) lap
  - iv) edge
  - v) butt
8. Describe the procedures used to prepare joints on structural steel shapes.
9. Describe the procedures used to fabricate using various structural steel shapes.

## **WDF-075          Drawings**

### **Learning Outcomes:**

- Demonstrate knowledge of drawings and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings.

### **Objectives and Content:**

1. Define terminology associated with drawings and sketches.
2. Describe metric and imperial systems of measurement and the procedures used to perform conversions.
3. Identify the types of drawings and describe their applications.
  - i) architectural
  - ii) engineering
  - iii) erection
  - iv) assembly
  - v) shop (detail)
4. Identify drawing projections and views and describe their applications.
  - i) projections
    - orthographic (1<sup>st</sup> and 3<sup>rd</sup> angle)
    - oblique
    - isometric
  - ii) views
    - plan
    - section
    - detail
    - elevation
5. Describe the use of scales.
6. Interpret information on drawings.
  - i) welding symbols
  - ii) lines
  - iii) legend

- iv) other symbols and abbreviations
  - v) notes and specifications
  - vi) schedules
  - vii) scales
7. Describe basic sketching techniques.
8. Describe dimensioning systems, their purpose and applications.
- i) datum/baseline
  - ii) elevation
  - iii) conventional
  - iv) running
  - v) aligned
  - vi) unidirectional
  - vii) group
9. Describe the procedures used for the care, handling and storage of drawings.
10. Interpret basic shop drawings.

## **WDF-080            Work Planning**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to plan and organize work tasks.

### **Objectives and Content:**

1.        Identify sources of information relevant to work task planning.
  - i)        supervisor
  - ii)       documentation
  - iii)       drawings
  - iv)       related professionals
  - v)        suppliers
  - vi)       clients
  
2.        Identify the considerations when planning work tasks.
  - i)        scheduling
  - ii)       sequence
  - iii)       material selection and handling
  - iv)       equipment selection
  
3.        Describe the procedures used to organize, move and store tools, equipment, materials and supplies.



# **LEVEL 3**

**Learning Outcomes:**

- Demonstrate knowledge of pattern and template development and its purpose.
- Demonstrate knowledge of the procedures used to develop simple templates.

**Objectives and Content:**

1. Define terminology associated with layout and pattern development.
2. Identify tools and equipment relating to layout and pattern development and describe their applications and procedures for use.
3. Explain the purpose of pattern and template development.
4. Identify materials used in pattern and template development and describe their characteristics and applications.
5. Identify the geometric operations used in performing layout and describe their applications.
6. Develop simple templates.

## **WLD-300            Jigs and Fixtures**

### **Learning Outcomes:**

- Demonstrate knowledge of basic jigs and fixtures and their applications.

### **Objectives and Content:**

1.        Define terminology associated with jigs and fixtures.
2.        Identify hazards and describe safe work practices pertaining to jigs and fixtures.
3.        Interpret information found on drawings to fabricate basic jigs and fixtures.
4.        Explain the purpose, applications and limitations of basic jigs and fixtures.
5.        Identify types of basic jigs and fixtures and describe their characteristics and applications.
6.        Describe the procedures used to fabricate basic jigs and fixtures.

## **WDF-090 Metallurgy**

### **Learning Outcomes:**

- Demonstrate knowledge of metals and their characteristics.
- Demonstrate knowledge of metallurgical principles.
- Demonstrate knowledge of material testing procedures.

### **Objectives and Content:**

1. Define terminology associated with metallurgy.
2. Describe the properties of metals.
  - i) mechanical
  - ii) physical
3. Identify types of metals and describe their characteristics and applications.
  - i) plain carbon steel
  - ii) low alloy steel
  - iii) heat treated steel
  - iv) stainless steel
  - v) duplex stainless steel
  - vi) non-ferrous
4. Describe classification numbering systems for metals.
  - i) Society of Automotive Engineers (SAE)
  - ii) American Iron and Steel Institute (ANSI)
  - iii) American Society of Testing and Materials (ASTM)
  - iv) Canadian Standards Association (CSA)
5. Describe the processes used in the heat treatment of metals.
  - i) stress relieving
  - ii) quenching
  - iii) hardening
  - iv) tempering
  - v) annealing
  - vi) normalizing
6. Identify the methods and processes used in the manufacture of steel and alloys.

7. Describe forging and casting processes.
8. Describe the effects of hot and cold working of metals.
  - i) stress
  - ii) contraction
  - iii) expansion
  - iv) distortion
  - v) work hardening
9. Describe the procedures used to prevent or correct problems that occur when working with metals.
10. Identify the causes of corrosion and describe the methods used to prevent or correct them.
  - i) oxidation
  - ii) galvanic corrosion
  - iii) chemical corrosion
11. Identify common metal testing techniques and describe their associated procedures.
  - i) Rockwell hardness
  - ii) Brinell hardness
  - iii) tensile
  - iv) Charpy impact
  - v) Izod impact

## **WLD-305            Shielded Metal Arc Welding V – Pipe and Tubing, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare pipe and tubing for shielded metal arc welding (SMAW) welds.
- Demonstrate knowledge of the procedures used to weld pipe and tubing in all positions using the SMAW process.

### **Objectives and Content:**

1. Define terminology associated with SMAW welds on pipe and tubing.
2. Interpret information pertaining to SMAW welds on pipe and tubing found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing SMAW welds on pipe and tubing in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) power source
  - iv) welding position
  - v) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for SMAW welds on pipe and tubing.
5. Describe the procedures used to prepare pipe and tubing base metals and joints for SMAW welds.
6. Describe the procedures used to perform welds on pipe and tubing in all positions using SMAW process.
7. Describe the procedures used to prevent and correct weld faults.
8. Perform SMAW welds on pipe and tubing in all positions.

## **WLD-310            Gas Metal Arc Welding V – Pipe and Tubing, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare pipe and tubing for gas metal arc welding (GMAW) welds.
- Demonstrate knowledge of the procedures used to weld pipe and tubing in all positions using the GMAW process.

### **Objectives and Content:**

1. Define terminology associated with GMAW welds on pipe and tubing.
2. Interpret information pertaining to GMAW welds on pipe and tubing found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW welds on pipe and tubing in all positions.
  - i) specification requirements
  - ii) base metals
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GMAW welds on pipe and tubing.
5. Describe the procedures used to prepare pipe and tubing base metals and joints for GMAW welds.
6. Describe the procedures used to perform welds on pipe and tubing in all positions using GMAW process.
7. Describe the procedures used to prevent and correct weld faults.

## **WLD-315            Flux Core Arc Welding III – Pipe and Tubing, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare pipe and tubing for flux core arc welding (FCAW) welds.
- Demonstrate knowledge of the procedures used to weld pipe and tubing in all positions using the FCAW process.

### **Objectives and Content:**

1. Define terminology associated with FCAW welds on pipe and tubing.
2. Interpret information pertaining to FCAW welds on pipe and tubing found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing FCAW welds on pipe and tubing in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for FCAW welds on pipe and tubing.
5. Describe the procedures used to prepare pipe and tubing base metals and joints for FCAW welds.
6. Describe the procedures used to perform welds on pipe and tubing in all positions using the FCAW process.
7. Describe the procedures used to prevent and correct weld faults.



## **WLD-320            Gas Tungsten Arc Welding V – Pipe and Tubing, All Positions**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare pipe and tubing for gas tungsten arc welding (GTAW) welds.
- Demonstrate knowledge of the procedures used to perform welds on pipe and tubing in all positions using the GTAW process.

### **Objectives and Content:**

1. Define terminology associated with GTAW welds on pipe and tubing.
2. Interpret information pertaining to GTAW welds on pipe and tubing found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GTAW welds on pipe and tubing.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) insert selection
  - v) power source
  - vi) welding position
  - vii) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GTAW welds on pipe and tubing.
5. Describe the procedures used to prepare pipe and tubing base metals and joints for GTAW welds.
6. Describe the procedures used to perform welds on pipe and tubing in all positions using GTAW process.
7. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare alloy steel base metals and joints for shielded metal arc welding (SMAW).
- Demonstrate knowledge of the procedures used to weld alloy steels in all positions using the SMAW process.

**Objectives and Content:**

1. Define terminology associated with SMAW welds on alloy steels.
2. Interpret information pertaining to SMAW welds on alloy steels found on drawings and specifications.
3. Identify types of alloy steels and describe their characteristics and applications.
4. Identify the considerations when selecting consumables and determining equipment set-up for performing SMAW welds on alloy steels in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - carbon equivalents
    - thickness
  - iii) power source
  - iv) welding position
  - v) joint type and design
5. Identify the requirements and describe the procedures to store consumables used for SMAW welds on alloy steels.
6. Describe the procedures used to prepare alloy steel base metals and joints for SMAW welds.
7. Describe the procedures used to perform welds on alloy steels in all positions using the SMAW process.
8. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare aluminum alloy base metals and joints for gas metal arc welding (GMAW) welds.
- Demonstrate knowledge of the procedures used to weld aluminum alloys in all positions using the GMAW process.

**Objectives and Content:**

1. Define terminology associated with GMAW welds on aluminum alloys.
2. Interpret information pertaining to GMAW welds on aluminum alloys found on drawings and specifications.
3. Identify types of aluminum alloys and describe their characteristics and applications.
4. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW welds on aluminum alloys in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
    - push/pull
    - spool gun
  - v) welding position
  - vi) joint type and design
5. Identify the requirements and describe the procedures to store consumables used for GMAW welds on aluminum alloys.
6. Describe the procedures used to prepare aluminum base metals and joints for GMAW welds.

7. Describe the procedures used to perform welds on aluminum alloys in all positions using the GMAW process.
8. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare stainless steel alloys base metals and joints for gas metal arc welding (GMAW) welds.
- Demonstrate knowledge of the procedures used to weld stainless steel alloys in all positions using the GMAW process.

**Objectives and Content:**

1. Define terminology associated with GMAW welds on stainless steel alloys.
2. Interpret information pertaining to GMAW welds on stainless steel alloys found on drawings and specifications.
3. Identify types of stainless steel alloys and describe their characteristics and applications.
4. Identify the considerations when selecting consumables and determining equipment set-up for performing GMAW welds on stainless steel alloys in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
5. Identify the requirements and describe the procedures to store consumables used for GMAW welds on stainless steel alloys.
6. Describe the procedures used to prepare stainless steel base metals and joints for GMAW welds.
7. Describe the procedures used to perform welds on stainless steel alloys in all positions using the GMAW process.
8. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare medium and high carbon steel base metals and joints for gas tungsten arc welding (GTAW) fillet and groove welds.
- Demonstrate knowledge of the procedures used to perform fillet and groove welds on medium carbon steel in all positions using the GTAW process.

**Objectives and Content:**

1. Define terminology associated with GTAW welds on medium carbon steel.
2. Interpret information pertaining to GTAW welds on medium carbon steel found on drawings and specifications.
3. Identify the considerations when selecting consumables and determining equipment set-up for performing GTAW welds on medium carbon steel in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
  - iv) power source
  - v) welding position
  - vi) joint type and design
4. Identify the requirements and describe the procedures to store consumables used for GTAW welds on medium carbon steel.
5. Describe the procedures used to prepare medium carbon steel base metals and joints for GTAW welds.
6. Describe the procedures used to perform welds on medium carbon steel using GTAW process.
  - i) temperature measuring devices

- ii) pre-heating
- iii) interpass temperature
- iv) post-heating
- v) stress relieving

7. Describe the procedures used to prevent and correct weld faults.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare ferrous and non-ferrous alloys and joints for gas tungsten arc welding (GTAW) welds.
- Demonstrate knowledge of the procedures used to perform welds on ferrous and non ferrous alloys in all positions using the GTAW process.

**Objectives and Content:**

1. Define terminology associated with GTAW welds on ferrous and non ferrous alloys.
2. Interpret information pertaining to GTAW welds on ferrous and non ferrous alloys found on drawings and specifications.
3. Identify types of ferrous and non ferrous alloys and describe their characteristics and applications.
4. Identify the considerations when selecting consumables and determining equipment set-up for performing GTAW welds on ferrous and non ferrous alloys in all positions.
  - i) specification requirements
  - ii) base metal
    - composition
    - thickness
  - iii) shielding gas selection
    - trailing gas
  - iv) back purging
  - v) power source
  - vi) welding position
  - vii) joint type and design
5. Identify the requirements and describe the procedures to store consumables used for GTAW welds on ferrous and non ferrous alloys.



6. Describe the procedures used to prepare ferrous and non ferrous alloys and joints for GTAW welds.
7. Describe the procedures used to perform welds on ferrous and non ferrous alloys in all positions using the GTAW process.
8. Describe the procedures used to prevent and correct weld faults.

## **WLD-350            Submerged Arc Welding**

### **Learning Outcomes:**

- Demonstrate knowledge of the procedures used to prepare base metals for submerged arc welding (SAW).
- Demonstrate knowledge of the procedures used to weld using the SAW process.

### **Objectives and Content:**

1. Define terminology associated with SAW welding.
2. Identify hazards and describe safe work practices pertaining to SAW welding.
3. Identify codes and standards pertaining to SAW welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Interpret information pertaining to SAW welding found on drawings and specifications.
5. Identify SAW welding equipment, consumables and accessories and describe their applications.
6. Identify the considerations and describe the procedures to store consumables used for SAW welding equipment.
7. Describe the procedures used to set up and adjust SAW welding equipment.
8. Describe the procedures used to inspect and maintain SAW welding equipment.
9. Describe the procedures and techniques used to deposit a weld bead using SAW welding equipment.
  - i) arc starting methods
  - ii) electrode extension
  - iii) deposition rates
  - iv) travel speeds
  - v) penetration

10. Identify the considerations when selecting consumables and determining equipment set-up for SAW welding.
  - i) specification requirements
  - ii) base metal
    - properties
    - thickness
  - iii) flux types
  - iv) filler metal types
  - v) welding position
  - vi) joint type and design
11. Describe the procedures used to prepare base metals and joints for SAW welding.
12. Describe the procedures used to weld using the SAW process.
13. Describe the procedures used to prevent and correct weld faults.

## **WLD-355          Resistance Welding**

### **Learning Outcomes:**

- Demonstrate knowledge of resistance welding (RW) equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain RW welding equipment.

### **Objectives and Content:**

1. Define terminology associated with RW welding.
2. Identify hazards and describe safe work practices pertaining to RW welding.
3. Identify codes and standards pertaining to RW welding.
  - i) Canadian Standards Association (CSA)
4. Interpret information pertaining to RW welding found on drawings and specifications.
5. Identify RW welding processes and describe their applications.
  - i) spot
  - ii) seam
  - iii) projection
6. Identify RW welding equipment and accessories and describe their applications.
7. Identify the considerations when determining RW welding equipment set-up.
  - i) specification requirements
  - ii) base metal
    - properties
    - thickness
  - iii) electrode size
8. Describe the procedures used to set up and adjust RW welding equipment.
  - i) time
  - ii) amperage
  - iii) pressure

9. Describe the procedures used to inspect and maintain RW welding equipment.
10. Describe the procedures used to prepare base metals for RW welding.
11. Describe the procedures used to weld using the RW process.

## **WLD-360            Stud Welding**

### **Learning Outcomes:**

- Demonstrate knowledge of stud welding equipment, consumables and accessories.
- Demonstrate knowledge of the procedures used to set up, adjust, operate, inspect and maintain stud welding equipment.

### **Objectives and Content:**

1. Define terminology associated with stud welding.
2. Identify hazards and describe safe work practices pertaining to stud welding.
3. Identify codes and standards pertaining to stud welding.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Interpret information pertaining to stud welding found on drawings and specifications.
5. Identify stud welding equipment, consumables and accessories and describe their applications.
6. Identify the requirements and describe the procedures to store consumables used for stud welding.
7. Describe the procedures used to set up and adjust stud welding equipment.
  - i) time
  - ii) amperage
  - iii) lift
  - iv) plunge
8. Describe the procedures used to inspect and maintain stud welding equipment.

9. Identify the considerations when selecting stud welding consumables and determining equipment set-up.
  - i) specification requirements
  - ii) base metal
    - properties
    - thickness
  - iii) stud
    - type
    - size
10. Describe the procedures used to prepare base metals for stud welding.
11. Describe the procedures used to perform stud welding.
12. Describe the procedures used to prevent and correct weld faults.
13. Describe the procedures used to test welded studs.

**Learning Outcomes:**

- Demonstrate knowledge of the procedures used to build up metal parts.
- Demonstrate knowledge of the procedures used to surface base metals.

**Objectives and Content:**

1. Define terminology associated with build up and surfacing of metal parts.
2. Identify hazards and describe safe work practices pertaining to build up and surfacing metal parts.
3. Interpret codes and standards pertaining to build up and surfacing of metal parts.
  - i) Canadian Standards Association (CSA)
  - ii) American Society of Mechanical Engineers (ASME)
  - iii) American Welding Society (AWS)
4. Interpret information pertaining to build up and surfacing of metal parts found on drawings and specifications.
5. Identify tools and equipment relating to building up and surfacing of metal parts and describe their applications.
6. Explain the purpose and applications of building up and surfacing of metal parts.
7. Identify the processes used to build up and surface metal parts and describe the considerations used to select them.
  - i) shielded metal arc welding (SMAW)
  - ii) gas metal arc welding (GMAW)
  - iii) flux core arc welding (FCAW)
  - iv) metal core arc welding (MCAW)
  - v) gas tungsten arc welding (GTAW)
  - vi) submerged arc welding (SAW)
  - vii) oxyfuel gas welding (OFW)



8. Identify types of wear requiring hard surfacing.
  - i) abrasion
  - ii) impact
  - iii) corrosion
  - iv) erosion
  
9. Describe the procedures used to build up and surface metal parts using welding processes.
  - i) identify base metal
  - ii) identify effects of heating and cooling
  - iii) identify effects of dilution
  - iv) select process
  - v) select filler material
  - vi) determine sequence