

# **Interprovincial Program Guide**

## **Ironworker (Structural/Ornamental)**

**2010**

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The CCDA Executive Committee recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Ironworker (Structural/Ornamental).

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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 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>DIAGNOSE</b>	To analyze or identify a problem or malfunction.
<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>SERVICE</b>	<p>Routine inspection and replacement of worn or deteriorating parts.</p> <p>An act or business function provided to a customer in the course of one's profession. (e.g., haircut).</p>
<b>TECHNIQUE</b>	<p>Within a procedure, the manner in which technical skills are applied.</p>
<b>TEST</b>	<p>v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality.</p> <p>n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.</p>
<b>TROUBLESHOOT</b>	<p>To follow a systematic procedure to identify and locate a problem or malfunction and its cause.</p>

## **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>			
IRW-100 Safety Awareness	IRW-105 Tools and Equipment	IRW-110 Communication and Trade Documentation	IRW-115 Drawings
IRW-120 Work Planning	IRW-125 Oxy-Fuel Cutting	IRW-130 Introduction to Welding	IRW-135 Access Equipment
IRS-200 Welding II	IRW-160 Plasma Arc Cutting		
<b>RIGGING AND HOISTING</b>			
IRW-140 Hoisting, Lifting and Rigging			
<b>CRANES</b>			
IRW-145 Introduction to Cranes	IRS-205 Hydraulic and Conventional Cranes	IRS-210 Tower Cranes	IRS-300 Electric Overhead Travelling Cranes
<b>REINFORCING</b>			
IRW-155 Reinforcing I			
<b>ERECTION, ASSEMBLY AND INSTALLATION</b>			
IRW-150 Structural Components	IRS-215 Structural Steel Erection and Dismantling	IRS-305 Pre-Engineered Structures	IRS-310 Pre-Cast Concrete Erection and Dismantling
IRS-320 Miscellaneous Ironwork	IRS-325 Ornamental Ironwork	IRS-315 Machinery and Equipment	

## Recommended Level Structure

**IRW = Common Units to Ironworker (Generalist, Reinforcing and Structural/Ornamental) IPGs.**

**IRS = Common Units to Ironworker (Generalist and Structural/Ornamental) IPGs.**

Level 1			Level 2		
Unit Code	Title	Page	Unit Code	Title	Page
IRW-100	Safety Awareness	18	IRS-200	Welding II	38
IRW-105	Tools and Equipment	19	IRS-205	Hydraulic and Conventional Cranes	40
IRW-110	Communication and Trade Documentation	20	IRS-210	Tower Cranes	42
IRW-115	Drawings	21	IRS-215	Structural Steel Erection and Dismantling	43
IRW-120	Work Planning	22			
IRW-125	Oxy-fuel Cutting	23			
IRW-130	Introduction to Welding	25			
IRW-135	Access Equipment	27			
IRW-140	Hoisting, Lifting and Rigging	28			
IRW-145	Introduction to Cranes	30			
IRW-150	Structural Components	32			
IRW-155	Reinforcing I	34			
IRW-160	Plasma Arc Cutting	36			
Level 3					
Unit Code	Title	Page			
IRS-300	Electric Overhead Travelling Cranes	46			
IRS-305	Pre-Engineered Structures	47			
IRS-310	Pre-Cast Concrete Erection and Dismantling	48			
IRS-315	Machinery and Equipment	50			
IRS-320	Miscellaneous Ironwork	51			
IRS-325	Ornamental Ironwork	52			

## 2006 NOA Sub-task to IPG Unit Comparison

NOA Sub-task		IPG Unit	
<b>Task 1 - Interprets occupational documentation.</b>			
1.01	Interprets drawings and specifications.	IRW-115	Drawings
1.02	Interprets standards, regulations and procedures.	IRW-110	Communication and Trade Documentation
<b>Task 2 - Communicates in the workplace.</b>			
2.01	Communicates with co-workers.	IRW-110	Communication and Trade Documentation
2.02	Communicates with other disciplines.	IRW-110	Communication and Trade Documentation
2.03	Communicates with apprentices.	IRW-110	Communication and Trade Documentation
2.04	Uses hand signals.	IRW-110	Communication and Trade Documentation
		IRW-140	Hoisting, Lifting and Rigging
2.05	Communicates electronically.	IRW-110	Communication and Trade Documentation
		IRW-140	Hoisting, Lifting and Rigging
<b>Task 3 - Uses and maintains tools and equipment.</b>			
3.01	Uses hand tools.	IRW-105	Tools and Equipment
3.02	Uses power tools.	IRW-105	Tools and Equipment
3.03	Uses powder-actuated tools.	IRW-105	Tools and Equipment
3.04	Uses aerial work platforms.	IRW-135	Access Equipment
3.05	Uses ladders.	IRW-135	Access Equipment
3.06	Uses scaffolding.	IRW-135	Access Equipment
3.07	Uses personal protective equipment (PPE).	IRW-100	Safety Awareness
3.08	Uses surveying equipment.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork
3.09	Uses welding equipment.	IRW-105	Tools and Equipment
		IRW-130	Introduction to Welding
3.10	Uses thermal and oxy-fuel cutting equipment.	IRW-125	Oxy-fuel Cutting

NOA Sub-task		IPG Unit	
<b>Task 4 - Organizes work.</b>			
4.01	Organizes materials and supplies.	IRW-120	Work Planning
4.02	Marks layouts.	IRW-150	Structural Components
		IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork
4.03	Maintains safe work environment.	IRW-100	Safety Awareness
4.04	Assesses site hazards.	IRW-100	Safety Awareness
4.05	Plans work tasks.	IRW-120	Work Planning
<b>Task 5 - Selects rigging equipment.</b>			
5.01	Matches load to lift capability.	IRW-140	Hoisting, Lifting and Rigging
5.02	Inspects rigging equipment.	IRW-140	Hoisting, Lifting and Rigging
5.03	Maintains rigging equipment.	IRW-140	Hoisting, Lifting and Rigging
<b>Task 6 - Uses hoisting and lifting equipment.</b>			
6.01	Uses hoisting equipment.	IRW-140	Hoisting, Lifting and Rigging
6.02	Uses lifting equipment.	IRW-140	Hoisting, Lifting and Rigging
6.03	Attaches rigging to load.	IRW-140	Hoisting, Lifting and Rigging
<b>Task 7 - Assembles and erects cranes.</b>			
7.01	Assesses site hazards.	IRW-145	Introduction to Cranes
7.02	Determines crane position.	IRW-145	Introduction to Cranes
		IRS-205	Hydraulic and Conventional Cranes
		IRS-210	Tower Cranes
		IRS-300	Electric Overhead Travelling Cranes
7.03	Prepares bases.	IRW-145	Introduction to Cranes
		IRS-205	Hydraulic and Conventional Cranes
		IRS-210	Tower Cranes
7.04	Erects cranes.	IRW-145	Introduction to Cranes
		IRS-205	Hydraulic and Conventional Cranes
		IRS-210	Tower Cranes
		IRS-300	Electric Overhead Travelling Cranes

NOA Sub-task		IPG Unit	
<b>Task 8 - Disassembles cranes.</b>			
8.01	Disassembles crane components.	IRW-145	Introduction to Cranes
		IRS-205	Hydraulic and Conventional Cranes
		IRS-210	Tower Cranes
		IRS-300	Electric Overhead Travelling Cranes
8.02	Prepares crane for transport.	IRW-145	Introduction to Cranes
		IRS-205	Hydraulic and Conventional Cranes
		IRS-210	Tower Cranes
<b>Task 9 - Installs primary and secondary structural members.</b>			
9.01	Erects falsework.	IRW-150	Structural Components
9.02	Attaches structural members.	IRW-150	Structural Components
		IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
9.03	Levels, plumbs and aligns structural members.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
9.04	Completes installation of structural members.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
<b>Task 10 - Installs ornamental components and systems.</b>			
10.01	Installs curtain walls.	IRS-320	Miscellaneous Ironwork
10.02	Installs miscellaneous components.	IRS-325	Ornamental Ironwork
<b>Task 11 - Installs conveyors, machinery and equipment.</b>			
11.01	Installs material handling systems.	IRS-315	Machinery and Equipment
11.02	Aligns material handling systems.	IRS-315	Machinery and Equipment
11.03	Places machinery and equipment.	IRS-315	Machinery and Equipment
<b>Task 12 - Repairs components.</b>			
12.01	Assesses current condition of components.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures



NOA Sub-task		IPG Unit	
		IRS-310	Pre-Cast Concrete Erection and Dismantling
12.02	Field-fabricates components.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
12.03	Replaces components.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
12.04	Performs preventative maintenance.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork
<b>Task 13 - Dismantles and removes structural, mechanical and miscellaneous components.</b>			
13.01	Ensures decommissioning of structure or components.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork
13.02	Plans sequence of disassembly.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork
13.03	Removes components.	IRS-215	Structural Steel Erection and Dismantling
		IRS-305	Pre-Engineered Structures

NOA Sub-task		IPG Unit	
		IRS-310	Pre-Cast Concrete Erection and Dismantling
		IRS-315	Machinery and Equipment
		IRS-320	Miscellaneous Ironwork
		IRS-325	Ornamental Ironwork

# **LEVEL 1**

## IRW-100            Safety Awareness

### 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.
2. Describe the procedures used to care for and maintain PPE.
3. Identify hazards and describe safe work practices.
  - i) personal
  - ii) workplace
    - lockout / tag out
    - confined space awareness
    - trenches and excavations
    - fire
    - heights (fall arrest and protection)
    - marine
  - iii) environmental
4. Identify and describe workplace safety and health regulations.
  - i) federal
    - Workplace Hazardous Material Information System (WHMIS)
  - ii) provincial/territorial
    - occupational health and safety
    - training and certification requirements
  - iii) worksite specific requirements

## **IRW-105            Tools and Equipment**

### **Learning Outcomes:**

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

### **Objectives and Content:**

1. Identify types of hand tools and describe their applications and procedures for use.
2. Describe the procedures used to inspect, maintain and store hand tools.
3. Identify types of power tools and describe their applications and procedures for use.
  - i) electric
  - ii) hydraulic
  - iii) pneumatic
  - iv) gas
4. Describe the procedures used to inspect, maintain and store power tools.
5. Identify types of measuring and layout tools and equipment and describe their applications and procedures for use.
6. Describe the procedures used to inspect, maintain and store measuring and layout tools and equipment.
7. Identify types of leveling and alignment instruments and describe their applications and procedures for use.
8. Describe the procedures used to inspect, maintain and store leveling and alignment instruments.
9. Identify types of powder actuated equipment and describe their applications.
  - i) certification requirements

**Learning Outcomes:**

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.
- Demonstrate knowledge of the procedures used to prepare and complete trade documentation.

**Objectives and Content:**

1. Describe effective verbal and non-verbal communication.
  - i) other tradespersons
  - ii) co-workers/colleagues
  - iii) supervisors
  - iv) apprentices
2. Identify types of communication devices and describe their applications and operation.
  - i) cellular
  - ii) two-way radio
  - iii) computer
3. Identify types of trade related documentation and describe their applications and procedures for use.
  - i) manufacturers' specifications
  - ii) codes and standards
  - iii) manuals
  - iv) drawings
  - v) shipping documentation
  - vi) safety documentation
4. Describe the procedures used to prepare and complete trade related documentation.

## IRW-115            Drawings

### Learning Outcomes:

- Demonstrate knowledge of drawings and their applications.
- Demonstrate knowledge of the procedures to interpret and extract information from drawings.

### Objectives and Content:

1. Define terminology associated with drawings.
2. Identify types of drawings and describe their applications.
  - i) civil/site/plot
  - ii) architectural
  - iii) mechanical
  - iv) structural
  - v) shop/detail drawings
  - vi) sketches
3. Identify drawing projections and views and describe their applications.
  - i) orthographic
  - ii) oblique
  - iii) isometric
  - iv) section
  - v) auxiliary
4. Interpret and extract information from drawings.
  - i) lines
  - ii) legend
  - iii) symbols and abbreviations
  - iv) title block
  - v) notes and specifications
  - vi) tolerances/allowances
  - vii) bill of materials
  - viii) schedules
  - ix) metric and imperial dimensioning
  - x) revisions
  - xi) scales

**Learning Outcomes:**

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

**Objectives and Content:**

1. Identify sources of information relevant to work task planning.
  - i) documentation
  - ii) drawings
  - iii) related professionals
  - iv) clients
  
2. Describe the procedures used to plan work tasks.
  - i) scheduling
  - ii) material/equipment selection
  - iii) weight calculation
  - iv) bar place order/sequence
  
3. Describe the procedures used to organize and store tools, equipment, materials and supplies on-site.
  - i) select location for material lay down
  - ii) offload/unload and sort materials and supplies
  - iii) set up equipment



## **IRW-125            Oxy-fuel Cutting**

### **Learning Outcomes:**

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

### **Objectives and Content:**

1. Define terminology associated with oxy-fuel cutting.
2. Identify hazards and describe safe work practices pertaining to oxy-fuel cutting.
  - i) personal
  - ii) shop/facility
  - iii) equipment
  - iv) ventilation
  - v) storage/handling
3. Identify and interpret codes and regulations pertaining to oxy-fuel equipment.
4. Identify oxy-fuel equipment and accessories and describe their applications.
5. Identify types of fuels and gases used in oxy-fuel cutting operations and describe their characteristics and applications.
6. Identify types of cutting flames and describe their application and the procedures for flame adjustment.
  - i) oxidizing
  - ii) carburizing
  - iii) neutral
7. Describe the procedures used to set-up, adjust and shut-down oxy-fuel equipment.
8. Describe the procedures used to inspect, maintain and store oxy-fuel equipment.
9. Describe the procedures used to cut materials using oxy-fuel equipment.

10. Identify common cutting faults and describe the procedures to prevent and correct them.
11. Set-up, operate and shut-down oxy-fuel equipment.

## **IRW-130            Introduction to Welding**

### **Learning Outcomes:**

- Demonstrate knowledge of Shielded Metal Arc Welding (SMAW) equipment and accessories.
- Demonstrate knowledge of SMAW welding processes.

### **Objectives and Content:**

1. Define terminology associated with SMAW welding.
2. Interpret information pertaining to SMAW welding found on drawings.
  - i) symbols
  - ii) abbreviations
3. Identify hazards and describe safe work practices pertaining to SMAW welding.
  - i) personal
  - ii) shop/facility
  - iii) equipment
  - iv) ventilation
  - v) storage/handling
4. Identify codes and standards pertaining to welding.
  - i) Canadian Welding Bureau (CWB)
5. Identify the SMAW welding processes and describe their characteristics and basic applications.
6. Identify SMAW welding equipment, consumables and accessories and describe their application.
7. Describe the procedures used to set-up and adjust SMAW welding equipment.
8. Describe the procedures used to inspect and maintain SMAW welding equipment.
9. Identify types of welds performed using SMAW welding equipment.

10. Identify welding positions and describe their applications.
11. Describe the procedures used to weld using SMAW welding equipment.
12. Identify common weld faults and describe the procedures to prevent and correct them.
13. Set-up, operate and shut-down SMAW welding equipment.

## **IRW-135            Access Equipment**

### **Learning Outcomes:**

- Demonstrate knowledge of ladders, scaffolding and aerial work platforms, their applications, limitations and procedures for use.

### **Objectives and Content:**

1. Define terminology associated with ladders, scaffolding and aerial work platforms.
2. Identify hazards and describe safe work practices pertaining to ladders, scaffolding and aerial work platforms.
3. Identify codes and regulations pertaining to ladders, scaffolding and aerial work platforms.
4. Identify types of ladders, scaffolding and aerial work platforms and describe their characteristics and applications.
5. Identify types of work positioning, fall arrest and protection equipment and describe their applications and procedures for use.
6. Describe the procedures used to erect, secure and dismantle ladders and scaffolding.
7. Describe the procedures used to inspect and maintain ladders, scaffolding and aerial work platforms.

**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 when performing 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 codes and 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. Perform calculations pertaining to rigging equipment.
  - i) safe working loads
  - ii) breaking strength
6. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.
7. Describe the procedures used to inspect, maintain and store hoisting, lifting and rigging equipment.
8. Identify types of knots, hitches and bends and describe their applications and the procedures used to tie them.
9. Describe the procedures used to rig material/equipment for hoisting and lifting.

10. Describe the procedures used to ensure the work area is safe for hoisting and lifting.
  - i) supervision of lift
  - ii) securing work area
  - iii) communication
  
11. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.
  - i) hand signals
  - ii) electronic communications
  - iii) audible/visual
  - iv) relay of signals
  
12. Calculate sling tension and sling angle when preparing for hoisting and lifting operations.
  
13. Describe the procedures used to determine the weight and weight distribution of loads.
  - i) reference load charts
  - ii) determine types of loads
  - iii) engineered lifts
  
14. Identify the factors to consider when selecting rigging equipment.
  - i) load characteristics
    - weight
    - size
    - shape
    - center of gravity
  - ii) environment
  
15. Describe the procedures used to perform a lift.
  - i) secure work area
  - ii) load determination
  - iii) selection of rigging hardware
  - iv) communication methods
  - v) pre-lift checks
  - vi) placement of load
  - vii) post-lift inspection

## IRW-145            Introduction to Cranes

### Learning Outcomes:

- Demonstrate knowledge of cranes, their applications and limitations.
- Demonstrate knowledge of crane lifting operations.

### Objectives and Content:

1. Define terminology associated with cranes and crane lifting operations.
2. Identify hazards and describe safe work practices pertaining to cranes and crane lifting operations.
3. Interpret codes and regulations pertaining to cranes and crane lifting operations.
4. Interpret information pertaining to crane lifting operations found on drawings and specifications.
5. Interpret tables and charts to lift and move loads.
  - i) crane limitations
    - tipping/stability failure
    - structural failure
6. Explain the principles of leverage and their application to cranes.
7. Identify types of cranes and describe their components, characteristics and applications.
  - i) hydraulic
  - ii) conventional
  - iii) tower
  - iv) electric overhead travelling (EOT)
  - v) crawler
  - vi) carrier mounted
  - vii) rough terrain
  - viii) all terrain
  - ix) high capacity
  - x) knuckle boom



- xi) derrick
  - xii) boom truck
8. Identify the considerations for crane assembly/installation on-site.
- i) site hazard assessment
    - overhead powerlines
    - underground services
    - obstructions
    - soil/ground conditions
  - ii) crane position
    - crane radius/swing area
    - headroom

**Learning Outcomes:**

- Demonstrate knowledge of structural components, their characteristics and applications.
- Demonstrate knowledge of fastening methods relating to structural steel erection.
- Demonstrate knowledge of falsework, their characteristics and applications.
- Demonstrate knowledge of the procedures used to erect and dismantle falsework.

**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) I-beam
  - ii) H-beam
  - iii) wide flange
  - iv) welded wide flange
  - v) angle
  - vi) channel
  - vii) tee

- viii) hollow structural steel (HSS)
  - ix) miscellaneous shapes
7. Identify types of structural components and their purpose.
- i) columns
  - ii) girders
  - iii) beams
  - iv) trusses
  - v) joists
  - vi) secondary steel
  - vii) decking
  - viii) girts
  - ix) purlins
  - x) sag rods
  - xi) bracing
  - xii) bridging
  - xiii) lintels
  - xiv) pre-cast
  - xv) glued laminated timber products
  - xvi) composite
8. Identify fastening methods associated with structural steel and describe their characteristics, applications and limitations.
- i) install fasteners/bolts
  - ii) welding
9. Describe the procedures used to install fasteners for securing structural steel members.
10. Identify types of falsework and describe their characteristics and applications.
11. Describe the procedures used to erect and dismantle falsework.

## IRW-155            Reinforcing I

### Learning Outcomes:

- Demonstrate knowledge of reinforcing materials and accessories.
- Demonstrate knowledge of the procedures to prepare for reinforcing concrete.

### Objectives and Content:

1. Explain the purpose of reinforcing concrete.
2. Define terminology associated with reinforced concrete.
3. Explain the forces and stresses associated with reinforced concrete.
  - i) compression
  - ii) tension
  - iii) shear
  - iv) live and dead loads
4. Identify hazards and describe safe work practices pertaining to reinforcing.
  - i) fall arrest and protection
  - ii) dowel protection
  - iii) work positioning (belly hook)
  - iv) repetitive strain injuries
  - v) proper packing/carrying techniques
5. Interpret codes and regulations pertaining to reinforcing.
6. Interpret information pertaining to reinforcing found on drawings and specifications.
7. Identify standards and identification systems relating to reinforcing steel.
  - i) grades and diameters
  - ii) mill standards
  - iii) Concrete Reinforcing Steel Institute (CRSI)
  - iv) colour codes and tags

8. Identify tools and equipment related to reinforcing and describe their applications and procedures for use.
  - i) bending
  - ii) cutting
  - iii) placing
  - iv) tying
  - v) splicing
  
9. Identify types of reinforcing materials and describe their properties, characteristics and applications.
  - i) rebar
  - ii) embedded plates
  - iii) welded wire mesh
  - iv) composite material
  
10. Explain the importance of maintaining proper reinforcing clearances and tolerances for reinforcing materials.
  - i) protecting reinforcing steel
  - ii) structural integrity
  
11. Identify reinforcing material accessories and describe their characteristics and applications.
  - i) tie wires
  - ii) bar supports
  - iii) coupling devices
  
12. Describe the procedures used to join rebar using the exothermic welding (Cadmold) process.
  
13. Describe the procedures used to prepare for reinforcing concrete.
  - i) site preparation
  - ii) interpretation of drawings and specifications
  - iii) selection and setup of equipment
  - iv) off-loading steel

**Learning Outcomes:**

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

**Objectives and Content:**

1. Define terminology associated with plasma arc cutting.
2. Identify hazards and describe safe work practices pertaining to plasma arc cutting.
  - i) personal
  - ii) shop/facility
  - iii) equipment
  - iv) ventilation
  - v) storage/handling
3. Describe the plasma arc cutting process and its applications.
4. Identify plasma arc cutting equipment and accessories and describe their applications.
5. Describe the procedures used to set-up, adjust and shut-down plasma arc cutting equipment.
6. Describe the procedures used to inspect, maintain and store plasma arc cutting equipment.
7. Describe the procedures used to cut using plasma arc cutting equipment.
  - i) free hand
  - ii) straight edge
8. Identify common cutting faults and describe the procedures used to prevent and correct them.
9. Set-up, operate and shut-down plasma arc cutting equipment.

## **LEVEL 2**

**Learning Outcomes:**

- Demonstrate knowledge of welding and gouging equipment and accessories.
- Demonstrate knowledge of welding processes and procedures.

**Objectives and Content:**

1. Define terminology associated with welding and gouging.
2. Interpret information pertaining to welding found on drawings and welding procedures.
  - i) symbols
  - ii) abbreviations
3. Identify hazards and describe safe work practices pertaining to welding and gouging.
  - i) personal
  - ii) shop/facility
  - iii) equipment
  - iv) ventilation
  - v) storage/handling
4. Identify and interpret codes and standards pertaining to welding and gouging.
  - i) Canadian Welding Bureau (CWB)
5. Identify welding processes and describe their characteristics and applications.
  - i) shielded metal arc welding (SMAW)
  - ii) gas metal arc welding (GMAW)
  - iii) gas tungsten arc welding (GTAW)
  - iv) flux core arc welding (FCAW)
  - v) stud welding
  - vi) arc-spot welding (ASW)
  - vii) submerged arc welding (SAW)



6. Identify welding equipment, consumables and accessories and describe their application.
  - i) FCAW
  - ii) stud welding
7. Describe the procedures used to set-up and adjust welding equipment.
  - i) FCAW
  - ii) stud welding
8. Describe the procedures used to inspect, maintain and store welding equipment.
  - i) FCAW
  - ii) stud welding
9. Identify types of welds and joints performed using welding equipment.
10. Identify welding positions and describe their applications.
11. Describe the procedures used to weld using welding equipment.
  - i) FCAW
  - ii) stud welding
12. Identify arc-air gouging equipment, consumables and accessories and describe their applications.
13. Describe the procedures used to gouge using arc-air gouging equipment.

**Learning Outcomes:**

- Demonstrate knowledge of hydraulic and conventional cranes, their components and accessories.
- Demonstrate knowledge of the procedures used to erect, set-up and disassemble hydraulic and conventional cranes.

**Objectives and Content:**

1. Define terminology associated with hydraulic and conventional cranes.
2. Identify and describe the procedures used to communicate during hydraulic and conventional crane operations.
  - i) hand signals
  - ii) electronic communications
  - iii) audible/visual
3. Identify hydraulic crane components, accessories and attachments and describe their characteristics and applications.
4. Identify conventional crane components, accessories and attachments and describe their characteristics and applications.
5. Identify the considerations for hydraulic and conventional crane assembly/installation on-site.
  - i) site hazard assessment
    - overhead powerlines
    - underground services
    - obstructions
    - soil/ground conditions
    - environmental conditions
  - ii) crane position
    - crane radius/swing area
    - quadrants of operation
    - headroom
6. Describe the procedures used to assemble and set-up hydraulic cranes.

7. Describe the procedures used to assemble and set-up conventional cranes.
8. Describe the procedures used to disassemble hydraulic cranes, their components, accessories and attachments.
9. Describe the procedures used to disassemble conventional cranes, their components, accessories and attachments.
10. Describe the procedures used to prepare hydraulic cranes for transport.
11. Describe the procedures used to prepare conventional cranes for transport.

**Learning Outcomes:**

- Demonstrate knowledge of tower cranes, their components and accessories.
- Demonstrate knowledge of the procedures used to erect, set-up and disassemble tower cranes.

**Objectives and Content:**

1. Define terminology associated with tower cranes.
2. Identify and describe the procedures used to communicate during tower crane operations.
  - i) hand signals
  - ii) electronic communications
  - iii) audible/visual
3. Identify types of tower cranes and describe their characteristics and applications.
  - i) stationary
    - fixed
    - slewing
  - ii) mobile
4. Identify tower crane components, accessories and attachments and describe their characteristics and applications.
5. Identify the considerations for tower crane assembly/installation on-site.
  - i) site hazard assessment
    - overhead powerlines
    - obstructions
  - ii) crane position
    - crane radius/swing area
6. Describe the procedures used to erect, set-up and climb/jump tower cranes.
7. Describe the procedures used to disassemble tower cranes, their components, accessories and attachments.
8. Describe the procedures used to prepare tower cranes for transport.

**Learning Outcomes:**

- Demonstrate knowledge of structural steel members, their characteristics and applications.
- Demonstrate knowledge of the procedures used to erect structural steel members and components.
- Demonstrate knowledge of the procedures used to dismantle and remove structural steel members and components.

**Objectives and Content:**

1. Define terminology associated with structural steel erection and dismantling.
2. Identify hazards and describe safe work practices pertaining to structural steel erection and dismantling.
  - i) temporary bracing
  - ii) environmental conditions
  - iii) sequence
3. Interpret codes, regulations and standards pertaining to structural steel erection and dismantling.
  - i) industry standards
  - ii) codes of practice
  - iii) government regulations
4. Interpret information pertaining to structural steel erection and dismantling found on drawings and specifications.
5. Identify tools and equipment relating to structural steel erection and dismantling and describe their applications and procedures for use.
  - i) erection
  - ii) aligning
  - iii) fastening
  - iv) inspecting
  - v) revision/fabrication

6. Identify structural steel members and describe their characteristics and applications.
  - i) columns
  - ii) girders
  - iii) beams
  - iv) trusses
  - v) joists
  - vi) decking
  - vii) girts
  - viii) purlins
  - ix) sag rods
  - x) bracing
  - xi) bridging
  - xii) lintels
7. Describe the procedures used to erect and install structural steel members.
8. Describe the procedures used to level, plumb and align structural steel members.
9. Describe the procedures used to inspect erected structural steel to ensure conformity to standards.
  - i) visual
  - ii) mechanical
10. Describe the procedures used to repair and replace structural steel members and components.
11. Describe the procedures used to dismantle and remove structural steel members and components.

# **LEVEL 3**

**Learning Outcomes:**

- Demonstrate knowledge of electric overhead travelling (EOT) cranes, their components and accessories.
- Demonstrate knowledge of the procedures to assemble and install EOT cranes.

**Objectives and Content:**

1. Define terminology associated with EOT cranes.
2. Identify and describe the procedures used to communicate during EOT crane operations.
  - i) hand signals
  - ii) electronic communications
  - iii) audible/visual
3. Identify hazards and describe safe work practices pertaining to EOT cranes and EOT crane operations.
  - i) bus bar
4. Identify EOT crane components, accessories and attachments and describe their characteristics and applications.
  - i) crane rails
  - ii) end trucks
  - iii) wheels
  - iv) bridge girders
  - v) hoist and trolleys
  - vi) crane stop
  - vii) load blocks
  - viii) cab
  - ix) bus bar
5. Identify types of EOT controls and describe their characteristics and applications.
  - i) cab operated
  - ii) remote operated
  - iii) pendant
6. Describe the procedures used to assemble and install EOT cranes.



**Learning Outcomes:**

- Demonstrate knowledge of pre-engineered structures and their components.
- Demonstrate knowledge of the procedures used to erect pre-engineered structures.

**Objectives and Content:**

1. Define terminology associated with pre-engineered structures.
2. Identify hazards and describe safe work practices pertaining to pre-engineered structures.
3. Interpret codes and regulations pertaining to pre-engineered structures.
4. Interpret information pertaining to pre-engineered structures found on drawings and specifications.
5. Identify tools and equipment relating to pre-engineered structures and describe their applications and procedures for use.
6. Identify types of pre-engineered structures and describe their characteristics and applications.
  - i) tapered beam
  - ii) single-span rigid frame
  - iii) multi-span rigid frame
  - iv) single span and continuous trusses
  - v) lean-to
7. Identify pre-engineered structure components and describe their characteristics and applications.
8. Describe the procedures used to plan and prepare for erection of pre-engineered structures.
9. Describe the procedures used to erect pre-engineered structures and their components.

**Learning Outcomes:**

- Demonstrate knowledge of pre-cast concrete members and their components.
- Demonstrate knowledge of the procedures used to erect pre-cast concrete.
- Demonstrate knowledge of the procedures to dismantle pre-cast concrete.

**Objectives and Content:**

1. Define terminology associated with pre-cast concrete erection and dismantling.
2. Identify hazards and describe safe practices pertaining to pre-cast concrete erection and dismantling.
3. Interpret codes and regulations pertaining to pre-cast concrete erection and dismantling.
4. Interpret information pertaining to pre-cast concrete erection and dismantling found on drawings and specifications.
5. Identify tools and equipment relating to pre-cast concrete erection and dismantling and describe their applications and procedures for use.
6. Identify types of pre-cast concrete members and components and describe their characteristics and applications.
  - i) panels
    - horizontal
    - vertical
  - ii) beams
  - iii) joists
  - iv) columns
  - v) single tees
  - vi) twin tees
7. Describe the procedures used to prepare for the erection of pre-cast concrete members and components.
  - i) site preparation
  - ii) equipment set-up

- iii) determine weight
  - iv) rigging procedures
  - v) material handling
  - vi) layout
8. Describe the procedures used for the erection of pre-cast concrete members and components.
- i) attaching to support clips
  - ii) aligning, leveling and plumbing
  - iii) fastening
    - welding
    - bolting
  - iv) grouting
9. Describe the procedures used to finish pre-cast concrete.
- i) removing lugs
  - ii) grinding
  - iii) painting
  - iv) packing
  - v) caulking
  - vi) installing gaskets
  - vii) air sealing
  - viii) grouting
10. Describe the procedures used to dismantle and remove pre-cast concrete members.

## IRS-315

## Machinery and Equipment

### Learning Outcomes:

- Demonstrate knowledge of the procedures used to install and remove machinery and equipment.

### Objectives and Content:

1. Define terminology associated with machinery and equipment installation and removal.
2. Identify hazards and describe safe work practices pertaining to installation and removal of machinery and equipment.
3. Interpret codes and regulations pertaining to installation and removal of machinery and equipment.
4. Interpret information pertaining to installation and removal of machinery and equipment found on drawings and specifications.
5. Identify tools and equipment relating to installation and removal of machinery and equipment and describe their applications and procedures for use.
6. Identify types of machinery and equipment installed and removed by ironworkers and describe their characteristics.
  - i) storage tanks
  - ii) bins
  - iii) hoppers
  - iv) conveyors
7. Describe the procedures used to install machinery and equipment.
  - i) move/transport
  - ii) assemble
  - iii) erect
  - iv) level
  - v) align
  - vi) support
  - vii) secure
8. Describe the procedures used to remove machinery and equipment.

## IRS-320

## Miscellaneous Ironwork

### Learning Outcomes:

- Demonstrate knowledge of miscellaneous ironwork.
- Demonstrate knowledge of the procedures used to fabricate and install miscellaneous ironwork.

### Objectives and Content:

1. Define terminology associated with miscellaneous ironwork.
2. Identify hazards and describe safe work practices pertaining to miscellaneous ironwork.
3. Interpret codes and regulations pertaining to miscellaneous ironwork.
4. Interpret information pertaining to miscellaneous ironwork found on drawings and specifications.
5. Identify tools and equipment relating to miscellaneous ironwork and describe their applications and procedures for use.
6. Identify types of miscellaneous ironwork and describe their components, characteristics and applications.
  - i) stairways
  - ii) ladders and platforms
  - iii) railings
  - iv) catwalks
  - v) fences
7. Describe the procedures used to fabricate miscellaneous ironwork.
  - i) shop
  - ii) field
8. Describe the procedures used to install miscellaneous ironwork.
  - i) site preparation
  - ii) material handling and movement

## IRS-325

## Ornamental Ironwork

### Learning Outcomes:

- Demonstrate knowledge of ornamental ironwork.
- Demonstrate knowledge of the procedures used to fabricate and install ornamental ironwork.

### Objectives and Content:

1. Define terminology associated with ornamental ironwork.
2. Identify hazards and describe safe work practices pertaining to ornamental ironwork.
3. Interpret codes and regulations pertaining to ornamental ironwork.
4. Interpret information pertaining to ornamental ironwork found on drawings and specifications.
5. Identify tools and equipment relating to ornamental ironwork and describe their applications and procedures for use.
6. Identify types of ornamental ironwork and describe their components, characteristics and applications.
  - i) stairways
  - ii) railings
  - iii) curtain walls
7. Describe the procedures used to fabricate ornamental ironwork.
  - i) shop
  - ii) field
8. Describe the procedures used to install ornamental ironwork.
  - i) site preparation
  - ii) material handling and movement
  - iii) layout
  - iv) install and secure items

9. Describe the procedures used for finishing ornamental ironwork.
  - i) grinding
  - ii) painting
  - iii) filling procedures
  - iv) polishing
10. Describe the procedures used to repair ornamental ironwork.
11. Describe the procedures used to remove ornamental ironwork.