



**Skilled  
Trades**  
Ontario

**Métiers  
spécialisés**  
Ontario

Apprenticeship  
Curriculum Standard

Reinforcing Rodworker

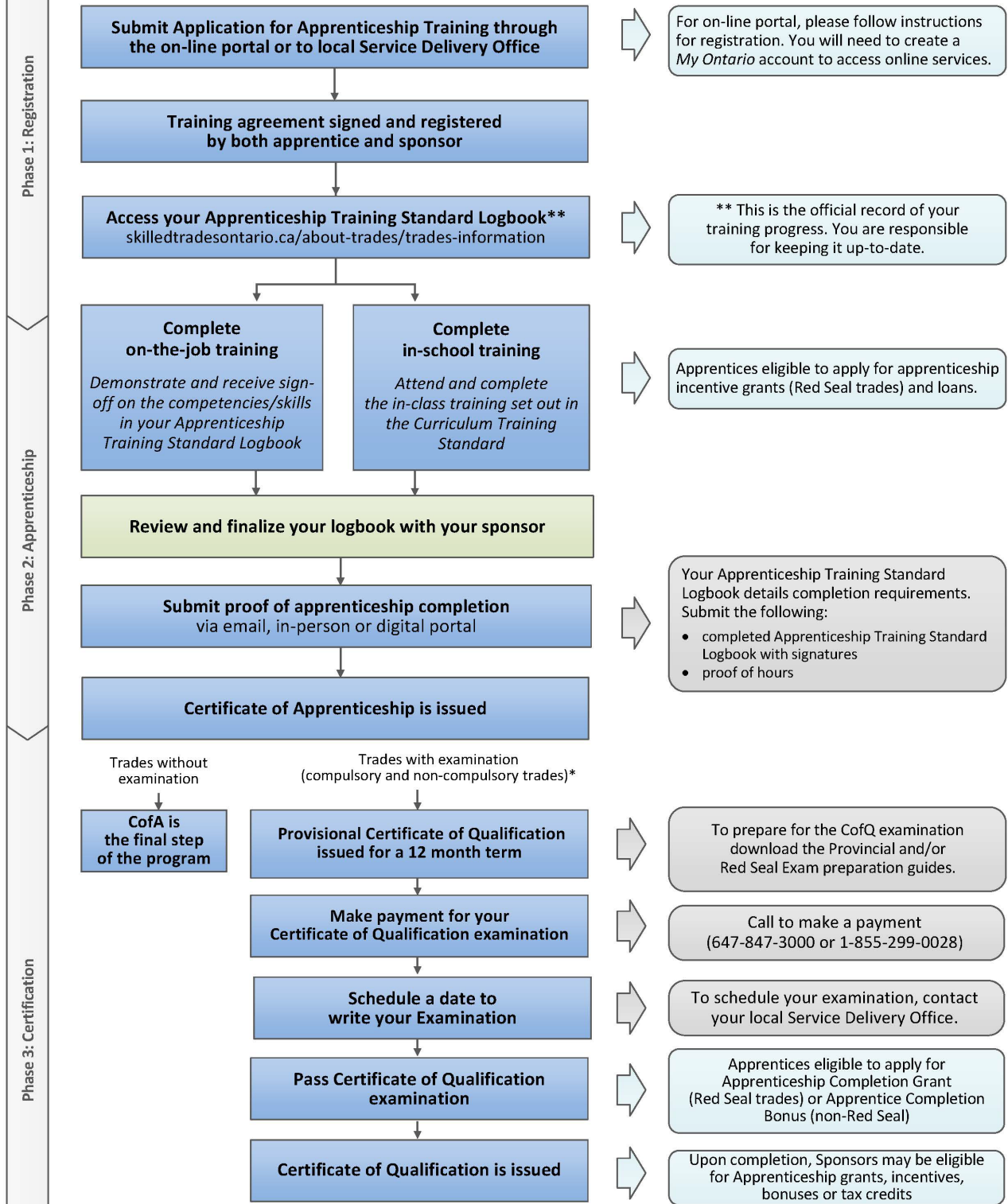
Levels 1 & 2

452A

2014



# Apprenticeship Pathway to a Certificate of Qualification



\* For a list of trades subject to a certification examination, visit: [skilledtradesontario.ca](http://skilledtradesontario.ca)

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**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](http://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](http://Skilled Trades Ontario.ca).

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*Maintained with transfer to Skilled Trades Ontario 2014 (V100)*

## **Preface**

This curriculum standard for the Reinforcing Rodworker trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 2 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](http://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 \(ontario.ca\)](http://www.skilledtradesontario.ca/building-opportunities-in-the-skilled-trades-act-2021-s.o.-2021-c.-28-bill-288)

## **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 46–47 and pages 66–68 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**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
<b>Level 1</b>				
S1341	Applied Trade Practices	30	27	3
S1342	Applied Trade Calculations	24	24	0
S1343	Concrete Reinforcing Blueprints	36	30	6
S1344	Fabrication of Reinforcing Concrete Members	24	8	16
S1345	Concrete Reinforcing Installation and Inspection	90	11	79
S1346	Rigging	36	22	14
	<b>Level 1 Totals</b>	<b>240</b>	<b>122</b>	<b>118</b>
<b>Level 2</b>				
S1347	Protect Self and Others	6	6	0
S1348	Post Tensioning Blueprints	24	24	0
S1349	Post Tensioning Layout and Fabrication	18	5	13
S1350	Post Tensioning Installation and Inspection	72	19	53
	<b>Level 2 Totals</b>	<b>120</b>	<b>54</b>	<b>66</b>
	<b>Totals</b>	<b>360</b>	<b>176</b>	<b>184</b>



# Level 1

**Program Summary of Reportable Subjects — Level 1**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
S1341	Applied Trade Practices	30	27	3
S1342	Applied Trade Calculations	24	24	0
S1343	Concrete Reinforcing Blueprints	36	30	6
S1344	Fabrication of Reinforcing Concrete Members	24	8	16
S1345	Concrete Reinforcing Installation and Inspection	90	11	79
S1346	Rigging	36	22	14
	<b>Level 1 Totals</b>	<b>240</b>	<b>122</b>	<b>118</b>

## **Evaluation and Testing**

The method of evaluation and/or testing may vary significantly from reportable subject to reportable subject. Evaluations should attempt to assess the level of practical skill possessed by each apprentice. Other forms of evaluation may include case studies, short answer and identification questions, where applicable. In most cases, questions requiring long, or essay- type written answers should be avoided.

Frequency of testing will also depend upon the materials being covered. Generally, evaluations should be carried out at the end of each learning unit. Weekly testing is recommended for material involving major memory recall, such as plant identification. In all cases, evaluations should tend to be short and frequent, as opposed to the one major test or evaluation at the end of the course of study.

Number:	S1341		
<b>Title:</b>	<b>Applied Trade Practices</b>		
Duration:	Total Hours: 30	Theory: 27	Practical: 3
Prerequisites:	None		
Content:	S1341.1 <i>Occupational Health and Safety Act</i>		
	S1341.2 Trade Specific Practices		
	S1341.3 Tools and Equipment Safety		
	S1341.4 Workplace Hazardous Materials Information System		
	S1341.5 Fall Protection and Hazard Awareness		

**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:**

IHSA Construction Health & Safety Manual  
*Occupational Health and Safety Act (OHSA)*  
Reinforcing Concrete for Ironworkers

Number:	S1341.1		
Title:	<b><i>Occupational Health and Safety Act</i></b>		
Duration:	Total Hours: 16	Theory: 16	Practical: 0
Cross Reference to Training Standard:	U0911.01, U0911.02, U0911.03, U0911.05, U0911.07, U0911.10, U0911.11		

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to interpret the *Occupational Health and Safety Act (OHSA)* as it applies to construction trades, specifically the Reinforcing Rodworker trade, describe the purpose and procedures of the Workplace Safety Insurance Board (WSIB).

### **Learning Outcomes and Content**

- S1341.1.1 Define worker and employee responsibilities:
- compliance with *OHSA*
  - use and wearing of appropriate Personal Protective Equipment (PPE)
  - hazard reporting
  - unsafe work refusal
- S1341.1.2 Define employer responsibilities:
- safe workplace requirements
  - compliance with *OHSA*
  - notification of job hazards
- S1341.1.3 Identify and report job hazards:
- pinch points
  - electrical
  - hoisting and rigging
  - trips/ falls/ openings
  - ventilation
  - lighting
  - fires
  - access and egress

- S1341.1.4 Identify WSIB reporting requirements:
- employee
  - employer
- S1341.1.5 Describe inspection, wearing, adjustment and maintenance of PPE:
- work boots
  - safety glasses
  - gloves
  - hardhats
  - clothing
- S1341.1.6 Describe site preparation for safe work site:
- ground conditions
  - lighting
  - scaffold inspection
- S1341.1.7 Apply housekeeping rules:
- safe work area
  - obstacle removal
  - access and egress
- S1341.1.8 Explain safe lifting techniques:
- posture
  - frequency
  - MSD profile

Number:	S1341.2		
<b>Title:</b>	<b>Trade Specific Practices</b>		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standard: U0911.02, U0911.05, U0911.10, U0911.11			

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to identify and describe correct lifting techniques, recognize and report hazards, communicate with co-workers and practice safe working procedures.

### **Learning Outcomes and Content**

S1341.2.1 Performs correct lifting and carrying:

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

S1341.2.2 Identifies specific workplace hazards:

- horizontal dowels
- vertical dowels
- form oil
- form overloading

Number: S1341.3

**Title: Tools and Equipment Safety**

Duration: Total Hours: 3 Theory: 2 Practical: 1

Cross Reference to Training Standard: U0911.05, U0911.06, U0911.08, U0911.10, U0911.11, U0912.04, U0912.06, U0913.01, U0913.02, U0913.04, U0913.05

### General Learning Outcomes

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

### Learning Outcomes and Content

S1341.3.1 Identify and select appropriate hand or power tools:

- wire reel
- tie pliers
- side cutters
- hickey bar
- bolt cutters
- tape measure
- quick cut saw
- reciprocating saw
- power shear
- sledge hammer
- tie gun
- grinders
- drills

S1341.3.2 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



- S1341.3.3 Identify defective hand and power tools:
- impact and corrosion damage
  - defective portable electric tools
  - poor connections
  - electrical hazards
  - defective plugs
  - improper groundings
- S1341.3.4 Explain safe carrying and handling procedures for hand and power tools:
- precautions against dropping tools when working overhead
  - safe methods of carrying tools
- S1341.3.5 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:	S1341.4		
Title:	<b>Workplace Hazardous Materials Information System (WHMIS)</b>		
Duration:	Total Hours: 4	Theory: 4	Practical: 0
Cross Reference to Training Standard: U0911.04			

### General Learning Outcomes

Upon successful completion, the apprentice is able to interpret the Workplace Hazardous Materials Information System (WHMIS), in accordance with required manufacturer recommendations, requirements or specifications.

### Learning Outcomes and Content

S1341.4.1 Identify the different types WHMIS labels:

- supplier
- workplace
- portable container

S1341.4.2 Identify the different types of warning symbols:

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

S1341.4.3 Describe the purpose of Material Safety Data Sheets (MSDS):

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

S1341.4.4 Describe the legal requirements for worker training:

- MSDS renewal
- MSDS access

Number:	S1341.5		
Title:	<b>Fall Protection and Hazard Awareness</b>		
Duration:	Total Hours: 4	Theory: 3	Practical: 1
Cross Reference to Training Standard:	U0911.01, U0911.05, U0911.06, U0911.07, U0911.09, U0911.11		

### General Learning Outcomes

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

### Learning Outcomes and Content

S1341.5.1 Explain the legal responsibilities for worker fall protection:

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

S1341.5.2 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

S1341.5.3 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

S1341.5.4 Describe the correct use of belly hooks:

- as per OHSA
- not a fall arrest device

<b>Evaluation Structure</b>				
Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
60%	10%	0%	0%	30

Number:	S1342		
<b>Title:</b>	<b>Applied Trade Calculations</b>		
Duration:	Total Hours: 24	Theory: 24	Practical: 0
Prerequisites:	None		
Content:	S1342.1 Introduction to Trade Related Calculations		
	S1342.2 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

Number:	S1342.1		
Title:	<b>Introduction to Trade Related Calculations</b>		
Duration:	Total Hours: 12	Theory: 12	Practical: 0
Cross Reference to Training Standard:	U0914.01, U0916.01, U0917.04		

## General Learning Outcomes

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

## Learning Outcomes and Content

S1342.1.1 Define the fundamentals of measuring systems:

- imperial measuring system
- metric measuring system

S1342.1.2 Describe the fundamentals, mathematical formulas and procedures to solve trade related problems for:

- whole numbers
  - addition
  - subtraction
  - division
  - multiplication
  - order of operations
- fractions
  - concept of fractions
  - need and use of fractions
  - denominator
  - numerator
  - common fractions
  - proper/improper fractions
  - mixed numbers
  - brackets
  - need for the common denominator (lowest)
- decimals
  - concepts
  - transition of fractions to decimals
  - omission of the denominator and substitution of the decimal point
  - 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, reinforcing)
- percentage
- ratios

Number:	S1342.2		
Title:	<b>Trade Calculation Applications</b>		
Duration:	Total Hours: 12	Theory: 12	Practical: 0
Cross Reference to Training Standard: U0914.01, U0916.01, U0917.04			

## 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

S1342.2.1 Describe the sequence involved in calculations to solve trade related problems:

- whole numbers
  - addition
  - subtraction
  - division
  - order of operations
  - multiplication
- 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

S1342.2.2 Explain the use of measuring instruments to check critical dimensions of assembled members:

- length
- width
- thickness
- spacing

S1342.2.3 Describe/perform the required planning and calculations to determine the specified concrete reinforcing procedures for an assigned project:

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

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

Number:	S1343		
<b>Title:</b>	<b>Concrete Reinforcing Blueprints</b>		
Duration:	Total Hours: 36	Theory: 30	Practical: 6
Prerequisites:	None		
Content:	S1343.1 Terms and Symbols		
	S1343.2 Material Identification		
	S1343.3 Layout		

**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:**

Reinforcing Concrete for Ironworkers

Reinforcing Plans for Ironworkers Keyed to Manual VII Vol. 1

RSIO Manual of Standard Practices

Number: S1343.1

**Title: Terms and Symbols**

Duration: Total Hours: 21 Theory: 21 Practical: 0

Cross Reference to Training Standard: U0912.01, U0912.02, U0912.03, U0915.01, U0915.02, U0915.03, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10, U0915.11

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to define terms and symbols for types and applications of concrete reinforcing drawings and layout specifications, in accordance with accepted industry standards and the requirements of assigned trade related projects.

### **Learning Outcomes and Content**

S1343.1.1 Identify and define terms, symbols, types and applications for concrete reinforcing techniques:

- identify and interpret abbreviations and symbols
- define layout and drafting terms

S1343.1.2 Describe the types and applications of drawings and layouts for concrete reinforcing techniques:

- identify types of blueprints
- interpret concrete reinforcing work activities from drawings and specifications

Number: S1343.2

**Title: Material Identification**

Duration: Total Hours: 3 Theory: 3 Practical: 0

Cross Reference to Training Standard: U0912.01, U0912.02, U0912.03, U0915.01, U0915.02, U0915.03, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10, U0915.11

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to identify and select the required materials for concrete reinforcing work, in accordance with accepted industry standards and the requirements of assigned trade related projects.

### **Learning Outcomes and Content**

S1343.2.1 Identify required materials for concrete reinforcing work according to drawings and specifications:

- identify material types
- identify material sizes
- identify material grades
- identify material quantities
- identify fabricated bars
- identify support materials

S1343.2.2 Select required materials for concrete reinforcing work according to drawings and specifications:

- identify material selection criteria

Number:	S1343.3		
Title:	<b>Layout</b>		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standard: U0912.01, U0912.02, U0912.03, U0915.01, U0915.02, U0915.03, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10, U0915.11			

### General Learning Outcomes

Upon successful completion, the apprentice is able to interpret drawings of a concrete reinforcing project and correctly determine position of reinforcing material in a final assembly, in accordance with accepted industry standards and the requirements of assigned trade related projects

### Learning Outcomes and Content

- S1343.3.1 Interpret the required drawings for a specified concrete reinforcing project:
- layout of project
  - project specifications
- S1343.3.2 Layout concrete reinforcing work according to drawings:
- quarter point slab
    - one- way
    - two-way
    - four-way
  - waffle slabs
  - beams
  - walls
  - columns
  - footings
  - bridge girders
  - joists
  - stairs

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
45%	15%	0%	10%	30

Number:	S1344		
Title:	<b>Fabrication of Reinforcing Concrete Members</b>		
Duration:	Total Hours: 24	Theory: 8	Practical: 16
Prerequisites:	None		
Content:	S1344.1 Drawings Reinforcing Members		
	S1344.2 Materials		
	S1344.3 Layout and Inspection		
	S1344.4 Shaping, Cutting and Fabrication		
	S1344.5 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:**

Reinforcing Concrete for Ironworkers  
Reinforcing Plans for Ironworkers Keyed to Manual VII Vol. 1  
RSIO Manual of Standard Practices

Number:	S1344.1		
Title:	<b>Drawings</b>		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0912.01, U0912.03, U0912.04, U0912.06, U0915.02, U0915.11			

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to interpret drawings for fabrication of concrete reinforcing members, in accordance with accepted industry standards for the assigned trade related tasks.

### **Learning Outcomes and Content**

- S1344.1.1 Interpret drawings related to the fabrication of concrete reinforcing members:
- identify types of drawings
  - identify bend types
  - identify reinforcing materials
  - identify bar schedule
  - identify dimensions of bent bars
  - identify bar sizes
  - interpret drawings

Number: S1344.2

**Title: Material Identification**

Duration: Total Hours: 2 Theory: 1 Practical: 1

Cross Reference to Training Standard: U0912.01, U0912.03, U0912.05, U0915.01, U0915.02, U0915.03 U0915.10

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to identify and select the specified materials for concrete reinforcing work, in accordance with accepted industry standards for the assigned trade related tasks.

### **Learning Outcomes and Content**

S1344.2.1 Select the required materials for specified concrete reinforcing projects:

- outline selection criteria
- select materials by type, size, quantity



Number: S1344.3

Title: **Layout**

Duration: Total Hours: 4 Theory: 1 Practical: 3

Cross Reference to Training Standard: U0912.01, U0912.03, U0912.05, U0915.01, U0915.02, U0915.03, U0915.04, U0915.05, U0915.06, U0915.07, U0915.09, U0915.10, U0915.11

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to layout and inspect materials for fabrication of concrete reinforcing members, in accordance with drawings and specifications of a concrete reinforcing project.

### **Learning Outcomes and Content**

S1344.3.1 Identify materials and layout procedures for the fabrication of concrete reinforcing members:

- material type
- material size
- material quantity
- material length
- hook bars
- column ties
- L-bars
- stirrups
- column spirals
- truss bars

S1344.3.2 Apply layout procedures for the fabrication of concrete reinforcing members, according to drawings and specifications.

S1344.3.3 Apply inspection procedures for concrete reinforcing members, according to drawings and specifications.

Number:	S1344.4		
Title:	<b>Shaping, Cutting and Fabrication</b>		
Duration:	Total Hours: 14	Theory: 4	Practical: 10
Cross Reference to Training Standard: U0912.01, U0912.06, U0913.03, U0915.01			

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to shape and cut concrete reinforcing materials, in accordance with drawings and specifications of a concrete reinforcing project.

### **Learning Outcomes and Content**

- S1344.4.1 Describe shaping and cutting procedures for the fabrication of concrete reinforcing members using:
- oxygen acetylene torches
  - quick cut gas powered saws
  - hand benders
  - hickey bars
  - hydraulic benders
  - power shear
- S1344.4.2 Perform shaping and cutting procedures to fabricate specified concrete reinforcing members.

Number:	S1344.5		
<b>Title:</b>	<b>Inspection</b>		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0912.01, U0915.01, U0915.02, U0915.11			

### General Learning Outcomes

Upon successful completion, the apprentice is able to verify through inspection of fabricated reinforcing materials, in accordance with drawings and specifications of a concrete reinforcing project.

### Learning Outcomes and Content

S1344.5.1 Identify inspection criteria of concrete reinforcing assemblies and compare to given drawings and specifications:

- distortion limits
- dimensions
- tolerances

S1344.5.2 Inspect concrete reinforcing assemblies and compare to specific drawings and specifications:

- distortion limits
- dimensions
- tolerances

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

Number:	S1345		
<b>Title:</b>	<b>Concrete Reinforcing Installation and Inspection</b>		
Duration:	Total Hours: 90	Theory: 11	Practical: 79
Prerequisites:	None		
Content:	S1345.1 Layout		
	S1345.2 Erection Methods		
	S1345.3 Installation and Securing		
	S1345.4 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:**

Reinforcing Concrete for Ironworkers  
Reinforcing Plans for Ironworkers Keyed to Manual VII Vol. 1  
RSIO Manual of Standard Practices

Number:	S1345.1		
Title:	<b>Layout</b>		
Duration:	Total Hours: 8	Theory: 2	Practical: 6
Cross Reference to Training Standard:	U0912.01, U0912.03, U0912.05, U0915.01, U0915.02, U0915.03, U0915.05, U0915.06		

### General Learning Outcomes

Upon successful completion, the apprentice is able to able to layout concrete reinforcing members, in accordance with accepted industry standards and the assigned trade related tasks.

### Learning Outcomes and Content

- S1345.1.1 Interpret drawings related to the location of benchmarks and reference points of concrete reinforcing members:
- identify types of drawings
  - interpret placing drawings
  - interpret bar schedule
- S1345.1.2 Verify through inspection the starting point benchmarks and reference points of concrete reinforcing members:
- identify starting point
  - identify center lines
  - identify quarter points
  - identify elevations
  - identify spacing
  - identify size/length/type and number of reinforcing steel for required project
  - identify number of bent bars for required project
- S1345.1.3 Layout material for the installation of reinforcing steel members according to specific drawings and specifications:
- establish starting point
  - calculate distance and spacing
  - layout material
  - perform the required adjustments to conform to drawings and specifications
  - inspect layout and compare to specifications

Number:	S1345.2		
Title:	<b>Erection Methods</b>		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standard: U0911.09, U0912.01, U0912.02, U0912.03, U0912.04, U0912.05, U0915.01, U0915.02, U0915.03, U0915.04, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10			

### General Learning Outcomes

Upon successful completion, the apprentice is able to describe concrete reinforcing material erection methods, in accordance with requirements of assigned trade related projects.

### Learning Outcomes and Content

- S1345.2.1 Describe the required installation sequence for concrete reinforcing work:
- identify the safest sequence to assemble concrete reinforcing materials
  - identify the most efficient sequence to assemble concrete reinforcing materials
  - apply best practices for assembly or preassembly of:
    - columns
    - beams
    - walls
    - footings
    - slabs
- S1345.2.2 Describe the required safety practices for concrete reinforcing erection methods:
- identify potential hazardous conditions
  - identify the specified protective equipment
  - describe the safe working practices
  - identify the required hand and power tools
- S1345.2.3 Describe the required procedures to erect concrete reinforcing materials:
- identify erection method
  - position the erection equipment
  - position specified power elevated working platforms
  - ensure sufficient fall-arrest systems are in place

Number:	S1345.3		
Title:	<b>Installation and Securing</b>		
Duration:	Total Hours: 70	Theory: 6	Practical: 64
Cross Reference to Training Standard: U0911.09, U0912.01, U0912.02, U0912.03, U0912.04, U0912.05, U0915.01, U0915.02, U0915.03, U0915.04, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10			

### General Learning Outcomes

Upon successful completion, the apprentice is able to install and secure concrete reinforcing materials, in accordance with accepted industry standards, drawings and specifications of the assigned trade related tasks.

### Learning Outcomes and Content

- S1345.3.1 Pace and setup concrete reinforcing members:
- describe the recommended safe placement practices
  - perform the specified safe placement practices
  - perform the specified placement practices for welded wire fabric
  - perform the specified placement practices for accessories
  - perform the specified placement for reinforcing
- S1345.3.2 Apply best practices for assembly or preassembly of columns including:
- spiral columns
  - square/rectangular/polygon columns
  - caissons
  - piers
  - tapered columns
- S1345.3.3 Apply best practices for assembly or preassembly of beams including:
- open stirrup
  - closed stirrup
- S1345.3.4 Apply best practices for assembly or preassembly of walls.
- S1345.3.5 Apply best practices for assembly or preassembly of footing.

- S1345.3.6 Apply best practices for assembly of slabs including:
- one way
  - two way
  - four way
  - waffle
- S1345.3.7 Apply best practices for assembly of miscellaneous structures including:
- trusses
  - stairs
  - vessels
  - slip-forms
  - culverts/inverts
  - bridge deck
  - corbels
  - headers
  - lintels
  - parapet walls
- S1345.3.8 Perform the required securing methods for concrete reinforcing members:
- describe safe securing methods including:
    - snap ties
    - figure 8 ties
    - saddle ties
    - nail ties
    - wrap combinations
    - double wire ties
    - rack ties
    - bracing
    - hold-backs
    - welding
  - perform the specified safe securing practices
  - perform the specified splicing practices including:
    - mechanical
    - welded
    - lap/tension
  - perform specified securing practices for welded wire fabric, epoxy coated reinforcing, composite reinforcing and stainless reinforcing



Number:	S1345.4		
Title:	<b>Alignment and Inspection</b>		
Duration:	Total Hours: 6	Theory: 1	Practical: 5
Cross Reference to Training Standard:	U0911.09, U0912.01, U0912.03, U0915.01, U0915.02, U0915.03, U0915.04, U0915.05, U0915.06, U0915.07, U0915.08, U0915.09, U0915.10, U0915.11		

### General Learning Outcomes

Upon successful completion, the apprentice is able to align and inspect concrete reinforcing materials, in accordance with accepted industry standards, drawings and specifications of the assigned trade related tasks.

### Learning Outcomes and Content

- S1345.4.1 Align concrete reinforcing components:
- identify the equipment required to align concrete reinforcing components
  - select and place alignment equipment
  - perform adjustments using the aligning equipment
  - perform permanent securing procedures when components are aligned to specifications
  - perform touch-up coating for epoxy reinforcing
- S1345.4.2 Inspect and document concrete reinforcement work:
- inspect concrete reinforcing work and comparing to drawings and specifications
  - document any deficiencies noted during the erection process including:
    - concrete coverage
    - number of bars
    - spacing of bars

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
14%	56%	0%	0%	30

Number:	S1346		
Title:	<b>Rigging</b>		
Duration:	Total Hours: 36	Theory: 22	Practical: 14
Prerequisites:	None		
Content:	S1346.1 Rigging Calculations		
	S1346.2 Fibre Rope		
	S1346.3 Rigging Hardware		
	S1346.4 Slings		
	S1346.5 Hoisting Equipment		
	S1346.6 Applied 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  
Cranes Reference Manual

Number:	S1346.1		
Title:	<b>Rigging Calculations</b>		
Duration:	Total Hours: 4	Theory: 3	Practical: 1
Cross Reference to Training Standard: U0912.05, U0914.01			

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform rigging calculations for determining the weights of loads.

### Learning Outcomes and Content

S1346.1.1 Identify materials by:

- types
- density
- dimensions

S1346.1.2 Identify shape formulae by:

- volume
- surface area
- rules of thumb for bars

S1346.1.3 Perform metric and imperial weight conversions:

- metric units
- imperial units

S1346.1.4 Perform the required calculations to establish weight of a load:

- calculate area
- calculate volume
- calculate mass
- calculate linear measurement
- calculate simple equations
- calculate weights of reinforced concrete shapes

Number:	S1346.2		
Title:	<b>Fibre Rope</b>		
Duration:	Total Hours: 4	Theory: 2	Practical: 2
Cross Reference to Training Standard:	U0914.02, U0914.03, U0914.05		

### General Learning Outcomes

Upon successful completion, the apprentice is able to use fibre rope in rigging applications, in accordance with accepted industry standards and the requirements of assigned trade related projects.

### Learning Outcomes and Content

- S1346.2.1 Identify types and applications of fibre rope:
- natural fibre
  - synthetic fibre
- S1346.2.2 Perform tying techniques for specified fibre rope knots, hitches and bends:
- identify types of knots
  - identify types of hitches
  - identify types of bends
  - demonstrate knot tying techniques
  - demonstrate appropriate tag-line placement
- S1346.2.3 Describe handling techniques for fibre rope:
- coiling techniques
  - uncoiling techniques
- S1346.2.4 Describe the inspection procedures to determine the condition of fibre rope:
- identify common fibre rope defects
  - safe working capacities
  - demonstrate rule of thumb formula
  - establish safety factors
  - determine safety for fibre rope
  - describe appropriate measures to take for defective fibre rope

Number:	S1346.3		
Title:	<b>Rigging Hardware</b>		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standard: U0914.02, U0914.03, U0914.04, U0912.05			

### General Learning Outcomes

Upon successful completion, the apprentice is able to use 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

S1346.3.1 Define rigging hardware terms and definitions:

- define rigging hardware
- define shackle types
- define hook types
- define able clamp types
- define spreader and equalizer beams
- identify alloy types

S1346.3.2 Describe the safety procedures required for rigging applications:

- identify hazardous conditions
- identify personal protective equipment
- describe safe working practices
- establish safety factors
- determine required safe rigging points
- determine safe working capacities of rigging hardware
- demonstrate rule of thumb formula

S1346.3.3 Prepare the equipment and material set up required for rigging procedures:

- describe equipment and material set up procedures
- select rigging procedures for specified applications
- prepare and set up procedures for rigging

- S1346.3.4 Perform of a lift utilizing rigging hardware in a rigging system:
- visually inspect rigging systems and compare to specifications
  - perform a lift using rigging hardware and make necessary adjustments for:
    - load center of gravity
    - load stability
    - load control
- S1346.3.5 Maintain rigging hardware equipment components.

Number: S1346.4

**Title: Slings**

Duration: Total Hours: 8 Theory: 4 Practical: 4

Cross Reference to Training Standard: U0912.04, U0912.05, U0914.02, U0914.03, U0914.04

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform lifts using slings, in accordance with accepted industry standards and the requirements of assigned trade related projects.

### Learning Outcomes and Content

S1346.4.1 Identify types and applications of slings:

- wire rope
- synthetic fibre
- chain

S1346.4.2 Identify safe working loads for slings:

- calculate safe working loads
- demonstrate rule of thumb formulae
- identify safety factors
- identify hazardous conditions

S1346.4.3. Outline the inspection procedures to determine the condition of slings:

- identify common sling defects
- identify and record inspection results
- determine safety for slings
- describe appropriate measures to take for defective slings

S1346.4.4 Maintain slings:

- cleaning
- lubricating
- storing

S1346.4.5 Perform lifts with slings, in accordance with specifications including specific hoisting considerations for epoxy coated reinforcing.

Number:	S1346.5		
Title:	<b>Hoisting Equipment</b>		
Duration:	Total Hours: 10	Theory: 6	Practical: 4
Cross Reference to Training Standard:	U0911.05, U0912.04, U0912.05, U0914.01, U0914.02, U0914.03, U0914.04, U0914.06		

## General Learning Outcomes

Upon successful completion, the apprentice is able to perform lifts with cranes and specified hoisting equipment, in accordance with accepted industry standards and the requirements of assigned trade related projects.

## Learning Outcomes and Content

- S1346.5.1 Describe types and applications of hoisting and jacking equipment and cranes used for rigging activities:
- identify and define all manually-operated hoisting and jacking equipment:
    - chainfall
    - comealong
    - tirfor
  - identify power-operated hoisting equipment
  - identify and define power-operated jacking equipment
  - identify and define crane types
- S1346.5.2 Identify safe working loads for hoisting and jacking equipment:
- identify load capacity of equipment
  - determine safety requirements for hoisting equipment
  - identify hazardous conditions
- S1346.5.3 Perform international hand signals:
- identify international hand signals
  - interpret international hand signals
  - perform international hand signals
  - use two-way radios to interpret hand signals
- S1346.5.4 Outline the inspection procedures to determine the condition of hoisting and jacking equipment:
- identify common defects
  - identify and record inspection results
  - describe appropriate measures to take for defective hoisting equipment



- S1346.5.5 Maintain hoisting and jacking equipment:
- cleaning
  - lubricating
  - storing
- S1346.5.6 Perform assembly procedures for hoisting equipment:
- determine required application for hoisting and jacking equipment
  - calculate and specify required hoisting equipment sizes
  - perform safe lift procedures following specified criteria
- S1346.5.7 Perform lifts with hoisting and jacking equipment:
- use international hand signals
  - observe specified safety requirements
  - control loads with tag lines
  - control center of gravity
  - maintain load stability
  - observe limits of approach

Number:	S1346.6		
Title:	<b>Applied Rigging Calculations</b>		
Duration:	Total Hours: 4	Theory: 3	Practical: 1
Cross Reference to Training Standard: U0914.01, U0914.05			

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform calculations necessary for determining safe working capacities and rigging configurations to perform safe hoisting of loads.

### Learning Outcomes and Content

S1346.6.1 Establish weights of loads.

S1346.6.2 Identify and select appropriate rigging components:

- rigging hardware
- slings
- hoisting equipment
- fibre rope

S1346.6.3 Identify and select appropriate rigging configuration:

- single vertical hitch
- bridle hitch
- basket hitch
- choker hitch

S1346.6.4 Perform rigging procedures for fibre rope:

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

S1346.6.5 Perform assembly and adjustment procedures for slings, rigging hardware and hoisting equipment:

- determine required application for slings
- calculate and specify the required sling sizes
- determine required application for rigging hardware
- calculate and specify the required rigging hardware
- determine required application for hoisting equipment
- calculate and specify the required hoisting equipment

S1346.6.6 Perform the required calculations to solve rigging problems:

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

<b>Evaluation Structure</b>				
Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
45%	15%	0%	10%	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

- 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
  - Nylon
  - Polypropylene
  - Manila
- Exacto Knife (5)
- Reinforcing Belts (20) containing:
  - Belt
  - Reel
  - Reel Pad
  - Back Pad
  - Tunnel Loop
  - Diagonal Cutting pliers
  - Tie Pliers (9")
  - Keel holder
- Steel Reinforcing – 10M-55M
- Welded Wire Fabric
- Composite Reinforcing
- Reinforcing Rod Splice Accessories
- Reinforcing Rod Bolster Accessories

- Reinforcing Rod High Chair Accessories
- Reinforcing Rod Stirrups
- Reinforcing Rod Spirals
- Reinforcing Rod Tie wire
- Reinforcing Rod Storage Racks
- Reinforcing Rod Bending Machine
- Tie Gun
- Fall arrest equipment
- Fall arrest harness (20)
- Belly-hooks (20)
- Gas-powered Cut off Saw
- Bolt Cutters
- Power shear
- Folding rule (5)
- Layout/Assembly Area Minimum 5000 square feet
- Hacksaws (10)
- Portable Band Saw
- Chalk
- Smokeater (5)
- 14" Cut off abrasive saw (2)
- Vices (5)
- Chalk Lines (20)
- Tape measure 25'8m (20)
- Overhead Pendant Crane Bay with 5 ton Trolley Hoist or similar hoisting device
- Scaffold equipment
- Lens Cleaning Station (2)
- Hard Hats (20)
- Face shields (10)
- Safety Glasses (20)
- Hickey Bar (5)
- Material rack
- Fork truck
- Power Elevated Working Platform
- Oxygen Acetylene torch outfits (10)
- Welding Machines (2)

# Level 2

**Program Summary of Reportable Subjects — Level 2**

<b>Number</b>	<b>Reportable Subjects</b>	<b>Hours Total</b>	<b>Hours Theory</b>	<b>Hours Practical</b>
S1347	Protect Self and Others	6	6	0
S1348	Post Tensioning Blueprints	24	24	0
S1349	Post Tensioning Layout and Fabrication	18	5	13
S1350	Post Tensioning Installation and Inspection	72	19	53
	<b>Level 2 Totals</b>	<b>120</b>	<b>54</b>	<b>66</b>

Number:	S1347		
Title:	<b>Protect Self and Others</b>		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Prerequisites:	None		
Content:	S1347.1 Post-Tension Safety		
	S1347.2 Post-Tension Tools and Equipment Safety Standards		

**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:**

IHSA Construction Health and Safety Manual  
Unbonded Post tensioning reference Manual  
Bonded Post Tensioning Reference Manual  
Reinforcing Rodworker Health and Safety Manual



<b>Number:</b>	S1347.1		
<b>Title:</b>	<b>Post-tension Safety</b>		
<b>Duration:</b>	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standard: U0911.03, U0911.05, U0911.06, U0911.07, U0911.08, U0911.11, U0911.03, U0912.02, U0912.04, U0916.02, U0917.02			

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to correctly identify hazards associated with the installation and stressing of post-tensioning systems.

### **Learning Outcomes and Content**

- S1347.1.1 Identify and apply housekeeping procedures regarding:
- cleanliness and order in the work area
  - storing of tools
  - securing loose objects
  - removing hazards
  - keeping aisle ways clear
- S1347.1.2 Explain the correct method for lifting and carrying materials:
- explain the correct method for lifting and carrying materials
  - proper body mechanics and industrial ergonomics
- S1347.1.3 Identify and use safety devices for protective clothing and eye protection:
- glasses
  - footwear
  - clothing

<b>Number:</b>	S1347.2		
<b>Title:</b>	<b>Post-tension Tools and Equipment Safety</b>		
<b>Duration:</b>	Total Hours: 3	Theory: 3	Practical: 0
<b>Cross Reference to Training Standard:</b>	U0911.03, U0911.05, U0911.06, U0911.07, U0911.08, U0911.11, U0911.03, U0912.02, U0912.04, U0913.01, U0913.02, U0913.04, U0913.05, U0916.02, U0917.02		

### General Learning Outcomes

Upon successful completion, the apprentice is able to describe the safe operation of post-tensioning equipment, in accordance with manufacturer’s specifications and accepted industry standards.

### Learning Outcomes and Content

S1347.2.1 Identify and apply safety practices related to equipment:

- design and proper use of guards
- warning signs and tag systems
- lubrication of moving equipment parts
- crushing and pinching hazards
- proper body position when using tools

S1347.2.2 State the safe operational procedures for hoisting equipment.

S1347.2.3 State the safe operational procedures for stressing equipment.

S1347.2.4 State the safe operational procedures for grouting equipment.

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

Number:	S1348		
Title:	<b>Post-Tensioning Blueprints</b>		
Duration:	Total Hours: 24	Theory: 24	Practical: 0
Prerequisites:	None		
Content:	S1348.1 Terms and Symbols		
	S1348.2 Material Identification		
	S1348.3 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:**

Unbonded Post Tensioning Reference Manual and Student Workbook

Bonded Post Tensioning Reference Manual

Number:	S1348.1		
Title:	<b>Terms and Symbols</b>		
Duration:	Total Hours: 16	Theory: 16	Practical: 0
Cross Reference to Training Standard: U0916.01, U0916.02, U0916.03, U0916.04, U0916.05, U0916.06, U0916.07, U0917.01, U0917.02, U0917.03, U0917.04			

### General Learning Outcomes

Upon successful completion, the apprentice is able to interpret terms and symbols for post-tensioning blueprints, in accordance the requirements of the specified trade related task.

### Learning Outcomes and Content

- S1348.1.1 Identify and define terms, symbols, types and applications for post-tensioning techniques:
- identify and interpret abbreviations and symbols
  - define layout and drafting terms
- S1348.1.2 Describe the types and applications of drawings and layout for post-tensioning systems:
- interpret concrete reinforcing work activities from drawings and specifications
  - identify types of blueprints

Number:	S1348.2		
Title:	<b>Material Identification</b>		
Duration:	Total Hours: 2	Theory: 1	Practical: 1
Cross Reference to Training Standard: U0916.01, U0916.02, U0916.03, U0916.04, U0916.05, U0916.06, U0916.07, U0917.01, U0917.02, U0917.03, U0917.04			

### General Learning Outcomes

Upon successful completion, the apprentice is able to identify and select the required materials for post-tensioning work, in accordance with accepted industry standards and the requirements of assigned trade related projects.

### Learning Outcomes and Content

- S1348.2.1 Identify required component for post-tensioning work according to drawings and specifications:
- identify component types
  - identify component composition
  - identify accessories
- S1348.2.2 Select required components for post-tensioning work according to drawings and specifications.

<b>Number:</b>	S1348.3		
<b>Title:</b>	<b>Calculations</b>		
<b>Duration:</b>	Total Hours: 6	Theory: 6	Practical: 0
Cross Reference to Training Standard: U0916.01, U0916.02, U0916.04, U0917.01, U0917.02, U0917.03, U0917.04, U0917.06			

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform the required calculations for post-tensioning work, in accordance with industry standards and the requirements of assigned trade related projects.

### Learning Outcomes and Content

- S1348.3.1 Perform the required planning to determine the specified post-tensioning system:
- outline planning techniques
  - describe estimating requirements for time, manpower, tools and equipment

- S1348.3.2 Perform the required calculations to determine the specified post-tensioning system:
- elevations
  - loads
  - dimensions
  - locations
  - stressing
  - elongation

Evaluation Structure				
Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
70%	0%	0%	10%	30

Number:	S1349		
Title:	<b>Post-Tensioning Layout and Modification</b>		
Duration:	Total Hours: 18	Theory: 5	Practical: 13
Prerequisites:	None		
Content:	S1349.1 Layout S1349.2 Modification of Members		

**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:**

Unbonded Post Tensioning Reference Manual and Student Workbook  
Bonded Post Tensioning Reference Manual

Number:	S1349.1		
Title:	Layout		
Duration:	Total Hours: 15	Theory: 3	Practical: 12
Cross Reference to Training Standard: U0916.01, U0916.02, U0916.04, U0916.05, U0916.06, U0916.07, U0917.01, U0917.02, U0917.03			

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform layout procedures for post-tensioning members, in accordance with drawings and specifications of the assigned trade related tasks.

### Learning Outcomes and Content

- S1349.1.1 Determine the specified reference point locations for post-tensioning work:
- determine the required benchmarks and reference points
  - locate and mark ordinate locations and bearing plates
  - locate and mark center lines
- S1349.1.2 Inspect the placement and condition of post-tensioning anchoring points:
- identify anchorage point location
  - inspect anchorage point condition
  - verify critical post-tensioning starting points
- S1349.1.3 Perform the layout for post-tensioning work:
- calculate distance and spacing
  - layout anchorage point
  - layout profile
  - perform the required adjustments to conform to drawings and specifications



<b>Number:</b>	S1349.2		
<b>Title:</b>	<b>Modification of Members</b>		
<b>Duration:</b>	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standard: U0916.01, U0916.04, U0916.05, U0916.06, U0916.07, U0917.02, U0917.05			

### General Learning Outcomes

Upon successful completion, the apprentice is able to perform modification procedures for post-tensioning components, in accordance with accepted industry standards and the requirements of the assigned trade related tasks.

### Learning Outcomes and Content

- S1349.2.1 Describe the construction features, types and application of post-tensioning components.
- S1349.2.2 Perform material layout for the modification of post-tensioning components following the drawings and specifications:
- identify components
  - layout components
  - inspect layout and compare to specifications
- S1349.2.3 Perform component cutting procedures to modify and assemble specified post-tensioning components:
- Identify and describe cutting procedures
  - modify components
  - assemble component
- S1349.2.4 Inspection post-tensioning assembly and compare to drawings and specifications:
- verify layout dimension for elevations and locations
  - verify correct component assembly

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

Number:	S1350		
Title:	<b>Post-Tensioning Installation, Assembly and Inspection</b>		
Duration:	Total Hours: 72	Theory: 19	Practical: 53
Prerequisites:	None		
Content:	S1350.1 Erection Methods		
	S1350.2 Installation and Securing		
	S1350.3 Alignment and Inspection		
	S1350.4 Stressing and Grouting		

**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:**

Unbonded Post Tensioning Reference Manual and Student Workbook  
Bonded Post Tensioning Reference Manual  
Rigging for Ironworkers Reference Manual

Number: S1350.1  
Title: **Erection Methods**  
Duration: Total Hours: 6 Theory: 3 Practical: 3  
Cross Reference to Training Standard: U0912.01, U0912.02, U0912.03, U0916.01, U0916.02, U0916.03, U0916.04, U0916.05, U0916.06, U0916.07, U0917.01, U0917.02, U0917.03, U0917.04

### General Learning Outcomes

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

### Learning Outcomes and Content

- S1350.1.1 Describe required installation sequence for post-tensioning work:
- identify the safe sequence to assemble post-tensioning components
  - identify the most efficient sequence to assemble post-tensioning components
- S1350.1.2 Identify the required safety practices for post-tensioning work:
- identify potential hazardous conditions
  - identify the specified protective equipment
  - describe safe working practices
  - perform the calculations to determine equipment and material requirements.
  - apply the specified safe working practices for post-tensioning
- S1350.1.3 Describe the required procedures to place post-tensioning materials:
- identify erection methods
  - identify rigging procedures
  - position erection equipment
  - position specified working platforms
  - install the required fall-arrest systems

Number:	S1350.2		
Title:	<b>Installation and Securing</b>		
Duration:	Total Hours: 48	Theory: 6	Practical: 42
Cross Reference to Training Standard: U0912.03, U0916.01, U0916.03, U0916.04, U0916.05, U0916.06, U0916.07, U0917.02, U0917.03			

### **General Learning Outcomes**

Upon successful completion, the apprentice is able to install and secure post-tensioning materials in accordance with government safety regulations, drawings and specifications of the assigned trade related tasks

### **Learning Outcomes and Content**

- S1350.2.1 Perform the rigging and hoisting technique for post-tensioning members:
- identify rigging techniques
  - identify hoisting techniques
  - identify post-tensioning members
  - perform proper rigging techniques
  - control post tensioning components during hoisting
  - place post tensioning components safely
  - communicate with co-workers effectively
- S1350.2.2 Place and setup of post-tensioning members:
- describe safe placement practices
  - place post tensioning components, in accordance with industry standard
  - communicate with co-workers effectively
- S1350.2.3 Perform the required securing methods for post-tensioning members:
- describe safe securing methods
  - secure post tensioning components, in accordance with industry standards

Number:	S1350.3		
Title:	<b>Alignment and Inspection</b>		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standard:	U0912.01, U0916.01, U0916.03, U0916.08, U0917.01		

### **General Learning Outcomes**

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

### **Learning Outcomes and Content**

- S1350.3.1 Perform the required alignment procedures for post-tensioning components:
- identify equipment required to align post-tensioning components
  - select and place alignment equipment
  - perform adjustments using the aligning equipment
  - performance permanent securing procedures when components are aligned to specifications
- S1350.3.2 Inspect and document procedures for post-tensioning work:
- inspect post-tensioning work and compare to drawings and specifications
  - document placement of components and any deficiencies noted during the erection process

Number:	S1350.4		
Title:	<b>Stressing and Grouting</b>		
Duration:	Total Hours: 12	Theory: 8	Practical: 4
Cross Reference to Training Standard:	U0912.01, U0912.02, U0912.03, U0912.04, U0912.05, U0913.02, U0913.04, U0913.05, U0916.08, U0917.01, U0917.02, U0917.03, U0917.04, U0917.05, U0917.06, U0917.07		

### General Learning Outcomes

Upon successful completion, the apprentice is able to stress and grout post-tensioning members, in accordance with industry standards and the requirements of assigned trade related projects.

### Learning Outcomes and Content

- S1350.4.1 Identify anchor heads and jacking equipment:
- types of anchor heads
  - types of jacking equipment
- S1350.4.2 Install and secure jacking equipment and wedges:
- remove pocket former
  - clean and prepare tendon and pocket
  - secure jacking equipment
  - insert wedges
- S1350.4.3 Identify the techniques involved in stressing a tendon.
- S1350.4.4 Install and secure anchor heads:
- install and secure anchor heads
  - performing cable projection cuts
- S1350.4.5 Describe grout mixing and pumping operations:
- identify grout material mixing ratios
  - mix grout
  - pump grout
- S1350.4.6 Perform grout applications according to post-tensioning specifications:
- cleanout duct
  - apply grout

S1350.4.7 Verify the achievement of required elongations, according to post-tensioning specifications:

- inspect elongations and compare to specifications
- document the inspection results

<b>Evaluation Structure</b>				
Theory Testing	Practical Application Testing	Projects	Notebook and 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

- Slings (20):
- Wire Rope
  - Nylon
  - Safety Spreaders
  - Chain Spreaders
- Two-way radios
- Spreader Beam/Bar
- Rigging hardware (shackles, cable clamps, hooks, turnbuckles)
- Chainfalls (2)
- Comealongs (2)
- Tirfor
- Fibre line of sufficient length for tagging loads
  - Nylon
  - Polypropylene
  - Manila
- Exacto Knife (5)
- Reinforcing Belts (20) containing:
  - Belt
  - Reel
  - Reel Pad
  - Back Pad
  - Tunnel Loop/scabbard
  - Diagonal Cutting pliers
  - Tie Pliers (9")
  - Keel holder
- Steel Reinforcing – 10M-55M
- Welded Wire Fabric
- Composite Reinforcing
- Reinforcing Rod Splice Accessories
- Reinforcing Rod Bolster Accessories



- Reinforcing Rod High Chair Accessories
- Reinforcing Rod Stirrups
- Reinforcing Rod Spirals
- Reinforcing Rod Tie wire
- Reinforcing Rod Storage Racks
- Reinforcing Rod Bending Machine
- Bar tendon
- Bar tendon tensioning nut
- Bar Tendon bearing plate
- Bar Tendon Anchoring nut
- Bar Tendon tensioning device
- Tie Gun
- Fall arrest equipment
- Fall arrest harness (20)
- Belly-hooks (20)
- Gas-powered Cut off Saw
- Bolt Cutters
- Power shear
- Folding rule (5)
- Layout/Assembly Area Minimum 5000 square feet
- Hacksaws (10)
- Portable Band Saw
- Chalk
- Smokeater (5)
- 14" Cut off abrasive saw (2)
- Vices (5)
- Chalk Lines (20)
- Tape measure 25'/8m (20)
- Overhead Pendant Crane Bay with 5 ton Trolley Hoist or similar hoisting device
- Scaffold equipment
- Lens Cleaning Station (2)
- Hard Hats (20)
- Face shields (10)
- Safety Glasses (20)
- Hickey Bar (5)
- Material rack
- Fork truck
- Power Elevated Working Platform
- Oxygen Acetylene torch outfits (10)
- Welding Machines (2)
- Tugger
- Post-Tensioning Ram and Power Pack (pump)
- Anchor assembly (20)
- Post-Tensioning Cable/tendons
- Wedge assembly (20)
- Pocket Former (20)

- Trumpet (20)
  - Paint Marker
- Chalk Lines (20)
- Plumb Bobs (5)
- Tape measure 25'/8m (20)
- 0-8 Ton Carrydeck Crane
- First Aid Station (5)
- Appropriate Fire Extinguisher
- Levels:
  - 4' (2)
  - 2' (2)
  - Torpedo (2)
- Turntable
- Grout mixer
- Grout hose
- Detensioning stool
- Plasma cutter
- Channel lock pliers
- Duct lengths
- Duct splices
- Grout material
- Couplers
- Seating tool
- Drill
- Twist bits
- Tendon accessories
- Duct tape
- Square (combination/2')



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Ironworker (Reinforcing)