Skilled Trades Ontario | Métiers spécialisés Ontario

Apprenticeship Curriculum Standard

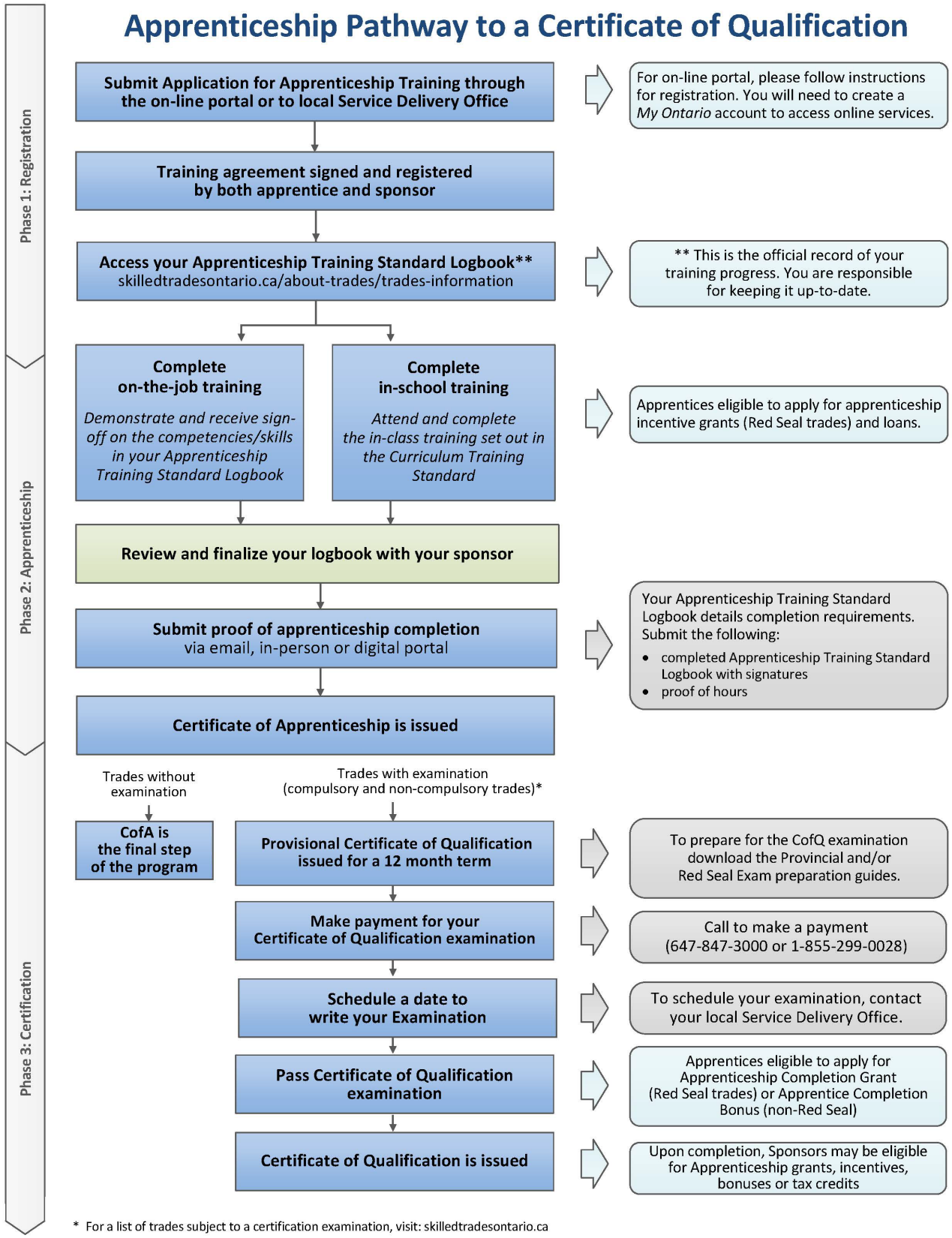
Ironworker — Structural and Ornamental

Levels 1, 2 and 3

420A

2014

Apprenticeship Pathway to a Certificate of Qualification



* For a list of trades subject to a certification examination, visit: skilledtradesontario.ca

Draft version: 2022-03-16

Table of Contents

Please Note: This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant and accurate based on the original date of publishing.

Please refer to STO's website: **skilledtradesontario.ca** for the most accurate and up to date information. For information about BOSTA and its regulations, please visit ***Building Opportunities in the Skilled Trades Act, 2021* (BOSTA).**

Any updates to this publication are available on-line; to download this document in PDF format, please follow the link: Skilled Trades Ontario.ca.

Maintained with transfer to Skilled Trades Ontario 2014 (V100)

Preface

This curriculum standard for the Ironworker — Structural and Ornamental trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 3 levels of training. The Reportable Subjects Summary chart (located on page 2) summarizes the training hours for each reportable subject.

The curriculum identifies the learning that takes place in-school. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards.

Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on a work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to verify that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Please refer to Skilled Trades Ontario website (www.skilledtradesontario.ca) for the most accurate and up-to-date information about Skilled Trades Ontario. For information on *Building Opportunities in the Skilled Trades Act, 2021 (BOSTA)*) and its regulations, please visit Building Opportunities in the Skilled Trades Act, 2021, S.O. 2021, c. 28 - Bill 288 (ontario.ca)

Pre-requisites

In order to advance to Level 2 of the apprenticeship program, an individual must have completed all of the units outlined in Level 1. Similarly, in order to advance to Level 3 of the program, an individual must have completed all of the units outlined in Level 1 and 2.

Hours Disclaimer (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed practical and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

Suggested Equipment for Training Delivery Agencies

The listing of tools on pages 56, 91 and 145 does not list minimum quantities based on the understanding that the delivering TDA is in the best position to determine the need based on its delivery methodology.

Personal and Safety Equipment: Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

Program Summary of Reportable Subjects

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Level 1				
S1381	Protect Self and Others	18	16	2
S1382	Applied Trade Calculations	36	34	2
S1383	Welding	54	15	39
S1384	Rigging	48	25	23
S1385	Structural Steel and Platework	54	26	28
S1386	Cranes	30	25	5
	Level 1 Total	**240**	**141**	**99**
Level 2				
1387	Welding	42	4	38
1388	Rigging	84	53	31
1389	Structural Steel and Platework	78	33	45
1390	Machinery Moving	36	27	9
	Level 2 Total	**240**	**117**	**123**
Level 3				
S1391	Ornamental and Miscellaneous Ironwork	72	21	51
S1392	Welding	54	21	33
S1393	Structural Steel and Platework	18	9	9
S1394	Curtain Wall	42	25	17
S1395	Machinery Moving	18	9	9
S1396	Automated Materials Handling Systems	36	19	17
	Level 3 Total	**240**	**104**	**136**

Level 1

Program Summary of Reportable Subjects – Level 1

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
S1381	Protect Self and Others	18	16	2
S1382	Applied Trade Calculations	36	34	2
S1383	Welding	54	15	39
S1384	Rigging	48	25	23
S1385	Structural Steel and Platework	54	26	28
S1386	Cranes	30	25	5
	Total	**240**	**141**	**99**

Number:	S1381		
Title:	**Protect Self and Others**		
Duration:	Total Hours: 18	Theory: 16	Practical: 2
Prerequisites:	None		
Content:	S138.1	*Occupational Health and Safety Act (OHSA)*, Workplace Safety Insurance Board (WSIB) and Infrastructure Health & Safety Association (IHSA)	
	S138.2	Trade Specific Practices	
	S138.3	Tools and Equipment Safety	
	S138.4	Workplace Hazardous Materials Information System (WHMIS)	
	S138.5	Fall Protection and Hazard Awareness	

Evaluation and Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

IHSA Construction Health and Safety Manual and Workbook
Structural Steel Erection Manual for Ironworkers
Ironworker Orientation Manual
Occupational Health & Safety Act (OHSA)

Number:	S1381.1		
Title:	***Occupational Health and Safety Act (OHSA)*, Workplace Safety Insurance Board (WSIB) and Infrastructure Health & Safety Association (IHSA)**		
Duration:	Total Hours: 4	Theory: 4	Practical: 0
Cross Reference to Training Standard: U0891.01, U0891.02, U0891.03, U0891.04 U0891.05, U0891.06, U0891.07, U0891.08, U0891.09, U0891.10, U0891.11, U0891.12			

General Learning Outcomes

Upon successful completion, the apprentice is able to explain the *OHSA* as it applies to construction trades, specifically the ironworker trade, understand the purpose and procedures of the WSIB and the role of the IHSA.

Learning Outcomes and Content

S1381.1.1 Define worker and employee responsibilities:

- compliance with *OHSA*
- use and wearing of appropriate Personal Protective Equipment (PPE)
- hazard reporting
- unsafe work refusal

S1381.1.2 Define employer responsibilities:

- safe workplace requirements
- compliance with *OHSA*
- notification of job hazards

S1381.1.3 Identify and report job hazards:

- pinch points
- electrical
- hoisting and rigging
- trips/ falls/ openings
- ventilation
- confined space
- lighting
- fires
- access and egress

S1381.1.4 Identify WSIB reporting requirements:

- employee
- employer

S1381.1.5 Describe inspection, wearing, adjustment and maintenance of PPE:

- work boots
- safety glasses
- gloves
- hearing protection
- respirators
- hardhats
- clothing
- fall arrest equipment

S1381.1.6 Describe site preparation for safe work practices:

- ground conditions
- lighting
- scaffold inspection

S1381.1.7 Apply housekeeping rules:

- safe work area
- obstacle removal
- access and egress

S1381.1.8 Explain safe lifting techniques

- posture
- frequency
- MSD profile

Number:	S1381.2		
Title:	**Trade Specific Practices**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0

Cross Reference to Training Standard: U0891.01, U0891.02, U0891.03, U0891.04 U0891.05, U0891.06, U0891.07, U0891.08, U0891.09, U0891.10, U0891.11, U0891.12

General Learning Outcomes

Upon successful completion, the apprentice is able to identify and describe correct lifting techniques, recognizing and reporting of hazards, communication with co-workers and safe working practice procedures.

Learning Outcomes and Content

S1381.2.1 Perform correct lifting and carrying techniques:

- single worker lift
- dual worker lift
- single worker carry
- dual worker carry

S1381.2.2 Identifies specific workplace hazards involved in:

- rigging
- structural steel
- curtain wall
- machinery moving
- welding
- confined spaces
- electrical power sources
- conveyor and automated material handling systems
- ornamental and miscellaneous steel

S1381.2.3 Identifies trade specific safety practices for:

- openings
- overhead hoisting
- falling objects
- working on open structural steel
- lockout/tag out

Number:	S1381.3		
Title:	**Tools and Equipment Safety**		
Duration:	Total Hours: 2	Theory: 1	Practical: 1

Cross Reference to Training Standard: U0891.01, U0891.02, U0891.03, U0891.04 U0891.05, U0891.06, U0891.07, U0891.08, U0891.09, U0891.10, U0891.11, U0891.12, U0893.01, U0893.02, U0893.03, U0893.04

General Learning Outcomes

Upon successful completion, the apprentice is able to identify and select appropriate hand and power tools, identify deficiencies and remove from service any defective equipment.

Learning Outcomes and Content

S1381.3.1 Identify and select appropriate hand and power tools:

- spud wrench
- combination square
- bull pin
- barrel pin
- drift pin
- hammer
- mag drill
- impact wrench
- torque wrench
- air compressor
- combination wrenches
- ratchet/socket
- center punch
- scriber
- chalk line
- pry bar
- scabbard
- powder actuated tools
- spirit levels
- optical level
- plumb-bob
- laser
- reamer
- tap/die

- tape measure
- tin snip
- portable band saw
- hydraulic ironworker
- hammer drill
- quick cut saw
- reciprocating saw
- power shear
- sledge hammer
- grinders
- drill
- hammer wrench

S1381.3.2 Identify and apply safety practices related to equipment:

- design and proper use of guards
- warning signs and tag systems
- lubrication of moving equipment parts
- grinding wheel guards
- two hand controls

S1381.3.3 Identify defective hand and power tools:

- impact and corrosion damage
- defective portable electric tools
- poor connections
- electrical hazards
- defective plugs
- improper groundings

S1381.3.4 Explain safe carrying and handling procedures for hand and power tools:

- precautions against dropping tools when working overhead
- safe methods of carrying tools
- tying off tools

S1381.3.5 Identify procedures and regulations related to injuries and their avoidance:

- location of first aid equipment
- use of protective equipment - goggles, safety glasses, face shields, kick back aprons
- special protective clothing
- removal and/or reporting of hazards

Number:	S1381.4		
Title:	**Workplace Hazardous Materials Information System (WHMIS)**		
Duration:	Total Hours: 2	Theory: 2	Practical: 0
Cross Reference to Training Standard: U0891.01, U0891.03, U0891.04 U0891.05, U0891.06, U0891.07, U0891.08, U0891.10, U0891.11, U0891.12			

General Learning Outcomes

Upon successful completion, the apprentice is able to interpret WHMIS, in accordance with required manufacturer recommendations, requirements or specifications.

Learning Outcomes and Content

S1381.4.1 Identify the different types WHMIS labels including:

- supplier
- workplace
- portable container

S1381.4.2 Identify the different types of warning symbols:

- corrosive materials
- dangerously reactive material
- flammable and combustible material
- oxidizing materials
- poisonous and infectious substances
- compressed gas

S1381.4.3 Describe the purpose of Material Safety Data Sheets (MSDS):

- personal safety
- safety of others
- storage
- transport
- handling
- usage

S1381.4.4 Describe the legal requirements for worker training:

- MSDS renewal
- MSDS access

Number:	S1381.5		
Title:	**Fall Protection and Working at Heights**		
Duration:	Total Hours: 4	Theory: 3	Practical: 1

Cross Reference to Training Standard: U0891.01, U0891.02, U0891.03, U0891.04 U0891.05, U0891.06, U0891.07, U0891.08, U0891.09, U0891.11, U0891.12, U0897.04

General Learning Outcomes

Upon successful completion, the apprentice is able to interpret the ironworker fall protection and hazard awareness requirements, in accordance with required manufacturer equipment recommendations, requirements or specifications.

Learning Outcomes and Content

S1381.5.1 Explain the legal responsibilities for worker fall protection:

- safety inspections
- employer/supervisor/worker
- operation and maintenance of equipment
- *OHSA*
- training requirements

S1381.5.2 Identify fall prevention methods:

- hazards and controls
- planning
- ladders
  - general safety guidelines
  - portable ladders
  - step/trestle/platform ladders
  - fixed ladders
- scaffolds
  - work platforms
  - powered elevating work platforms
- protective covers
- warning barriers and bump lines
- guardrails
- travel restraint systems
- floats

S1381.5.3 Describe the types and function of fall arrest systems.

- fall restricting system
- safety net design and location
- fall arrest system
  - body harness
  - lanyard and shock absorber
  - lifelines
  - retractable lifelines

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
70%	0%	0%	0%	30%

Number:	S1382		
Title:	**Applied Trade Calculations**		
Duration:	Total Hours: 36	Theory: 34	Practical: 2
Prerequisites:	None		
Content:	S1382.1	Introduction to Trade Related Calculations	
	S1382.2	Trade Calculation Applications	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Mathematics for Ironworkers
Layout Instruments for Ironworkers
Ironworker Rigging Manual

Number:	S1382.1		
Title:	**Introduction to Trade Related Calculations**		
Duration:	Total Hours: 18	Theory: 18	Practical: 0
Cross Reference to Training Standard: U0896.01, U0897.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to solve trade related calculations in accordance with requirements of the specified trade related task.

Learning Outcomes and Content

S1382.1.1 Define the fundamentals of measuring systems:

- imperial measuring system.
- metric measuring system

S1382.1.2 Describe the fundamentals, mathematical formulas and procedures to solve trade related problems for:

- whole numbers
  - addition
  - subtraction
  - division
  - multiplication
  - order of operations
- fractions
  - the concept of fractions
  - the need and use of fractions
  - denominator
  - numerator
  - common fractions
  - proper fractions (improper)
  - mixed numbers
  - brackets
  - the need for the common denominator (lowest)
- decimals
  - concepts
  - transition of fractions to decimals
  - rounding of decimals
  - decimal equivalent tables
  - metric conversions

- square root
  - squaring a number
  - square root by calculation
  - division and average
- area
  - basic units of square measure
  - calculations
  - square
  - rectangle
  - triangle
  - circle, cylinders
  - trade related problems
- volume
  - units of volume measure
  - calculations
  - rectangular or triangular forms
  - cylinders
  - mass
  - density of material (concrete, metals, liquids, other construction materials)
- percentage
- ratios
- Pythagorean theorem
- trigonometry

Number:	S1382.2		
Title:	**Trade Calculation Applications**		
Duration:	Total Hours: 18	Theory: 16	Practical: 2
Cross Reference to Training Standard: U0896.01, U0897.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform and apply trade related calculations to solve trade related tasks.

Learning Outcomes and Content

S1382.2.1 Describe the sequence involved in calculations to solve trade related problems:

- whole numbers
  - addition
  - subtraction
  - division
  - multiplication
  - order of operations
- fractions
  - denominator
  - numerator
  - common fractions
  - proper fractions (improper)
  - mixed numbers
  - brackets
  - common denominator (lowest)
- decimals
  - practice in decimals
  - addition
  - subtraction
  - multiplication
  - division
  - order of operations
  - rounding off decimals
  - changing decimals to fractions
  - changing fractions to decimals
  - using decimal equivalent tables

- square root
  - squaring a number
  - square root by calculation
  - division and average
- area
  - basic units of square measure
  - calculations
  - square
  - rectangle
  - triangle
  - circle
  - cylinders
  - trade related problems
- volume
  - units of volume measure
  - calculations
  - rectangular or triangular forms
  - cylinders
- ratios

S1382.2.2 Explain the use of measuring instruments to check critical dimensions of assembled members:

- length
- width
- thickness
- spacing
- elevation

S1382.2.3 Describe/perform the required planning and calculations to determine the specified structural/ornamental ironworking procedures for an assigned project:

- outline planning and coordinating techniques
- estimate requirements for time, manpower, tools and equipment
- calculate elevations
- calculate loads
- calculate dimensions

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
50%	10%	0%	10%	30%

Number:	S1383		
Title:	**Welding**		
Duration:	Total Hours: 54	Theory: 15	Practical: 39
Prerequisites:	None		
Content:	S1383.1	Blueprints, Drawings and Symbols	
	S1383.2	Oxy/Fuel Heating, Cutting, Brazing and Welding	
	S1383.3	Shielded Metal Arc Welding	
	S1383.4	Shielded Metal Arc Position Welding	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Introduction to Welding
Shielded Metal Arc Welding
Oxy-fuel gas cutting and Welding
Structural Steel Erection Manual for Ironworkers

Number:	S1383.1		
Title:	**Blueprints, Drawings and Symbols**		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standard: U0895.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints, drawings and symbols related to welding projects, in accordance with the requirements of the specified trade related task.

Learning Outcomes and Content

S1383.1.1 Identify and explain welding related terms and symbols for fillet welds:

- weld size
- weld finish
- weld spacing
- weld length

S1383.1.2 Identify and select welding and cutting base materials:

- joint types and preparation

S1383.1.3 Identify and explain the specified welding and cutting procedures:

- define visual weld faults
- define non-visual weld faults
- define testing methods

S1383.1.4 Identify and explain the blueprint or drawing layout specifications.

S1383.1.5 Describe the procedures for welding project layout:

- demonstrate correct usage of fillet gauge
- determine weld spacing

Number:	S1383.2		
Title:	**Oxy/Fuel Heating, Cutting, Brazing and Welding**		
Duration:	Total Hours: 14	Theory: 4	Practical: 10
Cross Reference to Training Standard: U0894.01, U0894.02, U0894.03, U0894.04, U0894.05, U0894.06, U0894.07, U0895.03			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform oxy/fuel heating, cutting, brazing and welding procedures, in accordance requirements of the specified trade related task.

Learning Outcomes and Content

S1383.2.1 Identify the safe operating practices for oxy/fuel heating, cutting, welding, and brazing procedures:

- clothing, eye, hand and face protection
- tank pressures and settings
- handling of cylinders
- setup, ignition and shutdown sequence
- fume recognition and abatement procedures

S1383.2.2 Define the terms for oxy/fuel heating, cutting and welding and brazing procedures:

- carburizing
- flashback
- backfire
- oxidizing
- neutral
- metallurgy

S1383.2.3 Describe the construction features and applications of oxy/fuel heating, cutting, welding and brazing equipment:

- cylinders, pressure regulators and valves
- gauges, hoses and manifolds
- torches and tips
- flashback arrestors

S1383.2.4 Describe the adjustment and maintenance procedures for oxy/fuel heating, cutting, welding and brazing equipment:

- pressure settings
- tip cleaning
- material assembly and setup procedures
- temperature control
- tip angles
- flame settings
- cylinder and torch pressure settings
- checking for leaks

S1383.2.5 Explain the procedures involved in the performance of oxy/fuel heating, cutting, welding and brazing:

- preheating and post heating
- cleaning procedures
- bending procedures
- manual and automatic cutting

S1383.2.6 Explain the sequence involved in the performance of inspection and corrections for oxy/fuel heating, cutting, welding and brazing procedures:

- distortions
- defects
- finishing

Number:	S1383.3		
Title:	**Shielded Metal Arc Welding (SMAW)**		
Duration:	Total Hours: 8	Theory: 8	Practical: 0
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.04, U0891.01, U0891.05, U0891.10			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform shielded metal arc welding procedures, in accordance with the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1383.3.1 Identify safe operating practices for shielded metal arc welding procedures:

- clothing, eye, hand and face protection
- voltage and amperage settings and polarity
- moisture and grounding protection
- arc emissions and ventilation
- hazardous conditions

S1383.3.2 Define the terms and descriptions for shielded metal arc welding materials and procedures:

- beads
- penetration
- closed and open circuit voltage
- slag
- consumables
- base metal
- fusion
- direct and alternating current

S1383.3.3 Describe the construction features and applications of shielded metal arc welding materials and equipment:

- transformers and rectifiers
- diesel/gas generator
- electrode specifications
- cables and electrode holders

S1383.3.4 Describe shielded metal arc welding equipment adjustment and maintenance procedures.

- cleaning
- cable and clamp condition
- amperage settings

S1383.3.5 Outline shielded metal arc welding equipment set-up and assembly procedures:

- electrode selection
- material assembly and clamping
- amperage settings

Number:	S1383.4		
Title:	**Shielded Metal Arc Position Welding (SMAPW)**		
Duration:	Total Hours: 29	Theory: 0	Practical: 29
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform and apply shielded metal arc position welding procedures, in accordance with Canadian Welding Bureau (CWB) specifications and the requirements of the specified trade related tasks, primarily focusing on flat and horizontal position welding and progressing to vertical and overhead position welding.

Learning Outcomes and Content

S1383.4.1 Explain the procedures involved in the performance of shielded metal arc welding equipment adjustment:

- amperage settings
- polarity

S1383.4.2 Explain the procedures involved in the performance of shielded metal arc welding equipment set-up and assembly:

- electrode selection
- ground clamping positions
- material preparation

S1383.4.3 Explain the procedures involved in the performance of shielded metal arc flat welding according to CWB specifications:

- stick angles
- stringer beads
- electrode travel speeds
- arc length

S1383.4.4 Explain the procedures involved in the performance of shielded metal arc horizontal welding to CWB specifications:

- stick angles
- stringer beads
- electrode travel speeds
- arc length

S1383.4.5 Explain the procedures involved in the performance of shielded metal arc vertical welding according to CWB specifications:

- stick angles
- stringer beads
- electrode travel speeds
- arc length

S1383.4.6 Explain the procedures involved in the performance of shielded metal arc overhead welding according to CWB specifications:

- stick angles
- stringer beads
- electrode travel speeds
- arc length

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
20%	25%	25%	0%	30%

Number:	S1384			
Title:	**Rigging**			
Duration:	Total Hours: 48		Theory: 25	Practical: 23
Prerequisites:	None			
Content:	S1384.1	Fibre Rope		
	S1384.2	Reeving		
	S1384.3	Rigging Calculations		

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging for Ironworkers
Hoisting and Rigging Safety Manual
Rigging pocket guide
Foreman training pocket guide
Cranes Reference Manual

Number:	S1384.1		
Title:	**Fibre Rope**		
Duration:	Total Hours: 22	Theory: 7	Practical: 15
Cross Reference to Training Standard: U0896.01, U0896.05, U0896.06, U0896.07			

General Learning Outcomes

Upon successful completion, the apprentice is able use specified type of fibre rope for rigging and lifting work members, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1384.1.1 Identify types of fibre rope:

- natural fibre
- polypropylene
- nylon
- polyester

S1384.1.2 Explain the techniques involved in the performance of tying specified fibre rope knots, hitches and bends:

- identify types of knots
- identify types of hitches
- identify types of bends
- demonstrate applications for knots
- demonstrate knot, bend and hitch tying techniques

S1384.1.3 Identify safe working loads for fibre rope:

- calculate safe working load/working load limit
- calculate breaking strengths
- identify safety factors/design factors
- select required calculated diameter

S1384.1.4 Describe the handling techniques for fibre rope:

- coiling techniques
- uncoiling techniques
- drum installation techniques
- storage requirements

S1384.1.5 Explain the techniques involved in the performance of fibre rope splicing:

- calculate splicing requirements for specifications
- perform hand splicing techniques for various size specifications
  - back splice
  - eye splice
  - short splice
  - long splice

S1384.1.6 Outline the inspection procedures to determine the condition of fibre rope:

- identify common fibre rope defects
- identify and record inspection results
- describe appropriate measures to take for defective fibre rope

S1384.1.7 Outline the requirements for maintenance procedures for fibre rope:

- cleaning
- storing

S1384.1.8 Describe rigging procedures and applications for fibre rope:

- determine required application for rigging
- calculate and specify the required rope size
- perform safe lifting procedures following the specified criteria

Number:	S1384.2		
Title:	**Reeving**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: U0896.02, U0896.03, U0896.04, U0896.05, U0896.09, U0903.04, U0903.05			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform reeving procedures for blocks, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1384.2.1 Define/identify reeving terms:

- define reeving
- define lacing
- identify parts of line
- identify lead line pull/pull line effort
- identify mechanical advantage

S1384.2.2 Identify and maintain reeving equipment components:

- identify reeving components
- identify parts of block
- identify reeving component maintenance requirements
- maintain components according to required procedures and schedules

S1384.2.3 Describe the safety procedures required for reeving:

- identify hazardous conditions
- Identify PPE
- describe safe working practices
- determine required safe anchorage points

S1384.2.4 Describe the equipment and material set up required to perform reeving procedures:

- explain the advantages between reeving and lacing
- describe the equipment and material set up procedures
- select the appropriate reeving procedures for specified applications
- perform the preparation and set up procedures for reeving

S1384.2.5 Outline inspection and testing of a reeving system:

- perform visual inspection of reeving systems and compare to specifications
- perform a reeving system test and make any necessary adjustments

S1384.2.6 Identify the sequence involved in the assigned reeving operations and securing procedures:

- apply safe working practices for reeving

Number:	S1384.3		
Title:	**Rigging Calculations**		
Duration:	Total Hours: 20	Theory: 15	Practical: 5
Cross Reference to Training Standard: U0896.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to determine the required rigging materials and capacities to perform lifts, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1384.3.1 Identify and select appropriate rigging components

S1384.3.2 Identify rigging material weight capacities:

- interpret capacity charts
- determine capacity using rules of thumb formula

S1384.3.3 Determine the sequence involved in completing metric and imperial weight conversions:

- metric units
- imperial units

S1384.3.4 Determine the sequence involved in completing the required calculations to perform safe rigging:

- calculate area
- calculate volume
- calculate mass
- calculate linear measurement
- calculate simple equations
- calculate centre of gravity
- calculate weights of structural shapes

S1384.3.5 Determine the sequence involved in completing the required calculations to solve rigging problems:

- identify typical rigging related problems
- describe the calculations required to solve rigging problems
- perform required calculations to solve rigging related problems

S1384.3.6 Determine the sequence involved in completing required calculations for safe reeving procedures:

- calculate mechanical advantages
- calculate velocity ratios
- calculate safe working capacities
- identify applicable safety factors
- calculate rope sizes
- determine system loads at anchor points
- determine effective loads and pull line effort/lead line pull

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
45%	25%	0%	0%	30%

Number:	S1385		
Title:	**Structural Steel and Platework**		
Duration:	Total Hours: 54	Theory: 26	Practical: 28
Prerequisites:	None		
Content:	S1385.1	Hand Tools	
	S1385.2	Power Tools and Equipment	
	S1385.3	Blueprints and Drawings	
	S1385.4	Fabrication of Members	
	S1385.5	Layout	
	S1385.6	Installation and Securing	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Structural Steel Erection Manual for Ironworkers
CISC Standard of Practice
Ironworker Fabrication Manual
Introduction to Blueprint Reading Manual
Layout Instruments for Ironworkers

Number:	S1385.1		
Title:	**Hand Tools**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standard: U0897.01, U0893.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to use and maintain hand tools to fabricate, assemble and disassemble structural steel and platework projects, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1385.1.1 Define the purpose and fundamentals of trade related hand tools:

- basic purpose for each type of hand tool

S1385.1.2 Describe the construction features, types and applications of trade related hand tools:

- layout devices
  - tape measure
  - marking gauge
  - combination square
  - bevel square
  - divider
  - square
  - level
  - scratch awl
  - plumb bob and line
- hammering tools
  - ball peen hammer
  - mallet
  - sledge hammer
- cutting tools
  - hand saws
  - chisels
- drive systems
  - screwdrivers
  - ratchets and sockets
- clamping devices

- threading tools
  - taps and dies
- sharpening stone
- erection wrenches
- connecting bar
- aligning pins
- adjustable wrenches

S1385.1.3 Explain the operating principles of trade related hand tools:

- tool holding/securing methods
- applications

S1385.1.4 Identify the steps involved in inspection, evaluation and maintenance of trade related hand tools:

- visual inspection for:
  - fractures
  - wear
  - damaged cutting edges
  - mushroomed ends
  - sharpness
- calibration checks for:
  - levels
  - squares
- maintenance procedures for hand tools:
  - sharpening
  - lubricating
  - aligning
  - adjusting
  - tightening
  - corrosion protection

S1385.1.5 Describe the appropriate use of hand tools to perform trade related tasks:

- cutting
- grinding
- drilling
- lay-out
- sharpening
- thread cutting
- hammering
- tightening

Number:	S1385.2		
Title:	**Power Tools and Equipment**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standard: U0897.01, U0897.06, U0897.07, U0897.08, U0893.02, U0893.03, U0893.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to use and maintain power tools and equipment to fabricate, assemble and disassemble structural steel and platework projects, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1385.2.1 Define the purpose and fundamentals of trade related power tools and equipment:

- basic purpose for each type of portable power tools

S1385.2.2 Describe the types and applications of trade related power tools and equipment:

- bench grinder
- magnetic drill
- impact wrenches
- multiplier
- rivet buster/helldog
- F1852 spline drive
- electric torque stall
- chisel
- scaler
- hydraulic jacks
- hydraulic Ironworker
- screwgun
- Nibbler
- laser
- digital theodolite
- skidmore
- hand drills

- hand grinders
  - angle
  - in-line
- saws
  - reciprocating saw
  - jig saw
  - circular saw
  - portable band saw
  - band saw
  - chain saw
  - hand held cut off saw

S1385.2.3 Explain the operating principles of trade related power tools and equipment:

- power sources for portable power tools:
  - electrical
  - cordless
  - pneumatic
  - hydraulic
  - gas engine
  - powder actuated

S1385.2.4 Identify the steps involved in inspection, evaluation and maintenance of trade related power tools and equipment:

- visual inspection for:
  - case fractures
  - wear
  - frayed wiring
  - loose components
  - air leaks on pneumatic tools
  - broken or bent plugs
- maintenance procedures for power tools:
  - lubrication
  - tightening of fasteners
  - repair of electrical cords
  - adjusting
  - tightening

S1385.2.5 Describe the correct use of power tools and equipment to perform trade related tasks:

- cutting
- grinding
- drilling
- sharpening
- thread repair
- tensioning
- cleaning
- securing/fastening

Number:	S1385.3		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 15	Theory: 13	Practical: 2

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.06, U0897.09, U0897.10, U0897.11, U0897.12, U0897.13, U0897.15, U0892.01, U0891.02, U0891.03

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints and drawings, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1385.3.1 Explain terms, symbols, types and definitions of structural steel blueprints.

- identify and explain abbreviations, lines and symbols
- define trade related terms for layout and drafting work
- identify blueprint types and applications including plans, elevations, sections and details

S1385.3.2 Identify materials used for structural steel and platework:

- identify structural steel and plate shapes and materials
- select the specified structural steel materials
- determine measurements of structural steel materials

S1385.3.3 Describe the application of specific knowledge and usage of blueprints to structural steel erection:

- interpret notes and revisions to drawings
- relate erection drawings to appropriate fabrication drawings
- explain structural steel work activities based on the of drawings and specifications

S1385.3.4 Identify the sequence required to perform the required planning and calculations to determine the specified structural steel procedures for an assigned project:

- outline planning and coordinating techniques
- estimate requirements for time, manpower, tools and equipment
- calculate and establish elevations
- determine loads
- establish dimensions
- determine structural steel reinforcing locations

S1385.3.5 Identify the sequence involved in the performance of layout from drawings for structural steel and platework:

- structural steel layout
- platework layout

Number:	S1385.4		
Title:	**Fabrication of Members**		
Duration:	Total Hours: 10	Theory: 4	Practical: 6
Cross Reference to Training Standard: U0897.15, U0892.01, U0893.01, U0893.02			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform the fabrication of members, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1385.4.1 Explain drawings related to the fabrication of structural steel members:

- identify abbreviations, lines and symbols
- define related terms for drawings
- identify blueprint types and applications
- explain structural steel member fabrication drawings and specifications

S1385.4.2 Describe the criteria for selection of materials used for structural steel members:

- identify materials and shapes for structural steel and plate members
- select specified structural steel members
- perform measurements of structural steel members

S1385.4.3 Identify the sequence of layout for the fabrication of structural steel members:

- perform layout of materials to fabricate structural steel members
- inspect and verify that the layout matches specifications

S1385.4.4 Outline the steps in fabrication and assembly for the specified members for structural steel and platework:

- identify the required tools to cut and assemble structural steel members
- use tools to fabricate structural steel members
- use tools to assemble structural steel members

Number:	S1385.5		
Title:	**Layout**		
Duration:	Total Hours: 8	Theory: 2	Practical: 6
Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.05, U0897.06, U0897.12, U0897.15			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform layout of structural steel and platework members, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1385.5.1 Determine layout locations, benchmarks and reference points of structural steel or platework:

- set up and adjust levelling devices
- use levelling devices to establish layout locations, lines and points

S1385.5.2 Describe the sequence involved in the performance of an inspection of layout for anchorage points:

- inspect placement of anchorage points
- inspect orientation of anchorage points
- inspect projection of anchorage points
- identify the condition of anchorage points

S1385.5.3 Describe the sequence involved in the performance of layout for structural steel or platework fabrication:

- perform layout and measure the position of members
- record anchorage points
- calculate distances and elevations
- perform adjustments based on calculations to conform to specifications

Number:	S1385.6		
Title:	**Installation and Securing**		
Duration:	Total Hours: 15	Theory: 3	Practical: 12

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.04, U0897.05, U0897.06, U0897.07, U0897.08, U0897.09, U0897.10, U09897.11, U0897.12, U0897.15, U0898.01, U0898.02, U0898.05, U0898.06

General Learning Outcomes

Upon successful completion, the apprentice is able to perform basic installation, fastening and tensioning procedures for structural steel and platework, in accordance with manufacturer recommendations and accepted industry standard.

Learning Outcomes and Content

S1385.6.1 Describe the sequence involved in the performance of safe methods to rig and hoist basic structural steel and platework members:

- identify structural steel and platework members
- identify the specific methods to rig and hoist structural steel and platework members
- perform basic rigging and hoisting procedures for structural steel and platework

S1385.6.2 Identify safe method to connect structural steel and platework members:

- explain the *OHSA* recommendations for the safe connection of structural steel and platework members
- perform basic connections of structural steel and platework members

S1385.6.3 Identify methods of securing structural steel and platework:

- metric/imperial bolts
- fastener thread terminology
- fastener grades
- nuts and washer construction
- fastener locking devices
- fastener corrosion protection
- pinned connections
- tension indicating fasteners
- splice fracture fasteners
- welded connections

S1385.6.4 Explain the safe method to install and tension structural steel members:

- explain techniques to perform tensioning including turn of nut, tension indicating washer and F1852 fasteners
- perform fastener installation
- perform basic fastener tensioning procedures
- calibrate tools used in tensioning fasteners
- perform pre-installation verification
- inspect fastener installation

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
30%	30%	10%	0%	30%

Number:	S1386		
Title:	**Cranes**		
Duration:	Total Hours: 30	Theory: 25	Practical: 5
Prerequisites:	None		
Content:	S1386.1	Types and Configurations	
	S1386.2	Principles of Operation	
	S1386.3	Pre-Lift Planning and Setup	
	S1386.4	Operating Procedures	
	S1386.5	Erection and Dismantlement	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging For Ironworkers
Cranes Reference Manual

Number:	S1386.1		
Title:	**Types and Configurations**		
Duration:	Total Hours: 8	Theory: 8	Practical: 0
Cross Reference to Training Standard: U0903.01, U0903.02, U0903.03, U0903.04, U0903.05, U0903.06			

General Learning Outcomes

Upon successful completion, the apprentice is able to identify crane types and configurations.

Learning Outcomes and Content

S13861.1 Identify crane types:

- mobile/rough terrain
- crawler
- hydraulic
- industrial pick and carry
- conventional
- tower
- mobile tower
- heavy lift
- overhead

S1386.1.2 Identify crane boom configurations:

- luffing jib
- fixed jib
- rear-pivoted luffing jib
- retractable hydraulic boom
- lattice boom
- stiff leg
- guy derrick
- Chicago boom
- boom extension

Number:	S1386.2		
Title:	**Principles of Operation**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross Reference to Training Standard: U0903.01, U0903.02, U0903.03, U0903.04, U0903.05, U0903.06			

General Learning Outcomes

Upon successful completion, the apprentice is able to demonstrate knowledge of the principles of operation of cranes.

Learning Outcomes and Content

S1386.2.1 Demonstrate principles of crane operation:

- center of gravity
- leverage
- rotation of upper works
- backward stability
- structural failure
- wire rope safety factors
- overloading

S1386.2.2 Identify quadrants of crane operation:

- define and identify quadrants
- define and identify sweep area
- carrier mounted
- rough terrain
- crawler mounted
- boom truck

S1386.2.3 Interpret crane load charts:

- crane base and boom configuration
- quadrants of operation
- boom length
- boom angle
- load radius
- capacity limits
- gross capacity
- net capacity
- parts of line

S1386.2.4 Identify factors that affect crane capacity:

- machine condition
- eccentric reeving
- outriggers
- footing
- level
- side loading
- increase of load radius/boom deflection
- rapid swing rate
- impact loading
- wind

Number:	S1386.3		
Title:	**Pre-lift Planning and Setup**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2

Cross Reference to Training Standard: U0903.01, U0903.02, U0903.03, U0903.04, U0903.05, U0903.06, U0892.01, U0892.02, U0892.03, U0892.04, U0892.05, U0892.06, U0892.07

General Learning Outcomes

Upon successful completion, the apprentice is able to perform pre-lift planning of mobile cranes, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1386.3.1 Determine factors that may affect crane placement:

- identify and clear obstacles
- identify ground conditions
- identify overhead hazards
- identify underground utilities

S1386.3.2 Describe the selection criteria for an appropriate crane:

- determine maximum load radius
- determine maximum load height
- determine maximum load
- determine optimum boom configuration

Number:	S1386.4		
Title:	**Operating Procedures**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: U0903.01, U0903.02, U0903.03, U0903.04, U0903.06, U0896.08			

General Learning Outcomes

Upon successful completion, the apprentice is able to identify and demonstrate operating procedures of cranes in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1386.4.1 Identify responsibilities:

- crane owner
- crane operator
- site supervision
- rigger

S1386.4.2 Identify hazards:

- factors affecting stability
- rate of tipping
- overloading
- rapid acceleration/deceleration
- critical lifts
- test lifts
- hitting the boom
- power lines
- boom back
- transmitters

S1386.4.3 Demonstrate communication:

- international hand signals
- helicopter hand signals
- overhead crane hand signals
- radio communication
- multiple signal person relay

S1386.4.4 Identify procedures for specialty crane lifts:

- tilt up
- pick and carry
- multiple crane lifts
- using main and auxiliary lines
- equalizer beams
- tailing procedure

Number:	S1386.5		
Title:	**Erection and Dismantlement**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross Reference to Training Standard: U0903.01, U0903.02, U0903.03, U0903.04, U0903.05, U0903.06			

General Learning Outcomes

Upon successful completion, the apprentice is able to demonstrate the theory related to erecting and dismantling mobile cranes, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1386.5.1 Describe the sequence of erecting and dismantling a hydraulic boom:

- extend boom
- swing out jib
- jib extension/stinger
- pinned boom extension
- luffing jibs
- offset jibs
- multiple sheave block

S1386.5.2 Describe the sequence of erecting and dismantling a crawler base:

- prepare base/set-up area
- set blocking/mats/grillage

S1386.5.3 Describe the sequence of erecting and dismantling a conventional crane boom:

- short boom procedure
- long boom procedure
- handling sections
- dunnage placement
- jib configurations
- pendant lines
- multiple sheave block
- single part line
- wedge socket

S1386.5.4 Describe the sequence of erecting and dismantling a truck mounted crane:

- prepare base/set-up area
- set outrigger blocking/mats
- extend outrigger
- level crane

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
55%	15%	0%	0%	30%

Summary of Recommended Equipment for Level 1

- Classroom Facilities
  Appropriately lit and ventilated classroom capable of seating 20 students including:
  - Whiteboard
  - Television
  - VCR/DVD
  - Overhead Projector
  - Laptop with speakers
  - Multimedia Projector
  - Flipchart
  - Slide Projector
  - Projector Screen
  - Calculators (20)

- Tools
  - Chipping Hammers (20)
  - Wire Brushes (20)
  - Welding Shield (20)
  - Welding Jackets (20)
  - Welding Gloves (20)
  - C-grips (20)
  - Sharpening Stone
  - C-clamps (20)
  - Vice Grips (20)
  - Files (20)
  - Smokeater (5)
  - Fillet Gauges (5)
  - Numbered Punch set
  - Lettered Punch set
  - Appropriate CC AC/DC welding machines to accommodate each student 250A (20)
  - Bench Grinder (5)
  - Fit-up Table (2)
  - 7″ Angle Grinders (10)
  - 4½″ Angle Grinders (5)
  - Vices (5)
  - Combination Square (20)
  - Tape measure 25′/8m (20)
  - Lens Cleaning Station (2)
  - Appropriate Fire Extinguisher
  - Face shields (10)
  - Safety Glasses (20)
  - Burning Table with Grizzly (2)

- Steel Sawhorses (10)
- Exacto Knife (5)
- Layout/Assembly Area Minimum 5000 square feet
- Rope Blocks 2-3 sheave capacity (20)
- Fiber Line: (1000′)
- Manila
- Polypropylene
- Nylon
- Rope Cutters (2)
- Fids (5)
- Multi Storey 1000 square foot structural building
- Scaffold equipment
- Slings (20):
- Fibre Line
- Calculators (20)
- 55 Ton Ironworker
- Mag-Drill
- Layout/Assembly Area Minimum 5000 square feet
- Hacksaws (10)
- Hosfelt Bender
- Scroll Bender
- Portable Band Saw
- Band Saw
- Line Burner
- Oxy-Acetylene Burning/Welding outfits on portable carts (10)
- Strikers (20)
- Burnbacks/flash arrestors (20)
- Burning Goggles (20)
- Tip Cleaners (5)
- Soapstone
- Scribers (5)
- Compass (5)
- Center punch (5)
- Drill Press (2)
- 14″ Cut off abrasive saw (2)
- W12 35 foot column erected with recoiling fall arrest
- Fork Truck 4Ton capacity
- Drill bit index (5)
- Hand Drills (5)
- Tap and Die index
- 2 foot Framing Square (20)
- Chalk Lines (20)
- Plumb Bobs (5)
- Try-square (1)
- Bevel Square (20)

- Structural Belts (20) containing:
  - Belt
  - Back Pad
  - Frog
  - 1 ¼″ Spuds (2)
  - Pin Holder
  - Bull Pin
  - Adjustable 12″
  - 4lb. Beater
  - Bolt Bag
- Fall Arrest Harness with two shock absorbing Lanyards (20)
- Fall Arrest Stanchions (10)
- First Aid Station (5)
- Travel Restraint equipment
- Hard Hats (20)
- Face Shields (10)
- Levels:
  - 4′ (2)
  - 2′ (2)
  - Torpedo (2)
- Metric Socket Set
- Imperial Socket Set
- Ratchet
- Johnson Bar
- Pry bar
- Imperial Impact Socket Set
- Torque Wrench
- Skidmore
- Electric or Air Ratchet Impact Gun (2)
- Metric Spanner Set
- Imperial Spanner Set
- Metric Allen Key Set
- Imperial Allen Key Set
- Sledgehammer
- Barrel Pins (20)
- Backing out hammer
- Helldog/rivet buster
- Material rack
- Plate Rack
- GMAW Setup with Power Source (2)
- FCAW Setup with Power Source (2)
- GTAW Setup with Power Source and Foot Pedal (2)
- Rod Oven (2)
- Ground Clamps (20)
- Electrode Holders (20)

- Separately Ventilated Weld Shop (5000 square feet)
- Booths for Position Welding to Accommodate Each Student (20)
- CC AC/DC welding machines to accommodate each student 250A
  Slings (20):
  - wire rope
  - nylon
  - safety spreaders
  - chain spreaders
- Spreader Beam/Bar
- Two-way radio
- Rigging hardware (shackles, cable clamps, hooks, turnbuckles)
- Chainfalls (2)
- Comealongs (2)
- Tirfor
- Fibre line of sufficient length for tagging loads
- Power Elevated Working Platform
- 0-8T carry deck crane

Level 2

Program Summary of Reportable Subjects – Level 2

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1387	Welding	42	4	38
1388	Rigging	84	53	31
1389	Structural Steel and Platework	78	33	45
1390	Machinery Moving	36	27	9
	Total	**240**	**117**	**123**

Number:	S1387		
Title:	**Welding**		
Duration:	Total Hours: 42	Theory: 4	Practical: 38
Prerequisites:	None		
Content:	S1387.1	Blueprints, Drawings and Symbols	
	S1387.2	Shielded Metal Arc Position Welding	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Ironworker Quality Construction Practices
Introduction to Welding Shielded Metal Arc Welding
Oxy-fuel gas cutting and Welding
Structural Steel Erection Manual for Ironworkers

Number:	S1387.1		
Title:	**Blueprints, Drawings and Symbols**		
Duration:	Total Hours: 2	Theory: 2	Practical: 0
Cross Reference to Training Standard: U0895.01, U0892.01			

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprint, drawings and symbols related to shielded metal arc welding projects, in accordance with the requirements of the specified trade related task.

Learning Outcomes and Content

S1387.1.1 Identify and explain welding related terms and symbols.

S1387.1.2 Identify and select shielded metal arc welding base materials:

- identify joint types
- define physical properties of base metal

S1387.1.3 Identify and explain the specified shielded metal arc welding procedures:

- define visual weld faults
- define non-visual weld faults
- define testing methods

S1387.1.4 Identify and explain the blueprint or drawing layout specifications.

S1387.1.5 Explain the procedures involved in the performance of shielded metal arc welding project layout.

Number:	S1387.2		
Title:	**Shielded Metal Arc Position Welding**		
Duration:	Total Hours: 40	Theory: 2	Practical: 38
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.04, U0891.01, U0891.05			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform shielded metal arc position welding procedures, in accordance with CWB specifications and the requirements of the specified trade related tasks, primarily focusing on horizontal and vertical positional welding and progressing to overhead position welding.

Learning Outcomes and Content

S1387.2.1 Perform shielded metal arc position welding equipment set-up and assembly:

- electrode selection
- ground clamping positions
- material preparation

S1387.2.2 Perform shielded metal arc welding equipment adjustment procedures:

- amperage settings

S1387.2.3 Explain the procedures involved in the performance of shielded metal arc flat welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1387.2.4 Explain the procedures involved in the performance of shielded metal arc horizontal welding to CWB specifications.

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1387.2.5 Explain the procedures involved in the performance of shielded metal arc vertical welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1387.2.6 Explain the procedures involved in the performance of shielded metal arc overhead welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
5%	65%	0%	0%	30%

Number:	S1388			
Title:	**Rigging**			
Duration:	Total Hours: 84		Theory: 53	Practical: 31
Prerequisites:	None			
Content:	S1388.1	Wire Rope		
	S1388.2	Rigging Hardware		
	S1388.3	Slings		
	S1388.4	Hoisting Equipment		

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging for Ironworkers
Pocket rigging guide
Ironworker Foreman Pocket Guide
Hoisting and Rigging Safety Manual

Number:	S1388.1		
Title:	**Wire Rope**		
Duration:	Total Hours: 36	Theory: 20	Practical: 16

Cross Reference to Training Standard: U0896.01, U0896.02, U0896.03, U0896.04, U0896.05, U0896.09

General Learning Outcomes

Upon successful completion, the apprentice is able to use specified type of wire rope for rigging and hoisting, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1388.1.1 Identify types and applications of wire rope:

- wire rope types
- wire rope grades
- wire rope constructions
- wire rope lay
- wire rope cores
- wire rope applications

S1388.1.2 Identify specified safe rigging procedures for hoisting with wire rope:

- determine the appropriate wire rope application for specified rigging requirements
- perform the calculations required to determine the required wire rope diameter
- perform the calculations required to determine the tension applied
- assemble required components
- inspect rigging assembly
- perform a safe specified lift

S1388.1.3 Describe the condition of wire rope:

- identify common defects in wire rope
- identify criteria for removal of wire rope from service
- record rope condition
- determine safety factor for the specific condition of wire rope
- outline the appropriate action for defective wire rope

S1388.1.4 Describe the maintenance procedures for wire rope:

- cleaning
- lubricating
- storage

S1388.1.5 Identify specified safe rigging procedures for hoisting with wire rope:

- determine the appropriate wire rope application for specified rigging requirements
- perform the calculations required to determine the required wire rope diameter
- perform the calculations required to determine the tension applied
- assemble required components
- inspect rigging assembly
- perform a safe specified lift

Number:	S1388.2		
Title:	**Rigging Hardware**		
Duration:	Total Hours: 11	Theory: 8	Practical: 3

Cross Reference to Training Standard: U0896.01, U0896.02, U0896.03, U0896.04, U0896.05, U0896.09, U0892.06

General Learning Outcomes

Upon successful completion, the apprentice is able to identify, select and apply the appropriate rigging hardware to perform safe lifts in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1388.2.1 Define rigging hardware terms:

- define shackle types
- define hook types
- define ring types
- define snatch block
- define sheave types
- define drum types
- define eye bolt types
- define turnbuckle types
- define swivel types
- define wedge sockets
- define basket sockets
- define swaged sockets
- define headache ball
- define block types
- define cable clamp types
- define spreader and equalizer beams

S1388.2.2 Identify and maintain rigging hardware equipment components:

- identify rigging components
- identify rigging equipment maintenance requirements

S1388.2.3 Describe the safe work practices required for use of rigging hardware:

- identify hazardous conditions
- identify PPE
- describe safe working practices
- determine required safe rigging points

S1388.2.4 Outline the sequence required to perform calculations for safe rigging operations:

- describe the equipment and material set up procedures
- calculate the mechanical advantages
- calculate velocity ratios
- calculate safe working capacities
- identify applicable safety factors
- determine safe working capacity from catalogue charts
- determine safe working capacity reduction for various rigging hardware applications

S1388.2.5 Describe the selection criteria for the appropriate rigging hardware required for rigging procedures.

S1388.2.6 Identify the steps involved in inspection and test of a rigging system:

- perform a visual inspection of rigging systems and compare to specifications
- perform a rigging system test and make necessary adjustments

S1388.2.7 Define the requirements involved in performing the assigned rigging operations and securing procedures:

- apply safe working practices for rigging
- perform a lift using the assigned rigging arrangement

Number:	S1388.3		
Title:	**Slings**		
Duration:	Total Hours: 21	Theory: 15	Practical: 6
Cross Reference to Training Standard: U0896.01, U0896.02, U0896.03, U0896.04, U0896.05, U0896.09			

General Learning Outcomes

Upon successful completion, the apprentice is able to identify, select and apply the appropriate slings, in accordance with accepted industry standards and the requirements of assigned trade related projects

Learning Outcomes and Content

S1388.3.1 Identify types and applications of slings:

- types
  - chain
  - wire rope
  - synthetic fibre
  - metal mesh
- applications

S1388.3.2 Identify safe working loads for slings:

- calculate safe working capacity using rule of thumb formula
- determine safe working capacity using catalogue charts
- identify safety factors
- identify hazardous conditions
- determine safe working capacity of sling configurations
  - single vertical hitch
  - basket hitches
  - bridle hitches
  - choker hitches
  - two eyes and a bight

S1388.3.3 Outline the inspection procedures to determine the condition of slings:

- identify common sling defects
- identify and record inspection results
- determine safety for slings
- identify criteria for removal from service
- determine safety factor for the specific condition of sling
- outline the appropriate action for defective sling

S1388.3.4 Identify the maintenance procedures for slings:

- cleaning
- lubricating
- storing

S1388.3.5 Describe assembly procedures for slings:

- determine required application for slings
- calculate or determine the required sling sizes and number
- perform safe lifting procedures following accepted industry standards

S1388.3.6 Describe techniques to perform lifts with slings in accordance *OHSA* and accepted industry standards.

Number:	S1388.4		
Title:	**Hoisting Equipment**		
Duration:	Total Hours: 16	Theory: 10	Practical: 6

Cross Reference to Training Standard: U0896.01, U0896.02, U0896.03, U0896.05, U0896.09, U0892.05, U0896.08

General Learning Outcomes

Upon successful completion, the apprentice is able to identify, select and apply the appropriate hoisting equipment in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1388.4.1 Describe types and applications of hoisting equipment used for rigging activities:

- identify and define manually-operated hoisting equipment
  - come-along
  - chainfall
  - tirfor
  - genie lift
  - beam clamp
  - plate clamp
- identify and define power-operated hoisting equipment
  - tugger
  - electric chain hoist
  - roustabout

S1388.4.2 Identify safe working capacities for hoisting equipment:

- determine safe working capacity
- determine safety requirements for hoisting equipment
- hazardous conditions
- identify personal protective equipment

S1388.4.3 Describe international hand signals and other forms of communication.

S1388.4.4 Outline the inspection procedures to determine the condition of hoisting equipment:

- identify common defects
- identify and record inspection results
- describe appropriate measures to take for defective hoisting equipment

S1388.4.5 Describe the sequences required to perform maintenance procedures for hoisting equipment:

- cleaning
- lubricating
- storage

S1388.4.6 Identify assembly procedures for hoisting equipment:

- determine required application for hoisting equipment
- determine the required hoisting equipment sizes
- perform safe lifting procedures following the specified criteria

S1388.4.7 Describe techniques used to perform lifts with hoisting equipment in accordance with the accepted industry standards:

- observe specified safety requirements under *OHSA*

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
35%	25%	0%	10%	30%

Number:	S1389		
Title:	**Structural Steel and Platework**		
Duration:	Total Hours: 78	Theory: 33	Practical: 45
Prerequisites:	None		
Content:	S1389.1	Blueprints and Drawings	
	S1389.2	Fabrication of members	
	S1389.3	Layout	
	S1389.4	Erection Methods	
	S1389.5	Installation and Securing	
	S1389.6	Alignment and Inspection	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Ironworker Structural Steel Erection Manual
Ironworker Fabrication Manual
Introduction to Blueprint Reading

Number:	S1389.1		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 11	Theory: 9	Practical: 2

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.04, U0897.05, U0897.06, U0897.07, U0897.08, U0897.09, U0897.10, U0897.11, U0897.12, U0897.15 , U0892.01, 0892.02, U0892.03, U0892.04, U0892.05, U0892.06, U0892.07

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints and drawings for structural steel and platework, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1389.1.1 Explain terms, symbols types and definitions of structural steel and platework blueprints:

- identify and explain abbreviations, lines and symbols
- define trade related terms for layout and drafting work
- identify blueprint types and applications
- explains structural steel and platework drawings and specifications

S1389.1.2 Identify materials used for structural steel and platework operations:

- identify structural steel and platework materials
- select the specified structural steel materials
- perform measurements of structural steel materials

S1389.1.3 Describe the planning and calculations required to determine the specified structural steel and platework procedures for an assigned project

- outline planning and coordinating techniques
- describe estimating requirements for time, manpower, tools and equipment
- calculate elevations
- calculate loads
- calculate dimensions
- calculate reinforcing locations

S1389.1.4 Explain drawings for specified structural steel and platework operations:

- structural steel layouts and drawings
- platework layouts and drawings

S1389.1.5 Apply knowledge and usage of blueprints to structural steel erection:

- interpret notes and revisions to drawings
- relate erection drawings with appropriate fabrication drawings
- explain structural steel work activities to drawings and specifications

Number:	S1389.2		
Title:	**Fabrication of Members**		
Duration:	Total Hours: 12	Theory: 4	Practical: 8
Cross Reference to Training Standard: U0897.10, U0897.15			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform the fabrication of structural steel and platework members, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1389.2.1 Explain drawings related to the fabrication of members for structural steel and platework:

- identify and explain abbreviations, lines and symbols
- define trade related terms for drawings
- identify blueprint types and applications
- explain member fabrication drawings and specifications

S1389.2.2 Identify selection criteria for materials used for structural steel and platework members:

- identify materials
- select the specified materials
- perform measurements of structural steel and platework members

S1389.2.3 Identify the correct procedures to layout for the fabrication of structural steel and platework members:

- perform layout of materials to fabricate structural steel members
- inspect and verify that the layout compares to specifications

S1389.2.4 Describe best practices to fabricate and assemble the specified members for structural steel and platework:

- identify the required cutting and assembly tools
- use tools to fabricate structural steel and platework members
- use tools to assemble structural steel and platework members

Number:	S1389.3		
Title:	**Layout**		
Duration:	Total Hours: 8	Theory: 2	Practical: 6
Cross Reference to Training Standard: U0897.01, U0897.10, U0897.15, U0893.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform layout of structural steel and platework members, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1389.3.1 Determine layout locations, benchmarks and reference points of structural steel or platework members:

- set up and adjust digital theodolites or levelling devices
- use digital theodolites or levelling devices to locate layout locations
- determine the location of specified lines, points and benchmarks

S1389.3.2 Describe the sequence in performing inspection of anchorage points for structural steel or platework members:

- inspect placement of anchorage points
- inspect orientation of anchorage points
- inspect projection of anchorage points
- identify the condition of anchorage points

S1389.3.3 Describe the procedures to perform layout for the fabrication of structural steel or platework members:

- perform layout and measuring the position of members
- record anchorage points
- calculate distances and elevations
- perform adjustments based on calculations to conform to specifications

Number:	S1389.4		
Title:	**Erection Methods**		
Duration:	Total Hours: 10	Theory: 5	Practical: 5

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.04, U0897.05, U0897.06, U0897.07, U0897.08, U0897.09, U0897.10, U0897.11, U0897.12, U0897.15, U0897.14, U0892.01, 0892.02, U0892.03, U0892.04, U0892.05, U0892.06, U0892.07

General Learning Outcomes

Upon successful completion, the apprentice is able to describe structural steel and platework material erection methods, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1389.4.1 Describe the required installation sequence for structural steel and platework materials:

- identify the safe sequence to install and assemble materials
- installation sequence to erect materials

S1389.4.2 Identify the required safety practices for structural steel and platework:

- identify potential hazardous conditions
- identify specified protective equipment
- describe the safe working practices
- determine equipment and material requirements
- apply specified safe working practices
- apply accepted industry standard practices for erection

S1389.4.3 Describe the installation of required falsework for specified structural steel and platework:

- define principles of falsework
- identify structural steel and platework projects that require falsework
- determine the required falsework
- erect falsework
- perform the removal procedures for falsework

S1389.4.4 Describe the procedures to erect structural steel and platework materials:

- identify erection methods
- position erection equipment in accordance with the industry standards
- position working platforms
- outline installation procedures for required fall-arrest systems

S1389.4.5 Describe the procedures to erect wind turbines:

- identify types and components of wind turbines
- identify erection methods for wind turbines
- position erection equipment in accordance with the industry standards

Number:	S1389.5		
Title:	**Installation and Securing**		
Duration:	Total Hours: 22	Theory: 6	Practical: 16

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.04, U0897.05, U0897.06, U0897.07, U0897.08, U0897.09, U0897.10, U0897.11, U0897.12, U0897.15, U0897.14, U0898.01, U0898.02, U0898.05, U0898.06

General Learning Outcomes

Upon successful completion, the apprentice is able to perform installation and fastening procedures for structural steel and platework, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1389.5.1 Identify the steps required to perform safe methods to rig and hoist structural steel and platework members:

- identifying structural steel and platework members
- identifying the specified methods for rigging and hoisting procedures
- perform rigging and hoisting procedures for structural steel and platework

S1389.5.2 Describe the methods used to setup and connect structural steel and platework members:

- explain the *OHSA* requirements for safe connection procedures
- perform the required setup procedures
- perform specified connection of members

S1389.5.3 Identify safe methods to secure structural steel and platework members:

- explain techniques to perform fastener tensioning
- perform the specified fastener securing procedures

Number:	S1389.6		
Title:	**Alignment and Inspection**		
Duration:	Total Hours: 15	Theory: 7	Practical: 8

Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.04, U0897.05, U0897.06, U0897.07, U0897.08, U0897.09, U0897.10, U0897.11, U0897.12, U0897.15, U0897.14, U0898.01, U0898.02, U0898.05, U0898.06, U0893.04

General Learning Outcomes

Upon successful completion, the apprentice is able to perform alignment and inspection procedures for structural steel and platework, in accordance with drawings and specifications of the assigned trade related task.

Learning Outcomes and Content

S1389.6.1 Describe the required alignment procedures for structural steel and platework members:

- identify the equipment required to align members
- select and place alignment equipment
  - turnbuckles
  - guy lines
  - lashing
  - cable clamps
  - tirfor
  - wedges
- perform adjustments using the aligning equipment
- perform permanent securing procedures when components are aligned to specifications

S1389.6.2 Describe the required inspection and documentation procedures for structural steel and platework:

- inspect the structural steel and platework and compare to drawings and specifications
- document deficiencies noted during the erection process

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
40%	30%	0%	0%	30%

Number:	S1390		
Title:	**Machinery Moving**		
Duration:	Total Hours: 36	Theory: 24	Practical: 12
Prerequisites:	None		
Content:	S1390.1	Blueprints and Drawings	
	S1390.2	Transportation Methods	
	S1390.3	Installation and Securing	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging for Ironworker Reference Manual
Cranes Reference Manual

Number:	S1390.1		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 11	Theory: 10	Practical: 1

Cross Reference to Training Standard: U0900.01, U0900.02, U0900.03, U0900.04, U0900.05, U0900.06, U0900.07, U0900.08, U0900.09

General Learning Outcomes

Upon successful completion, the apprentice is able to explain drawings and specifications required to move machinery, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1390.1.1 Explain blueprint terms and symbols related to machinery moving:

- identify and explain abbreviations and symbols
- define the trade terms for the layout requirements
- identify types of blueprints used for machinery moving
- explain the overall scope to the machinery moving task

S1390.1.2 Identify the equipment and components required to move machinery:

- material specifications
- material types and shapes

S1390.1.3 Describe the required calculations for machinery moving procedures:

- calculate elevations
- calculate loads
- calculate force required for inclined planes
- calculate load on anchor points for rigging
- calculate parts of line required for rigging equipment
- determine shoring requirements
- determine falsework and location requirements

S1390.1.4 Explain the drawings and layout required for a machinery moving project:

- determine type of drawings and layout methods

Number:	S1390.2		
Title:	**Transportation Methods**		
Duration:	Total Hours: 20	Theory: 15	Practical: 5
Cross Reference to Training Standard: U0900.02, U0900.03, U0900.04, U0900.05, U0900.09			

General Learning Outcomes

Upon successful completion, the apprentice is able to describe the appropriate transportation methods to move machinery in accordance with government safety regulations, accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1390.2.1 Describe the equipment installation sequence for safe and efficient machinery moving:

- identify the transportation methods used for machinery moving work
  - lateral move
  - vertical move
  - pick and carry
  - stand up/lay down
- identify the specific tools and equipment used to move machinery
  - pallet jack
  - fork truck
  - gantry crane
  - hydraulic gantry systems
  - skidding systems
  - rollers
  - multi rollers (skates)
  - inclined plane
  - strand jacking towers
  - jacks
  - jacking trailers
- identify the installation steps

S1390.2.2 Describe the specified rigging requirements for machinery moving work:

- identify related safety hazards
- identify PPE
- describe safe working practices for machinery moving
- determine the equipment and material requirements
- apply the safe working practices for machinery moving rigging activities

S1390.2.3 Identify the method to assemble required falsework for machinery moving:

- identify applications that require falsework for moving machinery
- determine the required falsework
  - floor plate
  - shoring
  - reinforcing
- perform falsework erection procedures
- perform falsework removal procedures

S1390.2.4 Identify the necessary accessory equipment assemblies required for machinery moving activities:

- position the required erection equipment
- position the required working platforms
- install the fall-arrest systems

Number:	S1390.3		
Title:	**Installation and Securing**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3

Cross Reference to Training Standard: U0900.01, U0900.02, U0900.03, U0900.04, U0900.05, U0900.06, U0900.07, U0898.03, U0898.04

General Learning Outcomes

Upon successful completion, the apprentice is able to install and secure machinery, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1390.3.1 Describe the required rigging and hoisting procedures to move machinery:

- install the required machinery moving equipment
- select and install the specified safe rigging and hoisting components
- use the appropriate communication methods to rig and hoist machinery

S1390.3.2 Identify setup procedures for machinery moving operations:

- identify the equipment setup procedures
- prepare machine bases
- prepare sole plates
- confirm anchor layout
- confirm elevation, orientation and position

S1390.3.3 Describe machinery moving operations.

- describe the precautions to observe when moving machinery
- move machinery to required location
- set machinery in final position

S1390.3.4 Describe specified securing procedures for machinery moving operations:

- identify securing methods
- secure machinery according to specifications

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
50%	20%	0%	0%	30%

Summary of Recommended Equipment for Level 2

- Classroom Facilities
  Appropriately lit and ventilated classroom capable of seating 20 students including:
  - Whiteboard
  - Television
  - VCR/DVD
  - Overhead Projector
  - Laptop with speakers
  - Multimedia Projector
  - Flipchart
  - Slide Projector
  - Projector Screen
  - Calculators (20)

- Tools
  - Chipping Hammers (20)
  - Wire Brushes (20)
  - Welding Shield (20
  - Welding Jackets (20)
  - Welding Gloves (20)
  - C-grips (20)
  - C-clamps (20)
  - Vice Grips (20)
  - Files (20)
  - Smoke Eater (5)
  - Fillet Gauges (5)
  - Numbered Punch set
  - Lettered Punch set
  - Appropriate CC AC/DC welding machines to accommodate each student 250A (20)
  - Bench Grinder (5)
  - Fit-up Table (2)
  - 7″ Angle Grinders (10)
  - 4½″ Angle Grinders (5)
  - Vices (5)
  - Combination Square (20)
  - Tape measure 25′/8m (20)
  - Lens Cleaning Station (2)
  - Appropriate Fire Extinguisher
  - Face shields (10)
  - Safety Glasses (20)
  - Burning Table with Grizzly (2)
  - Steel Sawhorses (10)

- Exacto Knife (5)
- Layout/Assembly Area Minimum 5000 square feet
- Rope Blocks 2-3 sheave capacity (20)
- Fiber Line: (1000′)
- Manila
- Polypropylene
- Nylon
- Rope Cutters (2)
- Fids (5)
- Multi Storey 1000 square foot structural building
- Scaffold equipment
- Slings (20):
- Fibre Line
- Calculators (20)
- 55 Ton Ironworker
- Mag-Drill
- Layout/Assembly Area Minimum 5000 square feet
- Hacksaws (10)
- Hosfelt Bender
- Scroll Bender
- Portable Band Saw
- Band Saw
- Line Burner
- Oxy-Acetylene Burning/Welding outfits on portable carts (10)
- Strikers (20)
- Burnbacks/flash arrestors (20)
- Burning Goggles (20)
- Tip Cleaners (5)
- Soapstone
- Scribers (5)
- Compass (5)
- Center punch (5)
- Drill Press (2)
- 14″ Cut off abrasive saw (2)
- W12 35 foot column erected with recoiling fall arrest
- Fork Truck 4Ton capacity
- Drill bit index (5)
- Hand Drills (5)
- Tap and Die index
- 2 foot Framing Square (20)
- Chalk Lines (20)
- Plumb Bobs (5)
- Try-square (1)
- Bevel Square (20)

- Structural Belts (20) containing:
  - Belt
  - Back Pad
  - Frog
  - 1 ¼″ Spuds (2)
  - Pin Holder
  - Bull Pin
  - Adjustable 12″
  - 4lb. Beater
  - Bolt Bag
- Fall arrest Harness with two shock absorbing Lanyards (20)
- Fall arrest Stanchions (10)
- First Aid Station (5)
- Travel Restraint equipment
- Hard Hats (20)
- Face shields (10)
- Levels:
  - 4′ (2)
  - 2′ (2)
  - Torpedo (2)
- Metric Socket Set
- Imperial Socket Set
- Ratchet
- Johnson Bar
- Pry bar
- Imperial Impact Socket Set
- Torque Wrench
- Skidmore
- Electric or Air Ratchet Impact Gun (2)
- Metric Spanner Set
- Imperial Spanner Set
- Metric Allen Key Set
- Imperial Allen Key Set
- Sledgehammer
- Barrel Pins (20)
- Backing out hammer
- Helldog/rivet buster
- Material Rack
- Plate Rack
- GMAW Setup with Power Source (2)
- FCAW Setup with Power Source (2)
- GTAW Setup with Power Source and Foot Pedal (2)
- Rod Oven (2)
- Ground Clamps (20)

- Electrode Holders (20)
- Separately Ventilated Weld Shop (5000 square feet)
- Appropriate Booths for Position Welding to Accommodate Each Student (20)
- Appropriate CC AC/DC welding machines to accommodate each student 250A Slings (20):
  - Wire rope
  - Nylon
  - Safety spreaders
  - Chain spreaders
- Spreader Beam/Bar
- Two-way radio
- Rigging hardware (shackles, cable clamps, hooks, turnbuckles)
- Chainfalls (2)
- Come-alongs (2)
- Tirfor
- Fibre line of sufficient length for tagging loads
- Power Elevated Working Platform
- 0-8T carry deck crane

Level 3

Program Summary of Reportable Subjects – Level 3

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
S1391	Ornamental and Miscellaneous Ironwork	72	21	51
S1392	Welding	54	21	33
S1393	Structural Steel and Platework	18	9	9
S1394	Curtain Wall	42	25	17
S1395	Machinery Moving	18	9	9
S1396	Automated Materials Handling Systems	36	19	17
	Total	**240**	**104**	**136**

Number:	S1391		
Title:	**Ornamental and Miscellaneous Ironwork**		
Duration:	Total Hours: 72	Theory: 21	Practical: 51
Prerequisites:	None		
Content:	S1391.1	Blueprints, Drawings and Symbols	
	S1391.2	Fabrication of Members	
	S1391.3	Layout	
	S1391.4	Erection Methods	
	S1391.5	Installation and Securing	
	S1391.6	Alignment and Inspection	

Evaluation and Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Architectural and Ornamental Ironworking
Ironworker Fabrication Manual
Ironworker Structural Steel Erection Manual
CISC Standard of Practice Manual

Number:	S1391.1		
Title:	**Blueprints, Drawings and Symbols**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2

Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09, U0892.01, U0892.02, U0892.03

General Learning Outcomes

Upon successful completion, the apprentice is able to explain symbols and drawings for ornamental and miscellaneous ironwork in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1391.1.1 Identify and define terms, symbols, types and applications for ornamental and miscellaneous ironwork:

- identify and explain abbreviations and symbols
- define layout and drafting terms
- identify types of blueprints
- explain work activities from drawings and specifications

S1391.1.2 Describe the required drawings for a specified ornamental and miscellaneous ironwork project:

- layout of project
- project specifications

S1391.1.3 Identify the specified materials required for ornamental and miscellaneous ironwork:

- identify material types
- identify material selection criteria

S1391.1.4 Describe the required planning for specified ornamental and miscellaneous ironwork procedures for an assigned project:

- outline planning and coordinating techniques
- describe estimating requirements for time, manpower, tools and equipment
- calculate elevations
- calculate loads
- establish dimensions
- reinforce locations

Number:	S1391.2		
Title:	**Fabrication of Members**		
Duration:	Total Hours: 28	Theory: 8	Practical: 20

Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09

General Learning Outcomes

Upon successful completion, the apprentice is able to perform fabrication procedures for ornamental and miscellaneous ironwork, in accordance with accepted industry standards for the assigned trade-related tasks.

Learning Outcomes and Content

S1391.2.1 Interpret drawings related to fabrication of ornamental and miscellaneous ironwork:

- identify types of drawings
- interpret drawings relating to:
  - stairs
  - landings
  - openings
  - lintels
  - headers
  - handrails
  - ladders
  - fences
  - doors
  - fire escapes
  - canopies
  - parapets
  - fascia
  - soffit
  - cladding
  - kickplate

S1391.2.2 Describe the construction features, types and applications of ornamental and miscellaneous ironwork.

- material types
- construction features and components
- applications

S1391.2.3 Describe procedures required to layout materials for fabrication of members following drawings and specifications:

- identify material position layout
- perform material layout
- perform inspection of layout and compare to specifications
- hand materials in accordance with safe working practices

S1391.2.4 Identify the procedures to cut, shape and fasten material to fabricate and assemble the specified ornamental and miscellaneous ironwork:

- perform cutting procedures
- perform shaping procedures
- perform member fabrication techniques
- perform member assembly procedures
- finish materials to specification

Number:	S1391.3		
Title:	**Layout**		
Duration:	Total Hours: 15	Theory: 5	Practical: 10
Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09			

General Learning Outcomes

Upon successful completion, the apprentice is able to layout ornamental and miscellaneous ironwork, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1391.3.1 Describe the specified reference point locations for ornamental and miscellaneous ironwork:

- determine the required benchmarks
- determine the required reference points / work points

S1391.3.2 Identify the placement and condition of ornamental and miscellaneous ironwork anchorage points:

- identify anchorage point location
- inspect anchorage point condition

S1391.3.3 Describe the techniques to perform the layout position for ornamental and miscellaneous ironwork anchorage points:

- perform anchorage point layout
- record anchorage point locations
- perform calculations for distance and spacing
- perform the required adjustments to conform to drawings and specifications
- establish correct layout for mitre cuts on single stringer
- establish correct layout for mitre cuts on dog leg stringer
- establish correct angles for mitre cuts on handrail sections
- establish correct lines for treads and risers

Number:	S1391.4		
Title:	**Erection Methods**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3

Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09, U0892.01, 0892.02, U0892.03, U0892.04, U0892.05, U0892.06, U0892.07

General Learning Outcomes

Upon successful completion, the apprentice is able to describe ornamental and miscellaneous erection methods, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1391.4.1 Describe the required installation sequence for ornamental and miscellaneous ironwork:

- identify the safe sequence to assemble ornamental and miscellaneous ironwork materials
- identify the most efficient sequence to assemble ornamental and miscellaneous ironwork materials

S1391.4.2 Identify the required safety practices for ornamental and miscellaneous ironwork:

- identify potential hazardous conditions
- identify specified protective equipment
- describe the safe working practices
- determine equipment and material requirements
- apply the specified safe working practices

S1391.4.3 Identify appropriate falsework for ornamental and miscellaneous ironwork.

S1391.4.4 Describe the required procedures to erect ornamental and miscellaneous ironwork materials.

S1391.4.5 Identify erection methods.

Number:	S1391.5		
Title:	**Installation and Securing**		
Duration:	Total Hours: 8	Theory: 2	Practical: 6

Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09, U0898.01, U0898.02, U0898.03, U0898.04, U0898.05, U0898.06, U0895.01

General Learning Outcomes

Upon successful completion, the apprentice is able to install and secure ornamental and miscellaneous materials, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1391.5.1 Describe the required rigging and hoisting techniques for ornamental and miscellaneous members:

- identify rigging techniques
- identify hoisting techniques
- identifying ornamental and miscellaneous ironwork members
- attach rigging to ornamental and miscellaneous members
- hoist ornamental and miscellaneous members

S1391.5.2 Identify the required materials to perform safe placement, connection and setup of ornamental and miscellaneous members:

- describe the safe placement, connection and setup practices
- perform the specified safe placement, connection and setup practices
- position the erection equipment
- position the specified working platforms
- install the required fall-arrest systems

S1391.5.3 Identify the required securing methods for ornamental and miscellaneous members:

- describe the recommended safe securing methods
  - welded connections
  - bolted connections
  - adhesive anchors
  - mechanical anchors
  - pinned connections
- perform the specified safe securing practices

S1391.5.4 Describe the practices involved in finishing ornamental and miscellaneous materials to specifications.

Number:	S1391.6		
Title:	**Alignment and Inspection**		
Duration:	Total Hours: 12	Theory: 2	Practical: 10
Cross Reference to Training Standard: U0899.01, U0899.02, U0899.03, U0899.04, U0899.05, U0899.06, U0899.07, U0899.08, U0899.09, U0898.06, U0893.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to align and inspect ornamental and miscellaneous ironwork materials, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1391.6.1 Describe the techniques for performing the alignment procedures for ornamental and miscellaneous ironwork components:

- identify the equipment required to align components
  - digital theodolites
  - total station
  - contractor level
  - spirit level
  - plumb bob
  - laser
- perform the selection and placement of alignment equipment
- perform adjustments using the aligning equipment
- perform permanent securing procedures when components are aligned to specifications

S1391.6.2 Describe the steps required for inspection and documentation procedures for ornamental and miscellaneous ironwork:

- inspect the work and compare to drawings and specifications
- document any deficiencies noted during the erection process

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
20%	30%	20%	0%	30%

Number:	S1392		
Title:	**Welding**		
Duration:	Total Hours: 54	Theory: 21	Practical: 33
Prerequisites:	None		
Content:	S1392.1	Blueprints and Drawings	
	S1392.2	Shielded Metal Arc Position Welding	
	S1392.3	Semi-Automatic Welding	
	S1392.4	Plasma Arc Cutting	
	S1392.5	Air Carbon Arc Cutting	
	S1392.6	Gas Tungsten Arc Welding	
	S1392.7	Submerged Arc Welding	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Shielded Metal Arc Welding
Oxy-fuel Gas Cutting and Welding
Flux Cored Arc Welding
Gas Tungsten Arc Welding
Gooderham Institute Weld Supervisor Manual
Interprovincial “Red Seal” Welder Upgrade Program (Book 1-4)

Number:	S1392.1		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 16	Theory: 15	Practical: 1

Cross Reference to Training Standard: U0894.01, U0894.02, U0894.03, U0894.04, U0894.05, U0894.06, U0894.07, U0895.01, U0895.02, U0895.03, U0895.04, U0895.05, U0895.06, U0895.07

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints and drawings related to welding projects, in accordance with the requirements of the specified trade related task.

Learning Outcomes and Content

S1392.1.1 Identify and explain welding related terms and symbols for groove welds.

S1392.1.2 Identify and select welding and cutting base materials:

- identify joint types
- define physical and mechanical properties of metal

S1392.1.3 Identify and explain the specified welding and cutting procedures:

- define visual weld faults
- define non-visual weld faults
- define testing methods

S1392.1.4 Identify and explain blueprint or drawing layout specifications.

S1392.1.5 Describe welding project layout procedures.

S1392.1.6 Identify and describe correct usage of fillet gauge.

Number:	S1392.2		
Title:	**Shielded Metal Arc Position Welding (SMAW)**		
Duration:	Total Hours: 20	Theory: 0	Practical: 20
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.04, U0895.06			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform shielded metal arc position welding procedures, in accordance with Canadian Welding Bureau (CWB) specifications and the requirements of the specified trade related tasks, in all positions focusing primarily on vertical and overhead position welding.

Learning Outcomes and Content

S1392.2.1 Describe shielded metal arc welding equipment adjustment procedures:

- amperage settings

S1392.2.2 Explain the procedures involved in the performance of shielded metal arc welding equipment set-up and assembly:

- electrode selection
- ground clamping positions
- material preparation

S1392.2.3 Explain the procedures involved in the performance of shielded metal arc flat welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1392.2.4 Explain the procedures involved in the performance of shielded metal arc horizontal welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1392.2.5 Explain the procedures involved in the performance of shielded metal arc vertical welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

S1392.2.6 Explain the procedures involved in the performance of shielded metal arc overhead welding to CWB specifications:

- electrode angles
- stringer beads
- electrode travel speeds
- arc length

Number:	S1392.3		
Title:	**Semi-Automatic Welding**		
Duration:	Total Hours: 8	Theory: 2	Practical: 6
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.05			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform Gas Metal Arc Welding (GMAW) and Flux Core Arc Welding (FCAW) procedures, in accordance with CWB specifications and the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1392.3.1 Define GMAW and FCAW semi-automatic welding equipment.

S1392.3.2 Identify semi-automatic welding equipment, components, materials and consumables:

- identify GMAW and FCAW equipment and components
- identify GMAW and FCAW consumables and materials

S1392.3.3 Describe safe operating procedures for semi-automatic welding equipment:

- identify safety hazards
- identify PPE
- describe safe working practices
- describe accepted trade practices for operating procedures

S1392.3.4 Explain the procedures involved in the performance of semi-automatic welding equipment set-up, assembly and maintenance procedures:

- polarity selection
- ground clamping positions
- material preparation
- voltage setting
- wire speed setting
- shielding gas selection
- adjustment procedures

S1392.3.5 Explain the procedures involved in the performance of semi-automatic welding to CWB specifications using the GMAW and FCAW process:

- ferrous materials
- non-ferrous materials
- fillet welds
- groove welds

S1392.3.6 Identify the inspection criteria for semi-automatic GMAW and FCAW welds according to CWB specifications:

- visually assess the quality of the GMAW and FCAW
- CAW weld and compare to CWB specifications

Number:	S1392.4		
Title:	**Plasma Arc Cutting**		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0895.01, U0895.07			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform plasma arc cutting procedures in accordance with CWB specifications and the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1392.4.1 Define plasma arc cutting equipment terms and definitions:

- identify related terms
- define related terms

S1392.4.2 Describe plasma arc equipment construction procedures:

- identify equipment components
- identify shielding gas

S1392.4.3 Describe the related safe operating procedures for plasma arc cutting equipment:

- identify safety hazards
- identify PPE
- describe safe working practices

S1392.4.4 Explain the procedures involved in the performance of plasma arc cutting equipment set-up, assembly and maintenance procedures:

- cutting tip selection
- ground clamping positions
- material preparation
- voltage settings
- adjustment procedures

S1392.4.5 Explain the procedures involved in the performance of plasma arc cutting:

- control distortion
- control cutting speeds

S1392.4.6 Define the inspection criteria for plasma arc cutting:

- visually assess the quality of the cutting process and compare to specifications

Number:	S1392.5		
Title:	**Air Carbon Arc Cutting**		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0895.01, U0895.07			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform arc gouging procedures, in accordance with CWB specifications and the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1392.5.1 Define arc gouging terms and equipment.

S1392.5.2 Describe arc gouging procedures and consumables:

- identify and select equipment components
- identify equipment setup procedures
- identify and select consumables and materials

S1392.5.3 Describe the related safety practices for arc gouging equipment:

- identify safety hazards
- identify PPE
- describe safe working practices

S1392.5.4 Explain the procedures involved in the performance of arc gouging equipment set- up, assembly and maintenance procedures, according to manufacturer recommendations:

- gouging electrode selection
- electrode placement
- travel direction
- air jet orientation
- polarity
- ground clamping positions
- material preparation
- voltage and amperage settings
- adjustment procedures
- compressed air settings

S1392.5.5 Explain the procedures involved in the performance of arc gouging, following accepted trade practice specifications:

- gouge out faults
- back gouging
- cut ferrous metals
- cut non-ferrous metals
- pierce holes

S1392.5.6 Describe the inspection criteria for arc gouging to trade specifications.

Number:	S1392.6		
Title:	**Gas Tungsten Arc Welding**		
Duration:	Total Hours: 4	Theory: 1	Practical: 3
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform Gas Tungsten Arc Welding (GTAW) procedure in accordance with CWB specifications and the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1392.6.1 Define GTAW equipment terms and definitions.

S1392.6.2 Identify semi-automatic welding equipment, components, materials and consumables:

- identify GTAW equipment and components
- identify GTAW consumables and materials

S1392.6.3 Describe the related safe operating procedures for GTAW equipment:

- identify safety hazards
- identify PPE
- safe working practices
- operating procedures

S1392.6.4 Explain the procedures involved in the performance of GTAW equipment set-up, assembly and maintenance procedures:

- polarity selection
- ground clamping positions
- material preparation
- amperage setting
- tungsten projection
- shielding gas selection
- adjustment procedures

S1392.6.5 Explain the procedures involved in the performance of GTAW to CWB specifications:

- ferrous materials
- non-ferrous materials
- fillet welds
- groove welds

S1392.6.6 Describe the inspection criteria for GTAW welds according to CWB specifications:

- visually assess the quality of the GTAW weld and compare to CWB specifications

Number:	S1392.7		
Title:	**Submerged Arc Welding**		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0895.01, U0895.02, U0895.06			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform SAW procedures in accordance with CWB specifications and the requirements of the specified trade related tasks.

Learning Outcomes and Content

S1392.7.1 Define submerged arc welding equipment terms.

S1392.7.2 Identify submerged arc welding equipment, components, materials and consumables:

- identify SAW equipment and components
- identify SAW consumables and materials

S1392.7.3 Describe related safe operating procedures for SAW equipment:

- identify safety hazards
- identify PPE
- describe safe working practices
- describe accepted trade practices for operating procedures

S1392.7.4 Explain the procedures involved in the performance of SAW equipment set-up, assembly and maintenance procedures:

- polarity selection
- ground clamping positions
- material preparation
- voltage setting
- wire speed setting
- shielding gas selection
- flux selection
- track setup
- track speed
- adjustment procedures

S1392.7.5 Explain the procedures involved in the performance of submerged arc welding to CWB specifications:

- ferrous materials
- non-ferrous materials
- groove welds

S1392.7.6 Describe the inspection criteria for submerged arc welds according to CWB specifications:

- visually assess the quality of the submerged arc weld and compare to CWB specifications

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
12%	58%	0%	0%	30%

Number:	S1393		
Title:	**Structural Steel and Platework**		
Duration:	Total Hours: 18	Theory: 9	Practical: 9
Prerequisites:	None		
Content:	S1393.1 Layout		
	S1393.2 Metal Building Systems Erection		

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Ironworker Structural Steel Erection Manual
Pre-Engineered Metal Building Systems
Layout Instruments for Ironworkers Reference Manual

Number:	S1393.1		
Title:	**Layout**		
Duration:	Total Hours: 12	Theory: 4	Practical: 8
Cross Reference to Training Standard: U0897.01, U0897.02, U0897.03, U0897.07, U0897.13			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform layout of structural steel members, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1393.1.1 Describe the techniques involved in layout of structural steel or platework from existing benchmarks and reference points:

- set up and adjust levelling devices/transits/theodolites/total stations
- use levelling devices to locate benchmarks and reference points
- determine the location of specified layout reference lines

S1393.1.2 Describe inspection of anchorage points for structural steel or plate work:

- inspect placement of anchorage points
- inspect the condition of anchorage points
- verify orientation
- verify projection

S1393.1.3 Explain verified position of structural steel or platework installation:

- perform layout and measure the position of members
- record anchorage points
- verify members are plumb
- verify assemblies are square
- perform swing angles
- calculate distances and elevations
- perform adjustments to conform to specifications and tolerances

Number:	S1393.2		
Title:	**Metal Building Systems Erection**		
Duration:	Total Hours: 6	Theory: 5	Practical: 1
Cross Reference to Training Standard: U0897.13			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform metal building systems erection, in accordance with manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1393.2.1 Describe the appropriate steps to plan and prepare for erection:

- unload members
- store and staging members
- conduct site evaluation
- verify anchor settings
- use levelling devices to locate benchmarks and reference points
- determine the location of specified layout reference lines
- organize fasteners

S1393.2.2 Identify primary and secondary structural framing members:

- bents
- purlins
- girts
- bracing
- tapered beams
- columns
- braced bay

S1393.2.3 Outline required steps to stabilize structure:

- install fasteners
- install bracing wall and roof

S1393.2.4 Explain the procedures for installation of wall materials:

- insulation
- siding
- door frames
- doors

S1393.2.5 Explain the procedures for installation of roof materials:

- insulation
- vents
- skylights
- roofing
- openings

S1393.2.6 Explain the procedures involved in the installation of accessories:

- flashing
- gutters
- trim

S1393.2.7 Identify position of metal building installation:

- perform layout and measure the position of members
- record anchorage points
- verify members are plumb
- verify assemblies are square
- perform swing angles
- calculate distances and elevations
- perform adjustments to conform to specifications and tolerances

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
20%	40%	10%	0%	30%

Number:	S1394			
Title:	**Curtain Wall**			
Duration:	Total Hours: 42		Theory: 25	Practical: 17
Prerequisites:	None			
Content:	S1394.1	Blueprints and Drawings		
	S1394.2	Members Fabrication		
	S1394.3	Layout		
	S1394.4	Erection Methods		
	S1394.5	Installation and Securing		
	S1394.6	Alignment and Inspection		

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Architectural and Ornamental Ironworking Reference Manual
Suspended Access Equipment
Layout Instruments for Ironworkers

Number:	S1394.1		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 15	Theory: 10	Practical: 5
Cross Reference to Training Standard: U0901.03, U0901.04, U0901.05, U0901.06, U0901.07, U0901.08, U0901.09, U0901.10, U0901.11, U0901.12			

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints, drawings and symbols for curtain wall in accordance with accepted specified industry standards and the requirements of assigned trade related projects

Learning Outcomes and Content

S1394.1.1 Identify and define terms, symbols, types and applications for curtain wall systems:

- identify and explain abbreviations and symbols
- define layout and drafting terms
- identify types of blueprints
- explain curtain wall work activities from drawings and specifications

S1394.1.2 Identify the specified materials required for curtain wall systems:

- identify material types
- identify material selection criteria

S1394.1.3 Describe the procedures required to plan and coordinate a curtain wall work project:

- outline planning and coordinating techniques
- describe estimating requirements for time, manpower, tools and equipment
- calculate elevations
- calculate loads
- identify and calculate dimensions
- identify reinforcing locations

Number:	S1394.2		
Title:	**Fabrication of Members**		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0901.01, U0901.03, U0901.04, U0901.05, U0901.06, U0901.07, U0901.12			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform fabrication procedures for curtain wall members, in accordance with accepted industry standards for the assigned trade related tasks.

Learning Outcomes and Content

S1394.2.1 Explain drawings related to the fabrication of curtain wall members:

- identify types of drawings
- interpret symbols
- explain drawings

S1394.2.2 Describe the construction features, types and application of curtain wall materials:

- material types
  - aluminium
  - stainless steel
  - granite and other stone materials
  - glass
- construction features
- applications

S1394.2.3 Determine the techniques for layout for the fabrication of curtain wall members following drawings and specifications:

- identify material position layout
- perform material layout
- perform inspection of layout and compare to specifications

S1394.2.4 Describe the procedures/techniques required to cut and shape materials to fabricate and assemble the specified curtain wall members:

- describe cutting procedures
- describe shaping procedures
- perform member fabrication techniques
- perform member assembly procedures

Number:	S1394.3		
Title:	**Layout**		
Duration:	Total Hours: 10	Theory: 5	Practical: 5
Cross Reference to Training Standard: U0901.04, U0901.08			

General Learning Outcomes

Upon successful completion, the apprentice is able to layout curtain wall members, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1394.3.1 Describe the specified reference point locations for curtain wall systems:

- determine required benchmarks and reference points
- determine elevations

S1394.3.2 Identify and describe the placement and condition of curtain wall anchoring points:

- identify anchorage point location
- identify anchorage point condition
- verify anchorage orientation
- verify anchorage elevation

S1394.3.3 Describe the techniques involve in layout for curtain wall components, positioning anchors and framing members:

- establish control lines
- perform anchorage point layout
- record the anchorage point locations
- perform the required adjustments to conform to drawings and specifications

Number:	S1394.4		
Title:	**Erection Methods**		
Duration:	Total Hours: 5	Theory: 5	Practical: 0

Cross Reference to Training Standard: U0901.01, U0901.02, U0901.03, U0901.04, U0901.05, U0901.06, U0901.07, U0901.08, U0901.09, U0901.10, U0901.11, U0901.12

General Learning Outcomes

Upon successful completion, the apprentice is able to demonstrate curtain wall system erection methods, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1394.4.1 Describe the required installation sequence for curtain wall systems:

- identify the safe sequence to assemble materials
- identify the most efficient sequence to assemble materials
- describe different system installation sequences
  - modular/unitized
  - stick
  - window wall

S1394.4.2 Identify the required safety practices for curtain wall systems:

- identify potential hazardous conditions
- identify PPE
- describe the recommended safe working practices
- determine equipment and material requirements
- apply the specified safe working practices

S1394.4.3 Describe the required procedures to erect curtain wall system components:

- identify erection methods
- identify specific rigging requirements
- identify specific erection equipment
- position the erection equipment in accordance with accepted trade standards
- position the specified working platforms
- install the required fall-arrest systems

Number:	S1394.5		
Title:	**Installation and Securing**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3

Cross Reference to Training Standard: U0901.01, U0901.02, U0901.03, U0901.04, U0901.05, U0901.06, U0901.07, U0901.08, U0901.09, U0901.10, U0901.11, U0901.12

General Learning Outcomes

Upon successful completion, the apprentice is able to install and secure curtain wall system components, in accordance with government safety regulations, drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1394.5.1 Describe the requirements to perform the required rigging and hoisting techniques for erection of curtain wall systems:

- identify rigging techniques
- identify hoisting techniques
- identify curtain wall members
- perform rigging and hoisting techniques

S1394.5.2 Identify the techniques involved in performing placement and setup of curtain wall system components:

- describe safe placement practices
- perform the specified safe placement practices
  - staging
  - materials handling
  - installation

S1394.5.3 Describe the methods required to secure curtain wall system components:

- describe safe securing methods
- perform the specified securing procedures

Number:	S1394.6		
Title:	**Alignment and Inspection**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3
Cross Reference to Training Standard: U0901.01, U0901.04, U0901.11, U0901.12			

General Learning Outcomes

Upon successful completion, the apprentice is able to align and inspect curtain wall system components, in accordance with drawings and specifications of the assigned trade-related tasks.

Learning Outcomes and Content

S1394.6.1 Identify the alignment procedures for curtain wall system members:

- identify the equipment required to align curtain wall system components
- perform the selection and placement of alignment equipment
- perform adjustments using the aligning equipment
- perform permanent securing procedures when components are aligned to specifications

S1394.6.2 Describe the sequence of steps involved in performing the required inspection and documentation procedures for curtain wall system members:

- inspect the curtain wall system installation and compare to drawings and specifications
- verify curtain wall seal
- verify curtain wall finish requirements
- document deficiencies noted during the erection process

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
35%	35%	0%	0%	30%

Number:	S1395			
Title:	**Machinery Moving**			
Duration:	Total Hours: 18		Theory: 9	Practical: 9
Prerequisites:	None			
Content:	S1395.1	Layout		
	S1395.2	Alignment and Inspection		

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging for Ironworkers
Cranes Reference Manual

Number:	S1395.1		
Title:	**Operations Layout**		
Duration:	Total Hours: 10	Theory: 5	Practical: 5
Cross Reference to Training Standard: U0900.01, U0900.06, U0900.07, U0893.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to layout for machinery moving operations in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1395.1.1 Identify benchmarks and reference point locations:

- determine the location of specified layout positions
- setup and adjust levelling and aligning devices
  - digital theodolite
  - total station
  - engineers level
  - contractor level
  - spirit level
  - laser
  - piano wire
  - plumb bob
- use levelling devices to locate layout positions

S1395.1.2 Describe the steps involved in performing an inspection or anchorage points for machinery moving:

- inspect placement of anchorage points/machine base
- identify the condition of anchorage points/machine base
- verify orientation of anchorage points/machine base
- verify projection of anchorage points/machine base
- verify elevation of anchorage points/machine base

S1395.1.3 Identify the methods used to layout positions for machinery moving components:

- measure and laying out the position of components
- record anchorage points/machine base
- perform swing angles
- calculate distances and elevations
- perform adjustments based on required specifications and tolerances

Number:	S1395.2		
Title:	**Alignment and Inspection**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross Reference to Training Standard: U0900.06, U0900.07, U0900.08			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform the alignment and inspection of machinery components, in accordance manufacturer recommendations and accepted industry standards.

Learning Outcomes and Content

S1395.2.1 Identify the techniques involved in performing the required alignment procedures for machinery:

- identify the tools and equipment required to align machinery
- select and place alignment equipment
- perform adjustments using the aligning tools and equipment
- perform securing procedures when machinery is aligned

S1395.2.2 Describe the sequence required to perform inspection and documentation procedures for machinery:

- inspect the machinery and compare to drawings and specifications
- document deficiencies noted during the inspection process
- commission equipment to specifications

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
35%	35%	0%	0%	30%

Number:	S1396		
Title:	**Automated Materials Handling Systems**		
Duration:	Total Hours: 36	Theory: 19	Practical: 17
Prerequisites:	None		
Content:	S1396.1	Blueprints and Drawings	
	S1396.2	Fabrication of Members	
	S1396.3	Layout	
	S1396.4	Erection Methods	
	S1396.5	Installation and Securing	
	S1396.6	Alignment and Inspection	

Evaluation & Testing:

Assignments related to theory and appropriate Application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Reference Materials:

Rigging For Ironworkers
Cranes Reference Manual
Conveyor Installation and Industrial Maintenance for Ironworkers
Layout Instruments for Ironworkers

Number:	S1396.1		
Title:	**Blueprints and Drawings**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross Reference to Training Standard: U0902.01, U0902.02, U0902.03, U0902.04, U0902.05, U0902.09, U0902.13			

General Learning Outcomes

Upon successful completion, the apprentice is able to explain blueprints, drawings and specifications for automated materials handling systems, in accordance with accepted industry standards and the requirements of assigned trade related projects.

Learning Outcomes and Content

S1396.1.1 Identify and define terms, symbols, types and applications for automated materials handling systems:

- identify and explain abbreviations and symbols
- define layout and drafting terms
- identify types of blueprints
- explain work activities from drawings and specifications
- identify conveyor equipment
  - bulk conveyor systems
  - precision conveyor systems

S1396.1.2 Identify the specified components required for automated materials handling systems:

- identify component types
  - bulk conveyor systems
  - precision conveyor systems
- identify material selection criteria

S1396.1.3 Describe installation procedures for an automated materials-handling systems work project:

- outline planning and coordinating techniques
- describe estimating requirements for time, manpower, tools and equipment
- calculate elevations
- calculate loads
- identify and calculate dimensions
- identify reinforcing locations

Number:	S1396.2		
Title:	**Fabrication of Members**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standard: U0902.02, U0902.03, U0902.04, U0902.05, U0902.09			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform fabrication procedures for automated materials handling system components in accordance with government safety regulations and accepted industry standards for the assigned trade related tasks.

Learning Outcomes and Content

S1396.2.1 Describe drawings related to the fabrication of automated material handling system components:

- identify types of drawings
- explain drawings

S1396.2.2 Describe the construction features, types and application of automated material handling system components:

- material types
- construction features
- applications

S1396.2.3 Identify required automated material handling system components following the drawings and specifications:

- identify material position layout
- perform material layout
- perform inspection of layout and compare to specifications

S1396.2.4 Describe the techniques used to cut and shape to fabricate and assemble the automated materials handling system components:

- identify the required shaping and cutting tools
- describe shaping procedures
- describe cutting procedures
- perform member fabrication techniques
- perform member assembly procedures

Number:	S1396.3		
Title:	**Layout**		
Duration:	Total Hours: 8	Theory: 2	Practical: 6

Cross Reference to Training Standard: U0902.01, U0902.02, U0902.03, U0902.04, U0902.05, U0902.09, U0893.04

General Learning Outcomes

Upon successful completion, the apprentice is able to perform layout procedures for automated materials handling system members, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1396.3.1 Identify the specified reference point locations for automated materials handling system members:

- determine the required benchmarks and reference points
- determine elevations

S1396.3.2 Describe the placement and condition of automated materials handling system members anchoring points:

- identify anchorage point location
- inspect anchorage point condition
- verify anchorage orientation
- verify anchorage elevation

S1396.3.3 Identify the requirements to perform the layout position for automated materials handling system members:

- perform anchorage point layout
- record the anchorage point locations
- perform calculations for distance and spacing
- perform the required adjustments to conform to drawings and specifications

Number:	S1396.4		
Title:	**Erection Methods**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standard: U0902.01, U0902.02, U0902.03, U0902.04, U0902.05, U0902.06, U0902.07, U0902.09, U0902.13			

General Learning Outcomes

Upon successful completion, the apprentice is able to perform automated materials handling system erection methods, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1396.4.1 Describe the required installation sequence for automated materials handling systems:

- identify the safe sequence to assemble materials
- identify the most efficient sequence to assemble materials

S1396.4.2 Identify the required safety practices for the installation of automated materials handling systems:

- identify potential hazardous conditions
- identify PPE
- describe safe working practices
- perform the calculations to determine equipment and material requirements
- apply safe working practices

S1396.4.3 Describe the required procedures to erect automated material handling system components:

- identify erection methods
- position erection equipment
- position the specified working platforms
- install the required fall-arrest systems

Number:	S1396.5		
Title:	**Installation and Securing**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3

Cross Reference to Training Standard: U0902.01, U0902.02, U0902.03, U0902.04, U0902.05, U0902.06, U0902.07, U0902.09, U0902.10, U0902.11, U0902.12, U0902.13, U0895.01, U0898.01

General Learning Outcomes

Upon successful completion, the apprentice is able to install and secure automated material handling systems, in accordance drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1396.5.1 Describe the rigging and hoisting techniques for automated material handling systems:

- identify and select components
- identify rigging and hoisting techniques
- perform rigging and hoisting techniques

S1396.5.2 Identify the techniques required for the placement and setup of automated material handling system:

- describe safe placement practices
- perform the specified safe placement practices

S1396.5.3 Describe the required securing methods for automated material handling system components:

- describe safe securing methods
  - fasteners
  - welded connections
  - chemical anchors
  - mechanical anchors
- perform the specified safe securing practices

S1396.5.4 Describe the adjustment procedures for hydraulic and pneumatic systems:

- explain hydraulic and pneumatic system specifications
- identify hydraulic and pneumatic system components
- describe the function of hydraulic and pneumatic system components
- describe the adjustment procedures for a hydraulic and pneumatic system

Number:	S1396.6		
Title:	**Alignment and Inspection**		
Duration:	Total Hours: 5	Theory: 3	Practical: 2
Cross Reference to Training Standard: U0902.07, U0902.08, U0902.10, U0902.11, U0902.12, U0902.13, U0893.04			

General Learning Outcomes

Upon successful completion, the apprentice is able to align and inspect automated material handling system, in accordance with drawings and specifications of the assigned trade related tasks.

Learning Outcomes and Content

S1396.6.1 Explain the alignment procedures for automated material handling system components:

- identify the equipment required to align components
- select and placement of alignment equipment
- perform adjustments using the aligning equipment
- perform permanent securing procedures when components are aligned to specifications

S1396.6.2 Identify appropriate tools for completion of commissioning work.

S1396.6.3 Describe the required inspection and documentation procedures for automated material handling systems:

- inspect the system installation and compare to drawings and specifications
- document deficiencies noted during the erection process

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook & Organizational Skills	Final Assessment
45%	25%	0%	0%	30%

Summary of Recommended Equipment for Level 3

- Classroom Facilities
  Appropriately lit and ventilated classroom capable of seating 20 students including:
  - Whiteboard
  - Television
  - VCR/DVD
  - Overhead Projector
  - Laptop with speakers
  - Multimedia Projector
  - Flipchart
  - Slide Projector
  - Projector Screen
  - Calculators (20)

- Tools
  - Chipping Hammers (20)
  - Wire Brushes (20)
  - Welding Shield (20
  - Welding Jackets (20)
  - Welding Gloves (20)
  - C-grips (20)
  - C-clamps (20)
  - Vice Grips (20)
  - Files (20)
  - Smoke Eater (5)
  - Fillet Gauges (5)
  - Numbered Punch set
  - Lettered Punch set
  - Appropriate CC AC/DC welding machines to accommodate each student 250A (20)
  - Bench Grinder (5)
  - Fit-up Table (2)
  - 7″ Angle Grinders (10)
  - 4½″ Angle Grinders (5)
  - Vices (5)
  - Combination Square (20)
  - Tape measure 25′/8m (20)
  - Lens Cleaning Station (2)
  - Fire Extinguisher
  - Face shields (10)
  - Safety Glasses (20)
  - Burning Table with Grizzly (2)
  - Steel Sawhorses (10)

- Exacto Knife (5)
- Layout/Assembly Area Minimum 5000 square feet
- Rope Blocks 2-3 sheave capacity (20)
- Fiber Line: (1000′)
- Manila
- Polypropylene
- Nylon
- Rope Cutters (2)
- Fids (5)
- Multi Storey 1000 square foot structural building
- Scaffold equipment
- Slings (20):
- Fibre Line
- Calculators (20)
- 55 Ton Ironworker
- Mag-Drill
- Layout/Assembly Area Minimum 5000 square feet
- Hacksaws (10)
- Hosfelt Bender
- Scroll Bender
- Portable Band Saw
- Band Saw
- Line Burner
- Oxy-Acetylene Burning/Welding outfits on portable carts (10)
- Strikers (20)
- Burnbacks/flash arrestors (20)
- Burning Goggles (20)
- Tip Cleaners (5)
- Soapstone
- Scribers (5)
- Compass (5)
- Center punch (5)
- Drill Press (2)
- 14″ Cut off abrasive saw (2)
- W12 35 foot column erected with recoiling fall arrest
- Fork Truck 4Ton capacity
- Drill bit index (5)
- Hand Drills (5)
- Tap and Die index
- 2 foot Framing Square (20)
- Chalk Lines (20)
- Plumb Bobs (5)
- Try-square (1)
- Bevel Square (20)

- Structural Belts (20) containing:
  - Belt
  - Back Pad
  - Frog
  - 1 ¼″ Spuds (2)
  - Pin Holder
  - Bull Pin
  - Adjustable 12″
  - 4lb. Beater
  - Bolt Bag
- Fall arrest Harness with two shock absorbing Lanyards (20)
- Fall arrest Stanchions (10)
- First Aid Station (5)
- Travel Restraint equipment
- Hard Hats (20)
- Face shields (10)
- Levels:
  - 4′ (2)
  - 2′ (2)
  - Torpedo (2)
- Metric Socket Set
- Imperial Socket Set
- Ratchet
- Johnson Bar
- Pry bar
- Imperial Impact Socket Set
- Torque Wrench
- Skidmore
- Electric or Air Ratchet Impact Gun (2)
- Metric Spanner Set
- Imperial Spanner Set
- Metric Allen Key Set
- Imperial Allen Key Set
- Sledgehammer
- Barrel Pins (20)
- Backing out hammer
- Helldog/rivet buster
- Material rack
- Plate Rack
- Glazing Bars
- Glass Cups
- Rubber Mallet
- Screw gun
- Screw Gun Bits

- GMAW Setup with Power Source (2)
- FCAW Setup with Power Source (2)
- GTAW Setup with Power Source and Foot Pedal (2)
- Rod Oven (2)
- Ground Clamps (20)
- Electrode Holders (20)
- Separately Ventilated Weld Shop (5000 square feet)
- Appropriate Booths for Position Welding to Accommodate Each Student (20)
- Appropriate CC AC/DC welding machines to accommodate each student 250A Slings (20):
  - wire rope
  - nylon
  - safety spreaders
  - chain spreaders
- Spreader Beam/Bar
- Two-way radio
- Rigging hardware (shackles, cable clamps, hooks, turnbuckles)
- Chainfalls (2)
- Come-alongs (2)
- Tirfor
- Fibre line of sufficient length for tagging loads
- Power Elevated Working Platform
- 0-8T carry deck crane

Skilled Trades Ontario | Métiers spécialisés Ontario

skilledtradesontario.ca

Ironworker (structural/ornamental)