Saskatchewan Apprenticeship and Trade Certification Commission
1-877-363-0536
www.saskapprenticeship.ca
Apprenticeship

Ironworker Structural
On-the-Job Training Guide

Ironworker Structural workers field fabricate, weld, cut, erect, and dismantle structural, miscellaneous, and ornamental metal work. They also erect and place pre-cast concrete, and rig and place machinery and equipment.

Training Requirements: 5400 hours (3 years) including: two 8 week and one 6 week technical training sessions delivered by SIAST at Palliser Campus in Moose Jaw.

Journeyperson to apprentice ratio for this trade is: 1:2

The information contained in this pamphlet serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The pamphlet summarizes the tasks to be covered by the apprentice during the on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of the apprenticeship term training on-the-job.

It is the employer's or journeyperson's training responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote safety in the workplace
- expose the apprentice to all appropriate tools, equipment
- provide guided, hands-on practice in rigging, hoisting, and crane signals
- document hours of work and work experiences
- provided guided instruction setting up and dismantling various types of cranes

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

Below, in-school instruction is listed first; suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

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

Level One

Safety Awareness
Safety equipment applications, maintenance and use
Safe work practices
OH&S Regulations
Fall arrest equipment

The employer can assist the apprentice to prepare for this section of technical training by:
- *identifying types of personal protective equipment (PPE) and clothing and describing their applications and limitations*
- *demonstrating the selection, use and maintenance of PPE for worksite applications*
- *identifying hazards and describing safe work practices such as lockout/tagout, confined space awareness and environmental*
- *describing expected attitudes in relation to housekeeping, PPE and emergency procedures*
- *explaining industry practices for hazard assessment and control procedures*
- *describing the roles, responsibilities, features and practices related to the workplace hazardous materials information system (WHMIS) program*
- *describing the contents and importance of the OH&S Regulations*
- *demonstrating how to apply the OH&S regulations to day-to-day work activities*
- *describing the requirements to use and the use of fall arrest equipment*

Tools and Equipment
Applications, maintenance, storage and procedures for use
Hand, electric, hydraulic, pneumatic and gas tools
Leveling and alignment instruments
Explosive actuated tools

The employer can assist the apprentice to prepare for this section of technical training by:
- *identifying types of hand and power tools and describing their applications and procedures for use*
- *providing opportunities to use and maintain basic hand and power tools commonly used in the trade*
- *providing opportunities to use and maintain power, hydraulic, pneumatic and gas tools used in structural steel construction and fabrication*
- *describing equipment storage and maintenance requirements*
- *demonstrating how to sharpen drill bits and the selection and use of taps and dies*
- *demonstrating the use of laser levels and transits to find differences in elevation, and how to perform reverse shot calculations*
- *providing opportunities to use various levelling instruments, including the set up and use of transits*
- *identifying hazards and describing safe work practices pertaining to using explosive actuated tools*
- *providing instruction on safe operating procedures of explosive actuated tools*

Access Equipment
Applications, limitations and procedures for use
Scaffolds and ladders
Swing stages, sky climbers, angel wings and crane man baskets
Aerial work platform (AWP) operation

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with ladders, scaffolding and AWP*
- *identifying hazards and describing safe work practices pertaining to ladders, scaffolding and AWP*
- *identifying OH&S Regulations pertaining to all types of access equipment*
- *describing the procedures used to erect, secure, dismantle and inspect access equipment*
- *providing opportunities to set up and use various types of access equipment*

Cranes I
Types, applications and limitations
Crane lifting operations and safety
Basic load charts

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with cranes and crane lifting operations*
- *identifying hazards and describing safe work practices pertaining to cranes and crane lifting operations*
- *identifying types of cranes and describing their components, characteristics and applications*
- *discussing safety considerations for the assembly/installation of cranes such as overhead power lines, underground services and soil/ground conditions*
- *discussing crane positioning with regard to crane radius/swing area and headroom*
- *introducing the apprentice to basic load charts and demonstrating how to interpret them*

Hoisting, Lifting, and Rigging
Equipment applications, limitations and procedures for use
Procedures for hoisting and lifting operations
Calculations for hoisting and lifting operations
International crane hand signals

The employer can assist the apprentice to prepare for this section of technical training by:
- *describing the terminology associated with hoisting, lifting and rigging*
- *identifying hazards and describing safe work practices pertaining to hoisting, lifting and rigging*
- *identifying types of rigging equipment and accessories and describing their limitations, applications and procedures for use*
- *demonstrating and then having the apprentice perform calculations pertaining to rigging equipment safe working loads and breaking strength*
- *providing opportunities to select and install various wire rope hardware*
- *identifying types of hoisting and lifting equipment and accessories and describing their applications and procedures for use*
- *describing the procedures used to inspect, maintain and store hoisting, lifting and rigging equipment*
- *identifying types of knots, hitches and bends and describing their applications and the procedures used to tie them*
- *describing the procedures used to rig material/equipment for hoisting and lifting*
- *describing the procedures used to ensure the work area is safe for hoisting and lifting operations*
- *demonstrating how to calculate sling tension and sling angle when preparing for hoisting and lifting*
- *describing the procedures used to determine the weight and weight distribution of loads*
- *identifying the factors to consider when selecting rigging equipment such as weight, shape and centre of gravity*
- *describing the procedures used to perform a lift such as load determination, pre-lit checks and placement of load*
- *providing instruction on how to perform international crane hand signalling*

Structural Components
Characteristics and applications
Fastening methods
Characteristics and applications of falsework
Procedures for the erection and dismantling of falsework

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with structural components*
- *identifying hazards and describing safe work practices pertaining to structural components*
- *demonstrating how to interpret information pertaining to structural components found on drawings and specifications*
- *identifying types of structures and describing their characteristics*

- *identifying structural steel shapes and describing their designations, characteristics and applications*
- *identifying types of structural components such as secondary steel, girts and lintels and describing their purpose*
- *identifying fastening methods associated with structural steel and describing their characteristics, applications and limitations*
- *describing the procedures used to install fasteners for securing structural steel members*
- *identifying types of falsework and describing their characteristics and applications*
- *providing opportunities to construct and dismantle falsework*

Drawing Interpretation and Work Planning
Types of drawings and their applications
Interpreting and extracting information from drawings
Preparation and use of trade related documentation
Planning and organizing work tasks
Planning and handling work materials
Effective communication practices

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with drawings*
- *identifying types of drawings and describing their applications*
- *identifying drawing projections and views and describing their applications*
- *providing instruction on interpreting and extracting information from drawings*
- *providing opportunities to read and interpret specifications and details from structural steel drawings*
- *identifying types of trade related documentation and describing their applications and procedures for use*
- *describing the procedures used to prepare and complete trade related documentation*
- *identifying sources of information relevant to work task planning*
- *describing the procedures used to plan work tasks*
- *describing the procedures used to organize and store tools, equipment, materials and supplies on-site*

Building Erection I
Erection and partial dismantling of a structural steel structure using a crane
Interpretation of drawings
Identification of structural components
Safe worksite practices
Rigging techniques

The employer can assist the apprentice to prepare for this section of technical training by:
- *having the apprentice identify structural steel members from drawings during erection operations*
- *assisting the apprentice to select the correct rigging equipment and accessories relating to structural steel erection*
- *providing opportunities to apply safe rigging practices and procedures to work as a team to erect structural steel components*
- *providing opportunities to select and install fasteners according to application and manufacturers specifications*

Welding I
Oxy fuel equipment and accessories
Oxy-fuel cutting
Shielded metal arc welding equipment and accessories
Shielded metal arc welding procedures

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with oxy-fuel and welding equipment*
- *identifying hazards and describing safe work practices pertaining to cutting and welding procedures*
- *identifying oxy-fuel and welding equipment and accessories and describing their applications*
- *describing the procedures used to inspect and maintain oxy-fuel and welding equipment*
- *demonstrating the procedures used to set up, adjust and shut down oxy-fuel equipment*
- *providing opportunities to set up and operate oxy-fuel cutting equipment to perform cutting operations*
- *demonstrating the procedures used to set up and adjust SMAW equipment*
- *providing opportunities to set up and operate SMAW equipment to perform welds*
- *describing common weld faults and procedures to prevent and correct these faults*

Industrial Mathematics

Whole numbers, common and decimal fractions
Conversions and comparisons with fractions, decimals and percents
Calculations and conversions using the metric and imperial systems
Calculations for average, perimeter, area and volume
Basic problems involving common and decimal fractions

The employer can assist the apprentice to prepare for this section of technical training by:

- *having the apprentice complete the online math program available on the apprenticeship website at www.saskapprenticeship.ca*
- *ensuring the apprentice can work in both the metric and imperial systems of measurement*
- *demonstrating how to convert between metric and imperial dimensions*
- *providing opportunities to perform basic area, perimeter and volume calculations*

Level Two

Cranes II

Crane and lifting operation terminology and safe work practices
Codes and regulations for cranes and lifting operations
Drawings, specifications; and tables and charts for crane lifting operations
Principles of leverage and their applications to cranes
Types, components, characteristics and applications for cranes
Crane assembly and on-site installation

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with hydraulic, conventional and tower cranes*
- *identifying and describing procedures used to communicate during crane operations*
- *identifying hydraulic, conventional and tower crane components, accessories and attachments and describing their characteristics and applications*
- *identifying considerations for crane assembly/installation on-site such as site hazard assessment and crane position*
- *describing the procedures used to assemble and set up hydraulic, conventional and tower cranes*
- *describing the procedures used to climb/jump tower cranes*
- *describing the procedures used to disassemble hydraulic, conventional and tower cranes, their components, accessories and attachments*
- *describing the procedures used to prepare hydraulic, conventional and tower cranes for transport*
- *providing opportunities to assist with set up, placement, moving, and dismantling of hydraulic, conventional and tower cranes*

Drawing Interpretation
Specifications and details on structural steel drawings
Specifications and details on miscellaneous steel drawings
Welding symbols
Specifications and shop fabrication drawings
Ornamental drawings
Reinforcing rebar drawings

The employer can assist the apprentice to prepare for this section of technical training by:
- *providing opportunities to interpret specifications and details on various structural steel drawings (site plans, shop drawings, cut sheets)*
- *describing the characteristics of welding symbols*
- *providing drawings showing welding symbols and describing their relationship to the work*
- *providing opportunities to interpret specifications and details on curtain wall drawings*
- *providing opportunities to interpret specifications and details on drawings depicting miscellaneous steel components, handrails, platforms, and stairs*
- *providing opportunities to interpret drawings for curtain wall systems and associated hardware as specified*
- *providing opportunities to interpret drawings to fabricate miscellaneous steel, hand railings, and stairs as specified*
- *providing opportunities to interpret drawings to place concrete reinforcing as specified*

Erection and Dismantling
Characteristics and applications of structural steel members
Erection procedures for structural steel members and components
Dismantling and removing procedures for structural steel members and components

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with structural steel erection and dismantling*
- *identifying hazards and describing safe work practices pertaining to erection and dismantling such as temporary bracing, environmental conditions and sequence*
- *ensuring the apprentice can select the correct tools and equipment relating to structural steel erection and dismantling, and that these tools and equipment are used safely and correctly*
- *asking the apprentice to identify structural steel members and describe their characteristics and applications*
- *assisting the apprentice to level, plumb and align structural steel members*
- *describing the procedures used to inspect erected structural steel to ensure conformity to standards*
- *describing the procedures used to repair, replace, dismantle and remove structural steel members and components*

Building Erection II
Erection of interior structural steel components using power rigging equipment
Power rigging equipment
Interpretation of drawings
Identification of structural components
Safe worksite practices
Rigging techniques

The employer can assist the apprentice to prepare for this section of technical training by:
- *having the apprentice identify steel components from drawings*
- *ensuring the apprentice can select the correct rigging and lifting equipment relating to structural steel erection and dismantling, and that this equipment is used safely and correctly*
- *providing opportunities to assist with winch installation procedures in various applications*
- *providing opportunities to apply safe rigging practices and procedures to work as a team to erect structural steel components*
- *providing opportunities to select and install fasteners according to application and manufacturers specifications*

Reinforcing Rebar
Reinforcing materials and accessories
Procedures to prepare for reinforcing concrete
Installation and tying techniques

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with reinforced concrete*
- *explaining the purpose for reinforcing concrete*
- *explaining the forces and stresses associated with reinforced concrete such as compression, tension shear and live and dead loads*
- *identifying hazards and describing safe work practices pertaining to reinforcing such as dowel protection, work positioning and proper packing and carrying techniques*
- *describing standards and identification systems relating to reinforcing steel such as grades, diameters, colour codes and tags*
- *identifying tools and equipment related to reinforcing and describing their applications and procedures for use*
- *identifying types of reinforcing materials such as welded wire mesh, tie wires and bar supports and describing their characteristics and applications*
- *explaining the importance of maintaining proper reinforcing clearances and tolerances for reinforcing materials*
- *demonstrating the various knots used to install reinforcing rebar, describing their applications and limitations*
- *providing opportunities to assist in installing and tying rebar for various applications*
- *providing opportunities to assist in the installation of welded wire fabric*
- *providing instruction on safe handling, hoisting, moving and storage of rebar*
- *providing experience working with and handling various types of rebar (steel, epoxy coated, composite)*
- *providing opportunities to identify rebar grade and composition, and use code to identify various types and sizes of rebar*

Welding II
Welding and gouging equipment and accessories
Welding and gouging processes and procedures
Flux cored arc welding procedures

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with various types of welding and gouging processes*
- *identifying hazards and describing safe work practices pertaining to welding and gouging activities*
- *identifying the various different welding processes and describing their characteristics and applications*
- *identifying different welding and gouging equipment, consumables and accessories and describing their applications*
- *demonstrating the procedures used to set up and adjust welding and gouging equipment*
- *describing the procedures used to inspect, maintain and store welding and gouging equipment and supplies*
- *identifying types of welds and joint preparations used during welding operations*
- *providing opportunities to select and set up various types of electric arc welding equipment to weld assorted thicknesses of materials in various positions*
- *providing opportunities to select and set up, adjust and use flux cored arc welding equipment to perform welding operations*
- *providing opportunities to select and set up, adjust and use carbon arc gouging equipment to perform gouging and cutting operations*

Ironworker Mathematics
Scientific numbers
Conversions and comparisons with percents, rates, ratios and proportions
Angle measurement and calculations
Calculations involving circles and partial circles
Basic geometry
Basic problems involving perimeter, area and volume

The employer can assist the apprentice to prepare for this section of technical training by:
- *providing opportunities to determine weights, volumes, area, and turning radius*
- *providing opportunities to perform trade related mathematical calculations that require the application of basic geometric formulas such as the Pythagorean formula*
- *if necessary, having the apprentice spend time on the online math program available on the apprenticeship website at www.saskapprenticeship.ca in order to work through any areas of difficulty*
- *allowing the apprentice to work out worksite problems and perform calculations in both the metric and imperial systems of measurement*
- *continuing to provide opportunities to perform basic area, perimeter and volume calculations*

Level Three

Access Equipment
Aerial work platform operations
Telefork operations

The employer can assist the apprentice to prepare for this section of technical training by:
- *demonstrating the operating procedures for various types of aerial work platforms*
- *demonstrating the operating procedures for telefork equipment*
- *discussing the hazards and safe work practices pertaining to these types of access equipment such as site conditions and equipment limitations*

Cranes III
Terminology associated with electric overhead traveling cranes (EOT)
Communication procedures during EOT crane operations
Hazards and safe work practices for EOT cranes and EOT crane lifting operations
EOT crane components and accessories
EOT crane controls
Assembly and installation procedures for EOT cranes

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with EOT cranes*
- *identifying and describing the procedures used to communicate during EOT crane operations*
- *identifying hazards and describing safe work practices pertaining to EOT crane and EOT crane operations*
- *identifying EOT crane components, accessories and attachments and describing their characteristics and applications*
- *identifying types of EOT controls such as cab operated, remote operated and pendant and describing their characteristics and applications*
- *describing the procedures used to assemble and install EOT cranes*

Miscellaneous and Ornamental Ironwork
Interpretation of shop drawings
Components, characteristics and applications
Fabrication and installation procedures
Floor and roof decking procedures
Wood glulam handling and erection

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with miscellaneous and ornamental ironwork*
- *identifying hazards and describing safe work practices pertaining to miscellaneous and ornamental ironwork*
- *providing opportunities to interpret information used to fabricate and install miscellaneous and ornamental ironwork found on drawings and specifications*
- *providing opportunities to interpret drawings to install curtain wall systems and associated hardware as specified*
- *identifying tools and equipment relating to miscellaneous and ornamental ironwork and describing their applications and procedures for use*
- *describing the procedures used to fabricate and install miscellaneous and ornamental ironwork*
- *describing the procedures used for the finishing or ornamental ironwork*
- *describing the procedures used to repair or remove ornamental ironwork*
- *providing opportunities to layout and fabricate jigs for special applications*
- *providing opportunities to layout and fabricate ornamental steel projects*
- *providing opportunities to assist in the construction, installation/assembly of various types of curtain walls*
- *providing opportunities to rig up and assist with the hoisting and installation of laminated wood products such as glulam beams*

Pre-engineered Structures

Interpretation of drawings specific to engineered structures
Components
Erection procedures

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with pre-engineered structures*
- *identifying hazards and describing safe work practices pertaining to pre-engineered structures*
- *assisting apprentice to interpret information pertaining to pre-engineered structures found on drawings and specifications*
- *identifying tools and equipment relating to pre-engineered structures and describing their applications and procedures for use*
- *identifying types of pre-engineered structures such as tapered beam, single-span and multi-span rigid frame and lean-to, and describing their characteristics and applications*
- *identifying pre-engineered structure components and describing their characteristics and applications*
- *describing the procedures used to plan and prepare for the erection of pre-engineered structures*
- *providing opportunities to erect pre-engineered structures and their components*

Machinery and Equipment

Types and characteristics
Interpretation installation information from drawings
Identification of structural components for installation and removal
Installation and removal procedures
Safe work practices

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with machinery and equipment installation and removal*
- *identifying hazards and describing safe work practices pertaining to the installation and removal of machinery and equipment*
- *assisting apprentice to interpret information pertaining to the installation and removal of machinery and equipment found on drawings and specifications*
- *identifying tools and equipment relating the installation and removal of machinery and equipment and describing their applications and procedures for use*

- *identifying types of machinery and equipment installed and removed by Ironworkers such as storage tanks, hoppers and conveyors and describing their characteristics*
- *describing the procedures used to install or remove machinery and equipment*
- *providing opportunities for the apprentice to assist with the installation and removal of machinery and equipment*

Building Erection III
Dismantling of a structural steel structure using a crane
Identification of structural components
Safe worksite practices
Advanced rigging techniques
Sequence of dismantling
Sequence of component storage
Trailer loading and storage of components

The employer can assist the apprentice to prepare for this section of technical training by:
- *describing the sequence of dismantling a structural steel building with respect to the order of re-installation*
- *describing the procedures used to stack and secure structural steel components for storage or for transport*
- *providing opportunities to select materials and equipment for rigging systems*
- *providing opportunities to learn about calculating load weights, using load charts to determine crane capacity, measuring boom deflection, and determining weight displacement*
- *providing opportunities to dismantle steel buildings*
- *providing opportunities to apply safe rigging practices and procedures to work as a team to dismantle structural steel components*
- *providing opportunities for the apprentice to perform the signalling during crane lifting operations*

Precast Concrete
Components of pre-cast concrete members
Erection and dismantling procedures

The employer can assist the apprentice to prepare for this section of technical training by:
- *defining terminology associated with pre-cast concrete erection and dismantling*
- *identifying hazards and describing safe work practices pertaining to pre-cast concrete erection and dismantling*
- *assisting apprentice to interpret information pertaining to pre-cast concrete erection and dismantling found on drawings and specifications*
- *identifying tools and equipment relating to pre-cast concrete erection and dismantling and describing their applications and procedures for use*
- *identifying types of pre-cast concrete members and components and describing their characteristics and applications*
- *describing the procedures used to prepare, erect, finish and dismantle pre-cast concrete members and components*
- *providing opportunities to assist with the erection and dismantling of pre-cast concrete members and components*
- *providing opportunities to choose appropriate rigging and perform hook up procedures for slinging various pre-cast components into position*

Welding III
Plasma arc cutting equipment and accessories
Plasma arc cutting procedures

The employer can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with plasma arc cutting*
- *identifying hazards and describing safe work practices pertaining to plasma arc cutting*
- *describing the plasma arc cutting process and its applications*
- *identifying plasma arc cutting equipment and accessories and describing their applications*
- *describing the procedures used to set up, adjust and shut down plasma arc cutting equipment*
- *describing procedures used to inspect, maintain and store plasma arc cutting equipment*
- *describing the procedures used to cut using plasma arc cutting equipment*
- *identifying common cutting faults and describing the procedures used to prevent and correct these faults*
- *providing opportunities for the apprentice to set up, operate and shut down plasma arc cutting equipment*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

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