

Appendix A

Work Process Schedules for: Ironworker (including the Architectural and Ornamental Ironworker, Reinforcing Concrete Ironworker, and the Structural Ironworker)

The schedules are attached to and are a part of these Standards for the above identified occupations.

1. TERM OF APPRENTICESHIP

The term of the Ironworker apprentice shall be **(Insert Number of Years)** with an OJL attainment of **(Insert OJL Hours)** supplemented by the required hours of related instruction.

2. RATIO OF APPRENTICES TO JOURNEYMEN (JOURNEYWORKERS)

(Insert Ratio) as covered in the **Collective Bargaining Agreement (CBA)**.

3. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on a percentage of the current journeyman wage rate, or as per the CBA.

3 Year Term Example*:

First 700-1000 hours	-	not less than	_____
Second 700-1000 hours	-	not less than	_____
Third 700-1000 hours	-	not less than	_____
Fourth 700-1000 hours	-	not less than	_____
Fifth 700-1000 hours	-	not less than	_____
Sixth 700-1000 hours	-	not less than	_____

4 Year Term Example*:

First 700-1000 hours	-	not less than	_____
Second 700-1000 hours	-	not less than	_____
Third 700-1000 hours	-	not less than	_____
Fourth 700-1000 hours	-	not less than	_____
Fifth 700-1000 hours	-	not less than	_____
Sixth 700-1000 hours	-	not less than	_____
Seventh 700-1000 hours	-	not less than	_____
Eighth 700-1000 hours	-	not less than	_____

*The Local Union and the JATC are to insert percentages negotiated in the CBA.

- A. Apprentices who receive credit for previous experience in the trade shall be paid, upon entrance to the trade, the wage rate of the period to which such credit advances them.
- B. Apprentices who complete the last period and who fail to pass the required journeyman examination shall be required to serve another six months, for which they shall be paid the regular last period rate.

4. SCHEDULE OF WORK EXPERIENCE (See attached Work Process Schedule)

The work processes required for each Ironworker occupation are identified on the following pages. The detailed knowledge and skill competencies within each of the work process clusters are found on the master list included after the individual Work Process Schedules.

The master Ironworker Work Process Schedule includes work processes listed within clusters. Each cluster lists the knowledge and skill competencies required of an Ironworker in order to master that cluster. The knowledge and skill competencies are developed and tested during related instruction and then applied on the job.

For each Ironworker occupation the minimum and maximum on-the-job learning (OJL) hours are identified for the primary clusters. The minimum number indicates the minimum hours of OJL required to reach the required skill level.

Note that the OJL hours are identified for the primary clusters applied and tracked on the job (e.g., welding, rigging and cranes, structural steel erection). While other clusters develop required knowledge and skills during related instruction, they support the application of the primary skills (e.g., orientation, blueprint reading, and mathematics).

JATCs may implement a traditional time-based apprenticeship model or they may implement a hybrid-progression model using distance learning for related instruction. With both models the JATC may select and modify the work processes to meet local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

5. SCHEDULE OF RELATED INSTRUCTION (See attached Related Instruction Outlines)

The International Association of Bridge, Structural, Ornamental and Reinforcing Ironworkers recommends a minimum of 204 classroom hours and a maximum of 2000 OJL hours per year for a time-based local union apprenticeship program. This means that the minimum is 612 hours of related instruction and a maximum of 6000 hours of OJL for a three-year program and a minimum of 816 hours of related instruction and a maximum of 8000 hours of OJL for a four-year program. While the International recommends 2000 hours per year of OJL, given the nature of the ironworking trade it is often difficult to obtain 2000 hours. Therefore the minimum total OJL hours per year must be greater than 1400.

The International has established a minimum requirement of 612 hours of related instruction for a three-year apprenticeship program. While the three-year program is the minimum requirement, the International suggests that local union JATCs consider 816 hours, which ideally is built into a four-year program.

The International recommends a minimum of 204 classroom hours and a maximum of 2000 OJL hours per year for a hybrid-progression apprenticeship program. Refer to the Work Process Schedules for the minimum and maximum OJL hours for specific work process clusters.

The clusters identified within the master Ironworker Work Process Schedule form the foundation for the related instruction courses. The courses identified within the individual occupational schedules are required to develop the necessary knowledge and skill competencies. JATC's are only required to include the skill clusters indicated in the appropriate Work Process Schedule in their local curriculum. JATC's may select other clusters from the master list in order to reach the required number of related instruction hours and to meet local needs.

Appendix A

WORK PROCESS SCHEDULE

IRONWORKER

O*NET-SOC CODE: 47-2221.00 RAPIDS CODE: 0669

The following table lists the work processes required for this Ironworker occupation. The recommended OJL hours for the primary clusters applied and tracked on the job are identified for 3-year and 4-year time-based and hybrid apprenticeship programs. The recommended related instruction hours are identified for the required work process clusters. **Refer to the master work process schedule for the specific knowledge and skills developed within each cluster.**

Work Processes (within competency clusters)	3-Year Time-based	4-Year Time-based	3-Year Hybrid	4-Year Hybrid	Related Instruction
Orientation for Ironworkers					8
Introduction to Blueprint Reading					20
10-Hour OSHA Training					10
Scaffold User Erector/Dismantler					16
OSHA Sub-Part R					8
First Aid/CPR					8
Foreman Training for Ironworkers					24
Welding	1400	2000	980-1400	1400-2000	110
Rigging and Cranes	1200	1600	840-1200	1120-1600	80
Structural Steel Erection	1400	2000	980-1400	1400-2000	100
Reinforcing Concrete	1000	1200	700-1000	840-1200	75
Architectural and Ornamental Construction	1000	1200	700-1000	840-1200	50
Totals	6000	8000	4200-6000	5600-8000	509

Appendix A

WORK PROCESS SCHEDULE

ARCHITECTURAL AND ORNAMENTAL IRONWORKER

O*NET-SOC CODE: 47-4099.99 RAPIDS CODE: 0373

The following table lists the work processes required for this Ironworker occupation. The recommended OJL hours for the primary clusters applied and tracked on the job are identified for 3-year and 4-year time-based and hybrid apprenticeship programs. The recommended related instruction hours are identified for the required work process clusters. **Refer to the master work process schedule for the specific knowledge and skills developed within each cluster.**

Work Processes (within competency clusters)	3-Year Time- based	4-Year Time- based	3-Year Hybrid	4-Year Hybrid	Related Instruction
Orientation for Ironworkers					8
Introduction to Blueprint Reading					20
Mathematics for Ironworkers					30
10-Hour OSHA Training					10
Scaffold User Erector/Dismantler					16
OSHA Sub-Part R					8
First Aid/CPR					8
Layout Instruments for Ironworkers					20
Foreman Training for Ironworkers					24
Welding	1200	1600	840-1200	1120-1600	110
Rigging and Cranes	1600	2400	1120-1600	1680-2400	80
Architectural and Ornamental Construction	3200	4000	2240-3200	2800-4000	100
Totals	6000	8000	4200-6000	5600-8000	434

Appendix A

WORK PROCESS SCHEDULE

IRONWORKER REINFORCING CONCRETE

O*NET-SOC CODE: 47-2171.00 RAPIDS CODE: 0471

The following table lists the work processes required for this Ironworker occupation. The recommended OJL hours for the primary clusters applied and tracked on the job are identified for 3-year and 4-year time-based and hybrid apprenticeship programs. The recommended related instruction hours are identified for the required work process clusters. **Refer to the master work process schedule for the specific knowledge and skills developed within each cluster.**

Work Processes (within competency clusters)	3-Year Time- based	4-Year Time- based	3-Year Hybrid	4-Year Hybrid	Related Instruction
Orientation for Ironworkers					8
Mathematics for Ironworkers					30
Introduction to Blueprint Reading					20
10-Hour OSHA Training					10
Scaffold User Erector/Dismantler					16
OSHA Sub-Part R					8
First Aid/CPR					8
Foreman Training for Ironworkers					24
Welding					
Rigging and Cranes	1200	1600	840-1200	1120-1600	110
Bonded Post Tensioning	1200	1600	840-1200	1120-1600	80
Unbonded Post Tensioning	800	1100	560-800	770-1100	30
Reinforcing Concrete	800	1100	560-800	770-1100	45
	2000	2600	1400-2000	1820-2600	75
Totals	6000	8000	4200-6000	5600-8000	464

Appendix A

WORK PROCESS SCHEDULE

STRUCTURAL IRONWORKER

O*NET-SOC CODE: 47-2221.00 RAPIDS CODE: 0669

The following table lists the work processes required for this Ironworker occupation. The recommended OJL hours for the primary clusters applied and tracked on the job are identified for 3-year and 4-year time-based and hybrid apprenticeship programs. The recommended related instruction hours are identified for the required work process clusters. **Refer to the master work process schedule for the specific knowledge and skills developed within each cluster.**

Work Processes (within competency clusters)	3-Year Time- based	4-Year Time- based	3-Year Hybrid	4-Year Hybrid	Related Instruction
Orientation for Ironworkers					8
Introduction to Blueprint Reading					20
10-Hour OSHA Training					10
Scaffold User Erector/Dismantler					16
OSHA Sub-Part R					8
First Aid/CPR					8
Precast Safety and Erection					30
Lead Hazard Training for Ironworkers					16
Foreman Training for Ironworkers					24
Welding	1200	1600	840-1200	1120-1600	110
Rigging and Cranes	1200	1600	840-1200	1120-1600	80
Structural Steel Erection	2000	2600	1400-2000	1820-2600	100
Pre-engineered Metal Buildings	1600	2200	1120-1600	1540-2200	45
Totals	6000	8000	4200-6000	5600-8000	475

Ironworker Master Work Process Schedule

Work Processes (within competency clusters)

Orientation to Ironworking

Knowledge Competencies:

- Describe the history of the Ironworkers
- Describe the structure of the union
- Describe the structure of the apprenticeship program
- Use general Safe Work Practices
- Measure linear distance using a tape measure and a folding rule
- Identify basic ironworking hand tools
- List the steps to tie the Bowline and Clove Hitch
- List the steps in the setup and break down oxyfuel equipment
- List the steps to connect leads for shielded metal arc welding
- Describe roles and responsibilities of the structural Ironworker
- Describe roles and responsibilities of the architectural and ornamental Ironworker
- Describe roles and responsibilities of the reinforcing Ironworker

Skill Competencies:

- Use common Personal Protective Equipment (PPE)
- Select, don and adjust a personal Fall Arrest Harness
- Set up and use an extension ladder
- Set up and use a step ladder
- Demonstrate proper lifting techniques
- Assemble and use a complete structural tool belt
- Use a pocket knife
- Use a chisel
- Use sledgehammers
- Use a ball peen hammer
- Use "C" Clamp
- Use "C" type locking pliers
- Use adjustable locking pliers
- Use a torpedo level
- Use a plumb bob
- Use a hacksaw
- Use aviation snips
- Use a tag line
- Use a striker (flint lighter)
- Use a torch tip cleaner
- Use a wire brush
- Use a slag hammer
- Use a connecting bar
- Use a spud wrench
- Use an adjustable spud wrench

Work Processes (within competency clusters)

- Use an adjustable wrench
- Use Allen wrench set
- Use a center punch
- Use a combination square
- Use soapstone
- Use a chalk box and chalk
- Use a bevel square
- Use a socket set
- Use a tap wrench
- Use a caulk gun
- Use a wire reel
- Use diagonal cutting pliers
- Use side cutting pliers
- Use a lumber crayon and holder
- Assemble and use a complete reinforcing tool belt
- Tie a bowline knot
- Tie a clove hitch
- Setup oxyfuel welding equipment
- Connect leads for shielded metal arc welding equipment
- Identify reinforcing steel bar sizes
- Identify marks on reinforcing steel
- Tie a single snap tie with a wrap
- Tie a saddle tie
- Tie a saddle tie with a wrap
- Tie a figure eight tie
- Tie two nail head ties

Introduction to Blueprint Reading

Knowledge Competencies:

- Identify the types of construction drawings
- Interpret symbols and drawing information
- Interpret elements of drawings and common abbreviations and acronyms
- Interpret the basic elements of a drawing

Skill Competencies:

- Interpret floor plans
- Interpret anchor bolt plans and details
- Interpret blueprint abbreviations and symbols
- Identify columns on blueprints
- Identify the elements of a drawing
- Interpret elevations
- Interpret crane plans
- Interpret roof framing plans and details

Work Processes (within competency clusters)

- Identify doors on blueprints
- Interpret reinforcing plans and details
- Interpret post - tensioning plans and details
- Interpret curtain wall plans and details

Welding

Knowledge Competencies:

- Describe the history of welding
- Identify various types of joints and symbols.
- Describe general welding safety concepts.
- Explain procedures for base metal preparation and welding repairs.

Shielded Metal Arc Welding (SMAW)

Knowledge Competencies:

- Describe the SMAW process
- Identify SMAW safety practices
- Describe the role of electricity in the SMAW process
- Identify the components of the SMAW equipment
- Describe the steps to setup SMAW equipment
- Identify SMAW electrodes
- Describe the process for making a weld using SMAW
- Determine the quality of a SMAW weld
- Describe the process for performing carbon arc cutting and gouging

Skill Competencies:

- Setup SMAW equipment
- Evaluate the quality of a SMAW weld
- Run a stringer bead
- Perform a butt joint (square) in the four basic positions
- Perform a butt/groove weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a lap weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a t-joint/fillet in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a corner joint in the four basic positions (flat, vertical, horizontal, overhead)
- Perform an edge joint in the four basic positions (flat, vertical, horizontal, overhead)

Flux Cored Arc Welding (FCAW)

Knowledge Competencies:

- Describe the FCAW process
- Identify FCAW safety practices
- Describe the role of electricity in the FCAW process
- Identify the components of the FCAW equipment
- Identify FCAW consumables
- Describe the procedures for performing minor maintenance and repairs of FCAW equipment
- Describe the steps to setup FCAW equipment

Work Processes (within competency clusters)

- Describe the process for making a weld using FCAW
- Determine the quality of a FCAW weld

Skill Competencies:

- Setup FCAW equipment
- Evaluate the quality of a FCAW weld
- Perform a butt/groove weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a lap weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a t-joint in the four basic positions (flat, vertical, horizontal, overhead)

Gas Tungsten Arc Welding (GTAW)

Knowledge Competencies:

- Describe the GTAW process
- Identify GTAW safety practices
- Describe the role of electricity in the GTAW process
- Describe the process of high frequency GTAW
- Identify the components of the GTAW equipment
- Identify tungsten electrodes
- Identify metals used with GTAW
- Describe the procedures for performing minor maintenance and repairs of GTAW equipment
- Describe the steps to setup GTAW equipment
- Describe the process for making a weld using GTAW
- Determine the quality of a GTAW weld

Skill Competencies:

- Setup GTAW equipment
- Evaluate the quality of a GTAW weld
- Perform a butt/groove weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a lap weld in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a t-joint in the four basic positions (flat, vertical, horizontal, overhead)
- Perform a corner joint in the four basic positions (flat, vertical, horizontal, overhead)
- Perform an edge joint in the four basic positions (flat, vertical, horizontal, overhead)

Oxyfuel Gas Cutting and Welding (OFC/W)

Knowledge Competencies:

- Describe the OFC process
- Identify OFW, OFB and OFC safety practices
- Identify the components of OFC equipment
- Describe the steps to setup OFC equipment
- Evaluate the OFC process
- Describe the Oxyfuel Welding (OFW) process
- Describe the Oxyfuel Brazing (OFB) process
- Describe the air fuel soldering process
- Identify oxyfuel consumables and accessories

Work Processes (within competency clusters)

Skill Competencies:

- Setup OFC equipment
- Perform oxyfuel cutting
- Perform oxyfuel welding
- Perform oxyfuel brazing

Gas Metal Arc Welding (GMAW)

Knowledge Competencies:

- Describe the GMAW process
- Identify GMAW safety practices
- Identify the components of the GMAW equipment
- Identify materials used with GMAW
- Describe the steps to setup GMAW equipment
- Describe the process for making a weld using GMAW
- Determine the quality of a GMAW weld

Skill Competencies:

- Setup GMAW equipment
- Perform a butt/groove weld in the appropriate position for short arc and/or pulse spray.
- Perform a lap weld in the appropriate position for short arc and/or pulse spray.
- Perform a t-joint in the appropriate position for short arc and/or pulse spray.
- Perform a butt/groove weld in the flat or horizontal position using globular or spray method.
- Perform a lap weld in the flat or horizontal position using globular or spray method.
- Perform a t-joint weld in the flat or horizontal position using globular or spray method.

Submerged Arc Welding (SAW)

Knowledge Competencies:

- Describe the SAW process
- Identify SAW safety practices
- Identify the components of the SAW equipment
- Identify materials used with SAW
- Describe the steps to setup SAW equipment
- Describe the process for making a weld using SAW
- Determine the quality of a SAW weld

Skill Competencies:

- Setup SAW equipment
- Perform a butt joint in the flat position
- Perform a t-joint in the horizontal position

Carbon Arc Cutting & Gouging

Skill Competencies:

- Perform carbon arc cutting and gouging

Work Processes (within competency clusters)

Rigging and Cranes

Rigging

Knowledge Competencies:

- Describe the evolution and history of rigging technology
- Identify types of fiber rope
- Describe the reeving process
- Identify types of wire rope
- Identify types of rigging hardware
- Identify types of slings
- Identify types of chain
- Identify rigging tools and devices
- Describe rigging procedures and precautions
- Describe rigging with hydraulic gantry systems

Skill Competencies:

- Identify types of fiber rope
- Demonstrate coiling and uncoiling techniques
- Whip the end of a line
- Inspect fiber rope
- Splice fiber rope
- Demonstrate the ability to tie various types of knots with fiber rope
- Reeve rope falls
- Identify types of wire ropes
- Inspect wire ropes
- Attach end fittings to wire rope
- Identify rigging hardware
- Demonstrate the use of a single choker hitch
- Demonstrate the use of a double wrap choker hitch
- Demonstrate the use of a single basket hitch
- Demonstrate the use of a double wrap basket hitch
- Inspect chains
- Use a jack
- Use a roller
- Use a pulling device
- Operate a fork lift
- Demonstrate crane signals

Cranes

Knowledge Competencies:

- Describe the history of cranes
- Identify the types and configurations of mobile cranes
- Describe the principles of crane operation
- Identify the quadrants of crane operation
- Read crane load charts
- Identify crane capacity factors

Work Processes (within competency clusters)

- List the steps for prelift planning and setup
- Describe mobile crane operating procedures
- Describe the process to erect, climb, dismantle, and transport tower cranes
- List key crane operating procedures

Skill Competencies:

- Assist with erecting, climbing, dismantling, and transporting cranes on job sites
- Assess site hazards
- Demonstrate proper crane set up as per manufacturers' instructions
- Level the crane (blocking, mats/pads and ensuring crane is level using a leveling device)
- Set up rubber tired mobile cranes as per manufacturers' instructions
- Set up crawler mobile cranes as per manufacturers' instructions
- Set up tower cranes as per manufactures' instructions
- Assembly (disassembly) of lattice booms
- Determine the total load from the net load
- Apply the total load to the values in the load capacity charts
- Give and follow standard crane hand signals
- Give and follow verbal crane signals
- Demonstrate the use of a lift study to perform a set-up

Structural Steel Erection

Knowledge Competencies:

- Review the historical use of iron
- Identify safe working practices when erecting structural steel
- Identify tools and equipment used for structural steel erection
- Read structural steel drawings
- Describe how to unload, shake out, and store structural steel materials
- Identify the steps to erect columns and beams
- Identify the steps to erect joists, joist girders, and trusses
- Describe the steps to plumb and align structural steel
- Identify the steps to bolt up structural steel
- Name the types of structural connections
- Identify correct practices to handle and install metal deck safely
- Identify correct practices to handle and install sheeting safely
- Describe the procedures for erecting bridges
- Describe the process for erecting towers
- Describe the process for erecting wind turbines
- Explain the process for erecting clear span and modular structures
- Describe the process for erecting amusement park structures
- Explain the process for erecting and installing composite materials

Skill Competencies:

- Identify and use hand tools
- Identify and use crane signals
- Handle & hake out structural steel

Work Processes (within competency clusters)

- Prepare a base plate to elevation
- Erect a column
- Make a beam-to-column connection
- Make a beam-to-beam connection
- Connect a bar joist to a beam
- Install bridging
- Plumb columns
- Space welded connections for plumbing purposes
- Identify and select a specific bolts
- Bolt up a connection
- Demonstrate the turn of the nut method
- Demonstrate the use of a DTI
- Demonstrate the use of a TC gun
- Perform a pre-installation verification test
- Install decking
- Install sheeting

Reinforcing Concrete

Knowledge Competencies:

- Describe the early history of reinforced concrete
- Describe the process of manufacturing of reinforcing steel
- Identify reinforcing tools, ties and safety practices
- Identify types of reinforced concrete construction
- Solve reinforcing concrete mathematics problems in Imperial and Metric
- Describe the use of reinforcing in bridge construction
- Describe principles and theory of reinforced steel
- Describe the process of the fabrication of reinforcing steel
- List the steps to unload, handle and store reinforcing steel
- Describe and interpret various types of construction and shop drawings
- Identify types of bar supports and their usages
- Describe the placement of reinforcing steel in footings
- Identify the placing of reinforcing steel in walls
- Identify the placing of reinforcing bars steel in columns
- Describe the placing of reinforcing steel in beams and girders
- Describe the placement of reinforcing steel in joists and slabs
- Describe reinforcement in highway structures and airport pavement
- Apply general principles for bar splicing and mechanical coupling

Skill Competencies:

- Identify the size and marks of reinforcing steel
- Identify and demonstrate the correct use of a full body harness
- Tie a single snap tie
- Tie a wrap and snap tie
- Tie a saddle tie

Work Processes (within competency clusters)

- Tie a wrap and saddle tie
- Tie a figure eight tie
- Tie two nail head ties
- Inspect all rigging equipment for safety hazards
- Identify the sizes and capacities of various chokers, shackles, and fiber straps
- Properly rig a bundle of reinforcing bars using a set of wire rope chokers or fiber straps
- Identify and place different types of bar supports
- Assemble a footing mat
- Layout and assemble a round and a square column
- Perform the proper rigging procedures for a column to be lifted

Architectural and Ornamental Construction

Knowledge Competencies:

- Identify the components of curtain wall systems
- Identify the components of window wall systems
- Identify the components of sloped walls and skylights
- Identify the components of storefronts, entranceways and cable walls
- Describe the proper use of sealants
- Describe the process of installing glass (glazing) and glass rails
- Discuss the procedures for testing window and curtain wall systems
- Describe different types of doors installed by Ironworkers
- Review the steps for installing swing doors
- Outline the steps for installing door closers
- Review the steps for installing sliding doors and mall fronts
- Review the steps for installing revolving doors
- Review the steps for installing rolling service doors
- Describe the processes for installing anchors and fasteners
- List the steps for erecting stairs and ladders
- List the steps for installing catwalks and grating
- List the steps for installing fence and guard rails
- List the steps for installing detention equipment
- Describe the process for installing space frames

Skill Competencies:

- Transfer control lines
- Construct a curtain wall
- Construct a window wall system
- Layout a storefront and entranceway
- Conduct an adhesion test
- Prepare joint surfaces
- Prime joint surfaces
- Mask and unmask joints
- Install backer rod and bond breaker tape
- Apply sealant with a manual cartridge gun

Work Processes (within competency clusters)

- Apply sealant with an air cartridge gun
- Apply sealant with an electric cartridge gun
- Apply sealant with a sausage gun
- Tool a caulked joint
- Maintain a sealant log
- Handle and store/secure glass crates
- Install glass in a wet glazing system
- Install glass in a dry glazing system
- Install glass in a pressure glazing system
- Install glass in a two-sided wet structural glazing system
- Layout a glass railing
- Drill holes for the shoe of glass rail
- Weld rails
- Set glass in a glass rail
- Assemble a swing door
- Install a swing door and weatherization
- Install a surface mounted door closer
- Install an overhead door closer
- Install a floor closer
- Erect a frame and install a sliding door
- Install a sliding mall front
- Glaze doors
- Set a sill in various door installations
- Install a revolving door
- Install a rolling service door
- Install adhesive anchors in a solid base material
- Install adhesive anchors into hollow base material
- Install mechanical anchors
- Install drop-in stairs
- Install handrails
- Install ornamental stairs
- Install a ladder
- Install a catwalk
- Install grating
- Layout and set fence posts
- Install fittings, top rail, and tension wire
- Weave chain link fence fabric
- Stretch fence fabric
- Install a gate in a chain link fence and an ornamental fence
- Install chain link fence in a specialty application
- Install guard rails
- Install a swing door and frame for a detention application
- Install a rolling door and frame for a detention application
- Install various types of detention hardware

Work Processes (within competency clusters)

Pre-Engineered Metal Buildings

Knowledge Competencies:

- Describe the history and trends of metal buildings
- List the steps to unload and store materials
- List the steps to erect primary structural framing systems
- List the steps to erect secondary framing systems
- List the steps to install insulation
- List the steps to install wall materials
- List the steps to install metal roofing
- List the steps to install flashing, trim, gutters, and accessories
- List the steps to repair common metal building problems and failures
- Describe re-roofing and other metal building renovations

Skill Competencies:

- Unload and store materials
- Erect primary structural framing systems
- Erect secondary framing systems
- Install insulation
- Install wall materials
- Install metal roofing
- Install flashing, trim, gutters, and accessories
- Repair common metal building problems and failures

Unbonded Post-tensioning

Knowledge:

- Describe principles and theory of post-tensioning
- Identify components of a monostrand post-tensioning system
- Identify components of stressing equipment
- Identify installation hand tools and equipment
- Describe how to do document control and unload and handle materials
- List the steps to install monostrand post-tensioned floor systems
- List the steps to prepare monostrand tendons prior to stressing
- List the steps to stress monostrand tendons
- List the steps to detension and lift off monostrand tendons
- Describe how to troubleshoot monostrand tendons and stressing equipment
- List the steps to finish off tendon tails
- Identify the components of an encapsulated system
- List the steps to install barrier cables
- Identify the components of post-tensioned slabs-on-ground/grade

Work Processes (within competency clusters)

Skill Competencies:

- Layout and install anchorage of banded tendons on the edge form
- Layout tendon placement
- Layout a tendon profile support system
- Uncoil and install a monostrand tendon into anchorage and edge form
- Prepare a monostrand tendon for stressing
- Hook up stressing equipment
- Properly position the stressing jack and stress a monostrand tendon using a pump with a sequence valve or a seating valve
- Measure and record elongation of a stressed tendon
- Detension a tendon using a jack with jack feet, a jack with detensioning stool, or special detensioning nose piece

Bonded Post-tensioning

Knowledge Competencies:

- Describe principles and theory of bonded post-tensioning
- Identify components of a bonded post-tensioning system
- Identify components of stressing equipment
- Identify installation hand tools and equipment
- Describe how to handle and store bonded post-tensioning materials and components
- List the steps to install bonded post-tensioned systems
- List the steps to stress bonded post-tensioning tendons
- List the steps to grout bonded post-tensioning systems
- List the steps to finish and protect bonded post-tensioning systems
- List the steps to field test bonded post-tensioning systems
- List the steps to troubleshoot bonded post-tensioning systems
- Identify the components of wire post-tensioning systems

Skills:

- Assemble ducts and vents
- Apply heat shrink sleeve
- Install tendons into the ducts
- Stress tendons
- Mix grout
- Follow pumping procedures
- Conduct a flow cone test

Conveyor Installation and Industrial Maintenance

Knowledge Competencies:

- Describe the history of conveyors
- Identify safety practices, procedures and tools used in conveyor and industrial maintenance work

Work Processes (within competency clusters)

- Describe types of overhead conveyor systems
- Describe types of floor conveyor systems
- Describe the process for installing conveyor systems
- Describe components and operation of various bulk handling systems
- Read conveyor drawings.
- Describe industrial maintenance procedures

Skill Competencies:

- Calculate theoretical mechanical advantage
- Read a barrel micrometer
- Read a vernier caliper
- Read a dial caliper
- Drill and tap a threaded hole
- Extract a broken stud
- Lay out a reverse vertical curve
- Lay out a compound vertical curve
- Use the 3-4-5 method
- Use the Pythagorean Theorem
- Sketch and dimension a hanger leg
- Read column lines on conveyor drawings (Interpret Standard Conveyor Drawings)
- Read title block information on conveyor drawings (Interpret Standard Conveyor Drawings)
- Identify and locate materials from a materials list (Identify and locate materials from lists and callouts)
- Identify and locate materials from callouts (Identify and locate materials from lists and callouts)
- Determine dimensions from conveyor drawings
- Follow cross-references between drawings
- Interpret sections and views
- Identify standard conveyor symbols (Interpret Standard Conveyor Drawings)
- Remove and replace a bearing with a puller and a bearing heater
- Remove and replace a bearing using a hydraulic press
- Align and tension v-belts

Precast Safety and Erection

Knowledge Competencies:

- Describe preconstruction planning for precast concrete
- Identify precast concrete erection practices and procedures
- Identify precast concrete equipment
- Identify precast concrete erection safety procedures
- Interpret precast concrete erection tolerances
- Identify precast concrete quality control procedures

Skill Competencies:

- Unload precast concrete

Work Processes (within competency clusters)

- Perform rigging on precast concrete
- Place precast concrete
- Align precast concrete
- Fasten precast concrete

Fence Erection

Knowledge Competencies:

- Identify types of fence, including chain link, ornamental, composite, blast deflector, PVC fence, farm/range fence, and guard rails.
- Read fence drawings
- Read survey plats
- Describes the process to layout fence line with gates
- Describes the process to erect/install fence posts
- Describes the process to erect/install fence rails
- Describes the process to erect/install chain link fence fabrics
- Describe the process to erect/install ornamental fence
- Describe the process to erect/install high security fence and gates
- Describe the process to erect/install baseball backstops
- Describe the process to erect/install cantilever gates
- Describe the process to erect/install semi cantilever gates
- Describe the process to erect/install swing gates
- Describe the process to erect/install vertical lift gates

Skill Competencies:

- Operate industrial trucks (fork lifts) and aerial lifts
- Operate augers
- Operate post drivers
- Operate hand diggers
- Inspect all equipment and tools
- Maintain all equipment and tools
- Read survey plats
- Read job specifications
- Communicate with utility companies
- Check off materials required
- Lay out fence line
- Lay out gates
- Fabricate gates
- Fabricate temporary fence and gates
- Fabricate, erect/install fence post
- Fabricate, erect/install fence rails
- Fabricate, erect/install chain link fence
- Fabricate, erect/install chain link fence fabric
- Fabricate, erect/install ornamental fence
- Fabricate, erect/install high security fence and gates
- Fabricate, erect/install baseball backstops

Work Processes (within competency clusters)

- Fabricate, erect/install cantilever gates
- Fabricate, erect/install semi cantilever gates
- Fabricate, erect/install swing gates
- Fabricate, erect/install vertical lift gates
- Fabricate, erect/install overhead supported gates
- Install barb wire
- Install razor ribbon
- Weave vertical and horizontal slats in chain link fence
- Splice wires (tension, barb and etc.)

10-Hour OSHA/SMART MARK

Knowledge Competencies:

- Describe the introduction to and the purpose of OSHA
- Identify electrical safety practices according to subpart-K
- Identify fall protection practices according to subpart-M
- Identify scaffold safety practices according to subpart-L
- Identify material handling practices according to subpart-H
- Identify tool safety practices according to subpart-I
- Identify personal protective equipment practices according to subpart-E
- Identify stairway and ladder practices according to subpart-X
- Identify hazard communications practices according to subpart-D
- Identify confined spaces practices according to subpart-C

Skill Competencies:

- Follow the OSHA 10-hour course guidelines on the job site
- Practice Electrical safety
- Practice Fall Protection
- Practice Scaffold Safety
- Practice Material Handling Safety
- Practice Hand and Power Tool Safety
- Practice Proper Personal Protective Equipment and Life Saving Equipment Safety
- Practice Stairway and Ladder Safety
- Practice Occupational Health And Environmental Controls
- Practice Confined Space Safety

Scaffold User/Erector/Dismantler

Knowledge Competencies:

- Identify the correct steps for using a scaffold
- Identify the correct steps for erecting a scaffold
- Identify the correct steps for dismantling a scaffold

Work Processes (within competency clusters)

Skill Competencies:

- Use a scaffold
- Erect/Dismantle a scaffold

OSHA Subpart R

Knowledge Competencies:

- Identify safe practices for fall protection
- Identify safe practices for multiple lifts
- Identify safe practices for structural steel assembly
- Identify safe practices for open web steel joists
- Identify safe practices for panelized joist erection
- Identify safe practices for pre-engineered metal buildings
- Identify safe practices for installing steel decking
- Identify safe practices for determining site conditions and sequencing

Skill Competencies:

- Follow the OSHA Subpart R course guidelines on the job site
- Practice multiple lifts safety
- Practice the safe assemble of structural steel
- Practice the erection of open web steel joists
- Practice safety of panelized joist erection
- Practice the safe erection of pre-engineered metal buildings
- Practice the safe installation of steel decking
- Describe the safe site conditions and sequencing

First Aid/CPR and AED Training

Knowledge Competencies:

- Describe first aid procedures commonly performed by Ironworkers on job sites
- Describe the process for performing cardiopulmonary resuscitation (CPR)
- Describe the process for using the Automated External Defibrillator (AED)

Skill Competencies:

- Demonstrate the ability to provide first aid procedures commonly performed by Ironworkers on job sites
- Demonstrate the ability to perform cardiopulmonary resuscitation (CPR)
- Demonstrate the ability to use an Automated External Defibrillator (AED)

Work Processes (within competency clusters)

Mathematics for Ironworkers

Knowledge Competencies:

- Perform addition, subtraction, multiplication, division and multiple operations with whole numbers
- Perform addition, subtraction, multiplication, division and multiple operations with common fractions
- Perform addition, subtraction, multiplication, division and multiple operations with decimal fractions
- Perform calculations involving percentages
- Perform calculations involving averages
- Perform calculations involving exponents
- Perform calculations involving roots
- Perform calculations involving ratios
- Perform calculations involving proportions
- Perform calculations involving linear measurements
- Perform calculations involving area measurements
- Perform calculations involving circular measurements
- Perform calculations involving volume measurements
- Perform calculations using basic geometry
- Perform calculations using basic trigonometry involving right triangles and the Pythagorean Theorem
- Perform conversions between English and Metric systems

Layout Instruments

Knowledge Competencies:

- Define terms related to construction layout
- Perform basic mathematical calculations used in layout
- Describe the use of an engineer's tape, tape measure and folding rule
- Describe the use of a plumb bob
- Describe the use of 2-foot and 4-foot levels
- Describe the use of measuring and Philadelphia rods
- Describe the use of a laser for distance measure
- Describe the use of a combination square, 2-foot square and scribe
- Describe the use of trammel points
- Describe the use of a chalk line
- Identify the functions of an automatic level
- Identify the functions of a handheld laser
- Identify the functions of an automatic rotating laser
- Identify the functions of a theodolite/transit
- Identify the functions of a total station

Skill Competencies:

- Use an engineer's tape, tape measure and folding rule
- Use a chalk line to establish a visible line

Work Processes (within competency clusters)

- Use a plumb bob to plumb a column
- Use a plumb bob to transfer a mark
- Check a level for accuracy
- Use torpedo, 2-foot and 4-foot levels
- Use a laser distance measuring device
- Use a combination and 2-foot square
- Read a measuring rod
- Set up a level and check elevations
- Transfer benchmarks with a level
- Set material to height with a level
- Check level calibration
- Use a handheld laser to check for plumb
- Use a handheld laser to turn 90 degrees
- Use a handheld laser to check for level
- Use a rotating laser to transfer plumb marks
- Use an automatic rotating laser to turn 90 degrees
- Use an automatic rotating laser to check for elevation
- Use an automatic rotating laser to transfer benchmarks
- Check an automatic rotating laser for calibration
- Set up and level a theodolite over a control point
- Set up and level a theodolite over a control line and transfer the line
- Set up and level a theodolite over a control line and plumb a column
- Check a theodolite for calibration
- Set up a total station over a control mark and measure distances
- Set up a total station over a control mark and fine tune the instrument for level

Fork and Aerial Lifts

Knowledge Competencies:

- Identify types of fork and aerial lifts
- Identify safety practices associated with fork and aerial lifts
- Describe the steps to operate a fork lift
- Describe the steps to operate an aerial lift

Skill Competencies:

- Operate a fork lift
- Operate an aerial lift

Wind Turbine Erection Training for Ironworkers

Knowledge Competencies:

- Describe the different forms of fall protection, rescue and evacuation techniques
- Identify the different types of equipment used in the wind energy workplace
- Describe the proper use, care, and maintenance of the safety and rescue equipment
- Describe basic fasteners and fastener safety

Work Processes (within competency clusters)

- Describe mechanical, electronic, and hydraulic torquing

Skill Competencies:

- Demonstrate the proper use of different fall protection and rescue equipment
- Demonstrate different evacuation techniques
- Operate and maintain safety equipment
- Operate mechanical, electronic, and hydraulic torque equipment

Foreman Training for Ironworkers

Knowledge Competencies:

- Identify the roles and responsibilities of the foreman
- Identify the characteristics of and create effective work teams
- Identify characteristics of and demonstrate effective communication skills
- Describe and apply the problem solving process to job site problems
- Document events and maintain records
- Support labor-management relations
- Plan and schedule work for the crew
- Assist with implementing the employer's safety program
- Describe and apply quality management principles to work done at the job site

General Foreman and Superintendent Training for Ironworkers

Knowledge Competencies:

- Identify the responsibilities and roles of a general foreman and a superintendent
- Demonstrate effective computer skills
- Describe and demonstrate critical administrative skills
- Display effective management level communications
- Describe and demonstrate management skills required of a general foreman or a superintendent
- Describe and apply safety management skills
- Describe the process for estimating a project's duration and cost
- Describe the components of and create a project plan and schedule to follow
- Describe and demonstrate project budgeting skills
- Solve potential problems at the management level
- Conduct a job completion evaluation