

Module Overview

This module presents the historical development of the ironworking trade. It explains personal qualities that contribute to successful employment. It also describes the organization and purpose of apprenticeship training, and the safety obligations of the employer and employee.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum*.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify the personal qualities that contribute to successful employment.
2. Describe the historical development of the trade.
3. Identify the organization and purpose of apprenticeship training.
4. Identify employer and employee safety obligations.

Performance Tasks

This is a knowledge-based module; there are no performance tasks.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Copies of the Quick Quiz*

Module Examinations**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Occupational Safety and Health Standards for the Construction Industry, 29 CFR, Part 1926, Latest Edition.
Washington, DC: OSHA Department of Labor, U.S. Government Printing Office.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover *Introduction to the Trade*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	Planned Time
Session I. Introduction; Opportunities; Your Training Program; Responsibilities	
A. Introduction	_____
B. Ironworking Trade	_____
1. History of Structural Steel Building Materials	_____
2. Ironworking	_____
C. Opportunities in the Construction Industry	_____
D. Your Training Program	_____
1. Standardized Training by NCCER	_____
2. Apprenticeship Program	_____
E. Responsibilities of the Employee	_____
1. Professionalism	_____
2. Honesty	_____
3. Loyalty	_____
4. Willingness to Learn	_____
5. Willingness to Take Responsibility	_____
6. Willingness to Cooperate	_____
7. Rules and Regulations	_____
8. Tardiness and Absenteeism	_____
Session II. Human Relations; Safety Obligations; Review; Module Exam	
A. Human Relations	_____
1. Making Human Relations Work	_____
2. Human Relations and Productivity	_____
3. Attitude	_____
4. Maintaining a Positive Attitude	_____
B. Employer and Employee Safety Obligations	_____
C. Module Review	_____
D. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

Module Overview

This module covers safety procedures used in the ironwork trade. The use and care of mobile equipment, such as forklifts and generators, is also covered.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Module 30101-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the consequences of on-the-job accidents.
2. Explain the special responsibilities of OSHA.
3. List potential hazards for ironworkers.
4. Describe safe work practices when near cranes.
5. List major health hazards classified by OSHA.
6. Identify and explain the safe operation of various pieces of light equipment, including:
 - Aerial lifts
 - Generators
 - Compressors
 - Forklifts

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Position and use an aerial work platform.
2. Demonstrate the proper use of a fall protection system.
3. Identify points of inspection on specified pieces of equipment.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Photos of high work

U.S. Department of Transportation Hazardous
Materials Regulations Manual

Equipment such as aerial lifts, generators, com-
pressors, and forklifts

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use various pieces of light equipment. Review general precautions needed when operating light equipment.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

The complete OSHA Safety and Health Regulations for Construction are located at www.osha.gov.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12½ hours are suggested to cover *Trade Safety*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; On-the-Job Accidents; OSHA	
A. Introduction	_____
B. On-the Job Accidents	_____
1. Examples of Hazardous Conditions	_____
2. Ironworking Accident Statistics	_____
3. Causes of Construction Accidents	_____
C. OSHA	_____
1. Fall Protection	_____
2. Controlled Decking Zones	_____
3. Opening Covers	_____
4. OSHA-Required Training	_____
Session II. Developing Safety Awareness; Job Site Safety	
A. Developing Safety Awareness	_____
1. Maintain a Safety Conscious Attitude	_____
2. Dress Safely for the Job	_____
3. Ventilation Needs and Respiratory Devices	_____
4. Tool Safety	_____
5. Report Damaged Equipment	_____
6. Welding Safety	_____
B. Job Site Safety	_____
1. Cranes	_____
2. Material Handling and Storage	_____

Session V. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module describes the power and hand tools used in ironworking. The use, care, and maintenance of these tools are covered, as well as specific safety considerations.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 and 30102-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain commonly used safety tools and equipment.
2. Identify and describe the proper use of common ironworking hand tools.
3. Identify the power sources for common ironworking tools.
4. Identify and describe the proper use of common ironworking power tools.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate the proper use of appropriate personal protective equipment.
2. Demonstrate the safe and effective use of available ironworking hand tools.
3. Demonstrate the safe and effective application of available power sources for ironworking power tools.
4. Demonstrate the safe and effective use of available ironworking power tools.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment,
including the following:

Face shields

Protective leather

Welding gloves

Welding shields

Fall protection devices

As available, examples of the following tools
and equipment:

Marking and measuring devices

Clamps

Wrenches

Cleaning tools

Threading tools

Pliers

Snips and shears

Alignment tools

Welding tools

Rivet buster

Air hammer

Side grinder

Impact wrench

Reciprocating saw

Powder-actuated tools

Appropriate power sources

Iron plate

Selection of reciprocating saw blades

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize the special safety precautions associated with each tool. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Bolt Depot, Inc. provides charts and tables of information on fasteners and bolts.
www.boltdepot.com/fastener-information.

Concrete Fastening Systems provides information on concrete anchors and fasteners.
<http://www.confast.com>.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Tools and Equipment of the Trade*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; PPE Safety Summary	
A. Introduction	_____
B. PPE Safety Summary	_____
1. Protective Equipment	_____
2. Fall Protection Equipment	_____
3. Laboratory	_____
Have trainees demonstrate the proper use of appropriate PPE. This laboratory corresponds to Performance Task 1.	
Session II. Hand Tools	
A. Measuring Tools	_____
B. Clamping Equipment	_____
C. Wrenches	_____
D. Cleaning Tools	_____
E. Cutting Tools	_____
F. Threading Tools	_____
G. Alignment Tools	_____
H. Belts and Bags	_____
I. Welding Tools	_____
J. Laboratory	_____
Have trainees practice the correct use of ironworking hand tools. This laboratory corresponds to Performance Task 2.	

Session III. Power Sources; Power Tools

A. Power Sources

1. Laboratory

Have trainees demonstrate the application of available power sources for ironworking power tools. This laboratory corresponds to Performance Task 3.

B. Power Tools

1. Rivet Buster and Air Hammer

2. Side Grinder

3. Impact Wrenches

4. Powder-Actuated Tools

5. Reciprocating Saw

Session IV. Power Tool Safety; Review and Testing

A. Power Tool Safety

1. Laboratory

Have trainees practice the correct use of various hand power tools. This laboratory corresponds to Performance Task 4.

B. Review

C. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.

2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

D. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module describes fastening systems used in ironworking. Types, tools, and installation procedures are covered.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30103-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Recognize and identify A-325 and A-490 bolts, washers, and nuts by their identifying markings.
2. Identify the four common methods of correctly tensioning bolts.
3. Describe how to use the tension control, calibrated wrench, and turn-of-nut methods of tightening high-strength bolts.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify selected high-strength bolts.
2. Demonstrate the turn-of-nut method.
3. Demonstrate calibrated wrench tightening.
4. Demonstrate the proper use of a tension control gun.

Materials and Equipment

Multimedia projector and screen <i>Ironworking Level One</i>	Various A-325 and A-490 bolts, nuts, and washers
PowerPoint® Presentation Slides (ISBN 978-0-13-213795-9)	Tension control guns
Computer	Calibrated wrenches
Whiteboard/chalkboard	Ratchets and sockets
Markers/chalk	Copies of the Quick Quiz*
Pencils and scratch paper	Module Examinations**
Appropriate personal protective equipment	Performance Profile Sheets**

* Located in the back of this module.

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Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Concrete Fastening Systems provides information on concrete anchors and fasteners. www.confast.com. Bolt Depot, Inc. provides charts and tables of information on fasteners and bolts. www.boltdepot.com.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover *Fastening*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Methods for Tensioning Bolts; Threaded Fasteners; Bolting Up Structural Steel; Load-Indicating Washer; Skidmore	
A. Introduction	_____
B. Methods for Tensioning Bolts	_____
C. Threaded Fasteners	_____
1. Thread Standards	_____
2. A-325 Bolts	_____
3. A-490 Bolts	_____
4. Determining Bolt Length	_____
5. Bevel Washers	_____
6. Care of Bolts	_____
7. Laboratory	_____
Have the trainees identify selected high-strength bolts. This laboratory corresponds with Performance Task 1.	
D. Bolting Up Structural Steel	_____
1. Tension Control Bolts	_____
2. Calibrated Wrench Tightening	_____
3. Turn-of-Nut Method	_____
E. Load-Indicating Washer	_____
F. Skidmore Calibrator	_____
Session II. Laboratory; Review and Testing	
A. Laboratory	_____
1. Have trainees demonstrate the turn-of-nut method. This laboratory corresponds to Performance Task 2.	
2. Have trainees demonstrate calibrated wrench tightening. This laboratory corresponds to Performance Task 3.	
3. Have trainees demonstrate the proper use of a tension control gun. This laboratory corresponds to Performance Task 4.	
B. Review	_____
C. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
D. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

Module Overview

This module introduces the trainee to manual and powered lifting devices, both mobile and stationary, used by ironworkers. Construction cranes are the most commonly used lifting device.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30104-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and describe common lifting equipment.
2. Identify and explain commonly used construction cranes.
3. Identify and explain crane manuals, recordkeeping, and safety.
4. Describe the activities involved in assembling construction cranes.
5. Identify and use the correct hand signals to guide a crane operator.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Use common lifting equipment.
2. Use crane manuals, perform recordkeeping, and describe crane safety.
3. Use and interpret hand signals.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Crane capacity chart

Range diagram and capacity chart

Horn or other audible signaling device

Selection of manufacturers' crane manuals and handbooks

A filled-in recordkeeping book

A number of blank pages from recordkeeping books

Construction crane for disassembly and assembly

Portable radios (walkie-talkies)

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on and around mobile cranes and using lifting devices. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

ASME 30.5-2007, Mobile and Locomotive Cranes. New York, NY: ASME International.

Crane Safety: A Guide to OSHA Compliance and Injury Prevention. Carl O. Morgan, Ph.D. Lanham, MD: Rowan & Littlefield Publishing Group, 1999.

OSHA Standards for the Construction Industry (29 CFR Part 1926). Latest edition. Washington, DC: Occupational Safety & Health Administration.

<http://www.osha.gov/pls/publications/publication.html>.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Mobile Construction Cranes*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Lifting Equipment	
A. Introduction	_____
B. Lifting Equipment	_____
1. Derricks	_____
2. Cranes	_____
3. Helicopters	_____
C. Laboratory	_____
Have trainees use common lifting equipment. This laboratory corresponds to Performance Task 1.	
Session II. Mobile Construction Cranes	
A. Mobile Construction Cranes	_____
1. Function and Uses	_____
2. Terminology	_____
3. Load Rating Capacities	_____
4. Inspecting the Crane	_____
5. Positioning the Crane	_____

Session III. Handbooks and Records; Assembly and Disassembly; Communication

A. Handbooks and Records

1. Crane Manuals and Handbooks
2. Crane Records
3. General Crane Safety

B. Laboratory

Have trainees use crane manuals, perform recordkeeping, and describe crane safety. This laboratory corresponds to Performance Task 2.

C. Crane Assembly

1. Assembling a Short Boom
2. Assembling a Long Boom
3. Disassembly of the Boom

D. Methods and Modes of Communication

1. Verbal Modes of Communication
2. Nonverbal Modes of Communication

E. Laboratory

Have trainees use and interpret hand signals. This laboratory corresponds to performance Task 3.

Session IV. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module covers how to inspect and use common rigging hardware, slings, and tag lines. It also explains how to select, inspect, use, and maintain special rigging equipment, including block and tackle, chain hoists, come-alongs, jacks, and tuggers.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30105-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and describe the uses of common rigging hardware and equipment.
2. Perform a safety inspection on hooks, slings, and other rigging equipment.
3. Describe common slings and determine sling capacities and angles.
4. Select, inspect, use, and maintain special rigging equipment, including:
 - Block and tackle
 - Chain hoists
 - Come-alongs
 - Jacks
 - Tuggers
 - Wire rope
 - Chain
5. Inspect heavy rigging hardware.
6. Tie knots used in rigging.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Perform a safety inspection on hooks, slings, and other rigging equipment.
2. Select, inspect, and use special rigging equipment, including:
 - Block and tackle
 - Chain hoists
 - Come-alongs
 - Jacks
 - Tuggers
 - Wire rope
 - Chain
3. Tie knots used in rigging.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Manufacturer's literature on different rigging hooks

Various rigging hooks with wear, cracks, and corrosion

Manufacturer's literature on shackles

Various types of shackles

Various eyebolts

Various lifting lugs

Turnbuckles

Manufacturer's literature on plate clamps

Various rigging plates and links

Various types of slings

A rigging pocket guide

OSHA 29 CFR Section 1926.251, Rigging Equipment for Material Handling

Samples of wire rope that have failed inspection

Rope for tying knots

Block and tackle lifting system

Sample loads for lifting

Spur-gear chain hoist

Electric chain hoist

Ratchet-lever hoist or come-along

Ratchet jack

Screw jack

Hydraulic jack

Tugger

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use various types of hoists, jacks, and tuggers. Ensure that all trainees are briefed on lifting safety and any other shop safety procedures. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

OSHA Standards for the Construction Industry (29 CFR Part 1926). Latest edition. Washington, DC: Occupational Safety & Health Administration. <http://www.osha.gov/pls/publications/publication.html>.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Rigging Equipment*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Rigging Hardware	
A. Introduction	_____
B. Rigging Hardware	_____
Session II. Slings and Tag Lines	
A. Slings	_____
B. Laboratory	_____
Have trainees practice performing a safety inspection on hooks, slings, and other rigging equipment. This laboratory corresponds to Performance Task 1.	
C. Tag lines	_____
D. Laboratory	_____
Have trainees practice tying knots used in rigging. This laboratory corresponds to Performance Task 3.	
Session III. Block and Tackle; Hoists; Ratchet-Lever Hoists and Come-Alongs; Jacks; Tuggers	
A. Block and Tackle	_____
B. Chain Hoists	_____
C. Ratchet-Lever Hoists and Come-Alongs	_____
D. Jacks	_____
E. Tuggers	_____
F. Laboratory	_____
Have trainees practice selecting, inspecting, and using special rigging equipment. This laboratory corresponds to Performance Task 2.	
Session IV. Review; Module Examination and Performance Testing	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
C. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

Module Overview

This module covers communications, basic rigging safety precautions, lift planning, and load and sling calculations. It also covers load charts and load balancing.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30106-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Determine the center of gravity of a load.
2. Identify the pinch points of a crane and explain how to avoid them.
3. Identify site and environmental hazards associated with rigging.
4. Properly attach rigging hardware for routine lifts.
5. Identify the components of a lift plan.
6. Perform sling tension calculations.
7. Determine the weight of beams and basic weight estimation.
8. Explain D/d.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Determine the center of gravity of a load.
2. Properly attach rigging hardware for routine lifts.
3. Perform sling tension calculations.
4. Perform a weight/volume calculation.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

ASME B30.5 Consensus Standard

29 CFR 1926.550, Cranes and Derricks

Completed lift plan

Crane manufacturer's literature

Typical teeter-totter and weights

Various lifting eyebolts

Rigging hardware

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Crane Safety on Construction Sites, 1998. Task Committee on Crane Safety on Construction Sites. Reston, VA: ASCE.

Rigging Handbook, 2003. Jerry A. Klinke. Stevensville, MI: ACRA Enterprises, Inc.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Rigging Practices*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety	
A. Introduction	_____
B. General Rigging Safety	_____
1. Personal Protection	_____
2. Equipment and Supervision	_____
3. Basic Rigging Precautions	_____
4. Load Path, Load Control, and Tag Lines	_____
5. Barricades	_____
6. Load-Handling Safety	_____
C. Working Around Power Lines	_____
D. Site Safety	_____
1. Site Hazards and Restrictions	_____
E. Emergency Response	_____
1. Fire	_____
2. Malfunctions During Lifting Operations	_____
3. Hazardous Weather	_____
Session II. Lifting Personnel; Lift Planning	
A. Lifting Personnel	_____
1. Personnel Platform Loading	_____
2. Personnel Platform Rigging	_____
B. Lift Planning	_____
1. Lift Plan Data	_____

Sessions III and IV. Load Balancing

A. Load Balancing

- 1. Center of Gravity
- 2. Sling Angles
- 3. Lifting Connectors
- 4. Choking
- 5. Lifting
- 6. Block Twisting

B. Laboratory

Have trainees practice determining the center of gravity of a load. This laboratory corresponds to Performance Task 1.

C. Laboratory

Have trainees practice performing sling tension calculations. This laboratory corresponds to Performance Task 3.

Session V. Unloading and Yarding; Unloading Joists; Miscellaneous Iron; Structural Iron

A. Unloading and Yarding Materials

- 1. Calculating Weight of an Object
- 2. Laboratory

Have trainees practice performing a weight/volume calculation. This laboratory corresponds to Performance Task 4.

- 3. Unloading
- 4. Using Slings

B. Unloading Joists

- 1. Flatbed Trailers

C. Miscellaneous Iron

D. Structural Iron

E. Laboratory

Have trainees practice properly attaching rigging hardware for routine lifts. This laboratory corresponds to Performance Task 2.

Session VI. Review and Testing

A. Review

B. Module Examination

- 1. Trainees must score 70 percent or higher to receive recognition from NCCER.
- 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

- 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
- 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

The ironworker uses drawings in all kinds of construction. These drawings contain structural details pertaining to loading conditions, fastening, and erection as well as general framework design and materials. Most drawings are computer-generated.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30107-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify the materials used in steel-frame buildings.
2. Name the parts of steel frames.
3. Interpret symbols used on plans and drawings, including symbols for:
 - Structural steel
 - Ornamental ironwork
 - Welding

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify job plans and drawings used for ironworking jobs.
2. Identify the symbols used on selected ironworking plans and drawings.
3. Identify selected structural steel symbols and applications on job plans and drawings.
4. Identify selected ornamental ironwork and welding symbols and applications on job plans and drawings.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
A set of structural drawings for a steel frame building

Actual drawings showing the following:
Shape details
Channels, H beams, and angles
Various structural details
Horizontal beam
Ornamental ironwork drawings
Welding drawings
If available, a section of a steel beam with an identifier marking
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with trade drawings. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

AISC 303-05, Code of Standard Practice for Steel Buildings and Bridges.

AISC 360-05, Specification for Structural Steel Buildings, Allowable Stress Design and Plastic Design.

AISC S342L, Load and Resistance Factor Design Specification for Structural Steel Buildings.

AASHTO HB-17, Standard Specifications for Highway Bridges.

ASTM A6, General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 12.5 hours are suggested to cover *Trade Drawings One*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Steel Structures	
A. Introduction	_____
B. Steel Structures	_____
1. Steel Shapes	_____
2. Detail Drawings	_____
3. Frames	_____
4. Roofs	_____
C. Laboratory	_____
Have trainees practice identifying materials used in steel-frame buildings and interpreting symbols used on plans and drawings.	
Session II. Assembly Drawings	
A. Assembly Drawings	_____
1. Base Plate Drawings	_____
2. Framing Plan	_____
3. Fabrication Shop Drawings	_____
B. Laboratory	_____
Have trainees identify plans and drawings used for ironworking jobs. This laboratory corresponds to Performance Task 1.	
Session III. Ornamental Ironwork; Welding Drawings	
A. Ornamental Ironwork Drawings	_____
B. Welding Symbols	_____

Session IV. Laboratory

A. Laboratory

1. Have trainees identify the symbols used on selected ironworking plans and drawings, including symbols for:
 - Structural steel
 - Ornamental ironwork
 - Welding

This laboratory corresponds to Performance Task 2.

2. Have trainees read basic structural drawings. This laboratory corresponds to Performance Task 3.

Session V. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module introduces the trainee to the types of structures that involve structural ironwork, such as bridges and multistory buildings. Structural ironworkers may also install decking and direct crane operators in hoisting structural components and maneuvering them into position.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30108-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify the types of construction that use structural steel.
2. Describe the steel structure erection process.
3. State the principles of structural stresses.
4. Identify the components of common steel structures.
5. Explain the requirements of bolted connections.
6. List the advantages of pre-engineered structures.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Describe different uses for structural steel.
2. Identify selected types, shapes, and grades of structural steel.
3. Identify different types of structural-steel beams.
4. Make bolted connections on structural steel.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Photographs of structures built with structural
steel, both finished and in process

Small sections of different shapes of steel

Selection of bolts

Hardened washers

SMAW, GMAW, and FCAW electrodes

Selection of typical structural ironworker tools

Sufficient number of the following for bolting
girder to steel:

- General-use bolts
- Washers
- Piece of structural steel
- Small section of girder
- Appropriate tools

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on or around structural steel. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Steel Construction Manual, 13th edition. Chicago, IL: American Institute of Steel Construction.

www.seaonc.org is a structural engineering website.

AISC Committee on the Code of Standard Practice, comp. *Code of Standard Practice for Structural Steel Buildings and Bridges*. (AISC 303-10) ed. Chicago, IL: American Institute of Steel Construction, 2010. Print.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover *Structural Ironworking One*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Steel; Steel Beams; Uses of Structural Steel	
A. Introduction	_____
B. Steel	_____
1. Steel Products	_____
2. Steel Shapes	_____
3. Grades	_____
C. Steel Beams	_____
D. Use of Structural Steel	_____
1. Pre-Engineered Buildings	_____
2. Bridges	_____
E. Laboratory	_____
1. Have trainees describe different uses for structural steel. This laboratory corresponds to Performance Task 1.	
2. Have trainees identify selected types, shapes, and grades of structural steel. This laboratory corresponds to Performance Task 2.	
3. Have trainees identify different types of structural-steel beams. This laboratory corresponds to Performance Task 3.	
Session II. Work Processes; Erection; Connections; Tools	
A. Work Processes	_____
B. Erection of Structural Members	_____
1. Columns	_____
2. Girders/Joists	_____
3. Trusses	_____
4. Bracing	_____
C. Connections	_____
1. Bolted Connections	_____
2. Welded Connections	_____
D. Tools	_____
E. Laboratory	_____
Have trainees make bolted connections on structural steel. This laboratory corresponds to Performance Task 4.	

Session III. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module describes the purpose and function of aligning and plumbing steel structures, and identifies the tools used for performing plumbing and aligning. It identifies and explains column base and base plate components and foundation failures. It also describes procedures for performing plumbing and aligning.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30109-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Describe the purpose and function of aligning and plumbing steel structures.
2. Identify the tools and equipment used for aligning and plumbing steel structures.
3. Identify the components of column bases, base plate, and foundation failures.
4. Explain selected plumbing and aligning tasks.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify selected alignment tools.
2. Demonstrate alignment methods.
3. Demonstrate plumbing a structure.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Come-alongs

Steamboat ratchets

Push-pull jacks

Mauls and beaters

Various sizes of shackles

Spools and thimbles

Turnbuckles

Wire-rope clips

Wedges

Drift pins

Transits and levels

Plumb bobs

Spirit levels

Havens clamps

Wire rope

Wood or metal form that can be plumbed and aligned

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires the trainees to use hand tools. Emphasize the special safety precautions associated with using hand tools. Ensure that trainees are briefed on the proper site or shop safety procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

American Institute of Steel Construction 303-05: Code of Standard Practice for Steel Buildings and Bridges.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover *Plumbing, Aligning, and Guying*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Purposes and Functions of Alignment; Tools and Equipment; Column Bases; Plumbing Procedures	
A. Introduction	_____
B. Purpose and Functions of Alignment	_____
C. Tools and Equipment	_____
1. Come-Alongs	_____
2. Steamboat Ratchets	_____
3. Push-Pull Jacks	_____
4. Mauls or Beaters	_____
5. Shackles	_____
6. Spools and Thimbles	_____
7. Turnbuckles	_____
8. Wire-Rope Clips	_____
9. Wedges	_____
10. Drift Pins	_____
11. Transits and Levels	_____
12. Plumb Bobs	_____
13. Spirit Levels	_____
14. Havens Clamp	_____
D. Laboratory	_____
Have trainees practice identifying selected alignment tools. This laboratory corresponds to Performance Task 1.	
E. Column Bases	_____
F. Plumbing Procedures	_____
G. Laboratory	_____
Have trainees practice demonstrating plumbing a structure. This laboratory corresponds to Performance Task 3.	

Session II. Aligning Methods; Review and Testing

A. Aligning Methods _____

B. Laboratory _____

Have trainees practice demonstrating alignment methods. This laboratory corresponds to Performance Task 2.

C. Module Review _____

D. Module Examination _____

1. Trainees must score 70 percent or higher to receive recognition from NCCER.

2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

E. Performance Testing _____

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.

2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module teaches principles of safe oxyfuel cutting. Setup, care, and maintenance are covered, as well as procedures and methods for performing various types of oxyfuel cuts.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30110-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain the use of oxyfuel cutting equipment.
2. Set up oxyfuel equipment.
3. Light and adjust an oxyfuel torch.
4. Shut down oxyfuel cutting equipment.
5. Disassemble oxyfuel equipment.
6. Change cylinders.
7. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
 - Gouging
8. Operate a motorized, portable oxyfuel gas cutting machine.

Performance Tasks

1. Set up oxyfuel equipment.
2. Light and adjust an oxyfuel torch.
3. Shut down oxyfuel cutting equipment.
4. Disassemble oxyfuel equipment.
5. Change empty cylinders.
6. Cut shapes from various thicknesses of steel, emphasizing:
 - Straight line
 - Square shape
 - Piercing
 - Bevel
 - Slot
7. Perform washing.
8. Perform gouging.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment

Oxygen cylinder (with cap)
Fuel gas cylinder (with cap)
Extra empty cylinders
Regulators (oxygen and fuel gas)
Extra regulators with check valves and flashback
arrestors
Hose set
A selection of usable and non-usable hoses
Combination cutting torch

continued

One-piece cutting torch
 Assorted torch nozzles (cutting, washing, gouging)
 Cylinder cart
 Motorized oxyfuel track cutter
 Framing squares
 Combination squares with protractor head
 Tape measure
 Soapstone
 Penknife
 Pliers
 Chipping hammers
 Friction lighters

Vendor cutting tip chart
 Tip cleaners, drills, and files
 Vendor-supplied videos/DVDs showing oxyfuel equipment in operation (optional)
 TV/VCR/DVD player (optional)
 Approved leak-testing solution
 Wrenches (torch, hose, and regulator)
 Steel plate

- Thin (16 to 10 gauge)
- Thick (¼-inch thick to 1-inch thick)

 Module Examinations*
 Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize the special safety precautions associated with the handling and use of cylinders and oxyfuel cutting equipment. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes, American Welding Society, Miami, FL.

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 17½ hours are suggested to cover *Oxyfuel Cutting*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction to Oxyfuel Safety; Oxyfuel Cutting Equipment, Part One	
A. Introduction	_____
B. Oxyfuel Safety Summary	_____
1. Protective Clothing and Equipment	_____
2. Fire/Explosion Prevention	_____
3. Work Area Ventilation	_____
C. Oxyfuel Cutting Equipment	_____
1. Oxygen	_____
2. Acetylene	_____
3. Liquefied Fuel Gases	_____
4. Regulators	_____
a. Laboratory	_____
Allow trainees to install and remove regulators from empty oxygen and gas cylinders.	
5. Hoses	_____

Session II. Oxyfuel Cutting Equipment, Part Two

- A. Cutting Torches
- B. Cutting Torch Tips
- C. Tip Cleaners and Tip Drills
- D. Friction Lighters
- E. Cylinder Cart
- F. Soapstone Markers
- G. Specialized Cutting Equipment

Session III. Setting Up Oxyfuel Equipment; Controlling the Oxyfuel Torch Flame

- A. Setting Up Oxyfuel Equipment
 - 1. Transporting and Securing Cylinders
 - 2. Cracking Cylinder Valves
 - 3. Attaching Regulators
 - 4. Installing Flashback Arrestors or Check Valves
 - 5. Connecting Hoses to Regulators
 - 6. Attaching Hoses to the Torch
 - 7. Connecting Cutting Attachments (Combination Torch Only)
 - 8. Installing Cutting Tips
 - 9. Closing Torch Valves and Loosening Regulator Adjusting Screws
 - 10. Opening Cylinder Valves
 - 11. Purging the Torch and Setting the Working Pressures
 - 12. Testing for Leaks
- B. Controlling the Oxyfuel Torch Flame
 - 1. Oxyfuel Flames
 - 2. Backfires and Flashbacks
 - 3. Igniting the Torch and Adjusting the Flame
 - 4. Shutting Off the Torch

Session IV. Shutting Down Oxyfuel Cutting Equipment; Disassembling Oxyfuel Equipment; Changing Cylinders

- A. Shutting Down Oxyfuel Cutting Equipment
- B. Disassembling Oxyfuel Equipment
- C. Changing Cylinders
- D. Laboratory

Have trainees set up, ignite, adjust, shut down, and disassemble oxyfuel equipment, as well as change cylinders. This laboratory corresponds to Performance Tasks 1 through 5.

Session V. Performing Cutting Procedures, Part One

- A. Performing Cutting Procedures
 - 1. Inspecting the Cut
 - 2. Preparing for Oxyfuel Cutting with a Hand Cutting Torch
 - 3. Cutting Thin Steel
 - 4. Cutting Thick Steel
 - 5. Piercing a Plate
 - 6. Cutting Bevels
 - 7. Washing
 - 8. Gouging

**Session VI. Performing Cutting Procedures, Part Two;
Portable Oxyfuel Cutting Machine Operation**

A. Laboratory

Have trainees perform straight-line cutting, square-shape cutting, piercing, slot cutting, bevel cutting, washing, and gouging. This laboratory corresponds to Performance Tasks 6 through 8.

B. Portable Oxyfuel Cutting Machine Operation

1. Torch Adjustment

2. Straight-Line Cutting

a. Laboratory

Allow trainees to practice straight-line cutting with an oxyfuel machine.

3. Bevel Cutting

a. Laboratory

Allow trainees to practice bevel cutting with an oxyfuel machine.

Session VII. Review and Testing

A. Module Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.

2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must complete each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.

2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.

D. Performance Accreditation Tasks – Have trainees complete PATs 1 through 3 according to the acceptance criteria.

1. Have trainees perform PAT 1, Setting Up, Igniting, Adjusting, and Shutting Down Oxyfuel Equipment. This task corresponds to *AWS EG2.0*, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 3 and 4.

2. Have trainees perform PAT 2, Cutting a Shape from Thin Steel. This task corresponds to *AWS EG2.0*, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 5, 6, and 7.

3. Have trainees perform PAT 3, Cutting a Shape from Thick Steel. This task corresponds to *AWS EG2.0*, Module 8 – Thermal Cutting Processes, Unit 1 – Manual OFC Principles, Key Indicators: 5, 6, and 7.

Module Overview

The steel or iron that ironworkers erect and mount is normally prepared prior to arriving on site, but there may be times when an ironworker must cut or weld steel. This module introduces the trainee to different types of arc welding that may be used on a site.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30110-11 and 29102-09.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify different welding processes and welding equipment.
2. State safety precautions associated with arc welding.
3. Identify and explain shielded metal arc welding (SMAW) electrodes.
4. Identify weld joints, their dimensions, and their applications from weld symbols and drawings.
5. Identify different types of arc welding machines.
6. Explain how to set up and use SMAW equipment to weld steel.
7. Explain the different codes governing welding.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify welding equipment.
2. Identify SMAW electrodes.
3. Identify welding joints from weld symbols and drawings.
4. Set up SMAW equipment and weld steel plate.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Access to different types of operational cutting and welding equipment:
SMAW equipment
GMAW/FCAW equipment
GTAW equipment
Plasma arc cutting equipment
Air carbon arc cutting equipment
Access to different types of SMAW electrodes
Access to an electrode storage oven

Access to all basic welding tools
Access to all welding-specific PPE, including applicable respirators
Access to welding lab facilities
Access to manufacturer's manuals for all available welding machines
Copies of company's confined space permits
Copies of company's hot work permits
Copies of MSDSs and related labels for hazardous materials that may have been stored in containers
Examples of good and defective welds made with different types of SMAW electrodes
Examples of different welding procedure specifications (WPS)
Welded example coupons for each type of basic joint
Miscellaneous mild steel plate coupons

continued

Example coupons for different weld types
 Angle gauges
 Backing gas and backing materials for plate welds
 Examples of welding drawings and welding symbols

Cutaway examples of welds
 Copies of the Quick Quiz*
 Module Examinations**
 Performance Profile Sheets**

* Located in the back of this module.

**Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines for working on or with welding equipment. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Welding Handbook, Volume 5, 2001. Miami, FL: The American Welding Society.

The Procedure Handbook of Arc Welding, 2000. Cleveland, OH: The Lincoln Electric Company.

OSHA Standard 1926.351, Arc Welding and Cutting, Current edition. Washington, DC: Occupational Safety and Health Administration.

Stick Electrode Welding Guide, 2004. Cleveland, OH: The Lincoln Electric Company.

Stick Electrode Product Catalog, 2008. Cleveland, OH: The Lincoln Electric Company. www.lincolnelectric.com.

Lincoln Electric Web site: <http://www.lincolnelectric.com> offers sources for products and training.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 22½ hours are suggested to cover *Introduction to Arc Welding*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Sessions I and II. Introduction; Welding and Cutting Processes; Safety	
A. Introduction	_____
B. Welding and Cutting Processes	_____
1. Shielded Metal Arc Welding	_____
2. GMAW/FCAW	_____
3. Gas Tungsten Arc Welding	_____
4. Plasma Arc Cutting Process	_____
5. Air Carbon Arc Cutting Process	_____
6. Shielding Gas	_____

C. Safety

1. PPE
2. Ventilation
3. Hot Work Permits and Fire Watches
4. Cutting Containers
5. Oxygen Hazards
6. Electrical Safety

D. Laboratory

Have trainees identify different types of welding equipment. This laboratory corresponds to Performance Task 1.

Session III. SMAW Electrodes; Selecting SMAW Electrodes; SMAW Filler Metal Storage and Control; Filler Metal Traceability Requirements

A. SMAW Electrodes

1. AWS Filler Metal Specification System
2. Electrode Classification System
3. Manufacturer's Classification
4. Electrode Sizes

B. Selecting SMAW Electrodes

1. Electrode Groups
2. Electrode Selection Considerations

C. SMAW Filler Metal Storage and Control

1. Code Requirements
2. Receiving Filler Metal
3. Storing Filler Metal
4. Storage Ovens

D. Filler Metal Traceability Requirements

E. Laboratory

Have trainees identify SMAW electrodes. This laboratory corresponds to Performance Task 2.

Session IV. Joint Design

A. Joint Design

1. Load Considerations
2. Types of Joints
3. Types of Welds
4. Welding Position
5. Codes and Welding Procedure Specifications
6. Weld Symbols and Drawings

B. Laboratory

Have trainees identify welding joints from weld symbols and drawings. This laboratory corresponds to Performance Task 3.

Module Overview

This module introduces the trainee to the basics of bar joists used to support building roofs and decks including yarding, handling, rigging, and erection.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30110-11, 29102-09, and 30112-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Recognize the various types of bar joists.
2. Explain how bar joists are designated.
3. Describe the proper procedures for rigging and storing steel joists.
4. Describe the proper erection procedures for bar joists.
5. Explain the use of joist girders in steel joist construction systems.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Identify selected types, shapes, and grades of bar joists and joist girders.
2. Interpret connection details for bar joists and girders.
3. Demonstrate the ability to handle, store, and rig different types of bar joists and girders.
4. Identify different bridging and mounting devices used with bar joists and joist girders.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)
Computer
Whiteboard/chalkboard
Markers/chalk

Pencils and scratch paper
Appropriate personal protective equipment
Erection drawings showing bridging spacing on
joists
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Review safety guidelines associated with working on bar joists and joist girders. Emphasize the importance of proper housekeeping.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

OSHA Standards for the Construction Industry (29 CFR Part 1926). Latest edition. Washington, DC: Occupational Safety & Health Administration.

Steel Construction Manual. 13th edition. Chicago, IL: American Institute of Steel Construction.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover *Bar Joists and Girders*. You will need to adjust the time required for testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Open-Web Bar Joists; Erecting Steel Joists; Joist Girders	
A. Introduction	_____
B. Open-Web Bar Joists	_____
1. Types and Designations	_____
2. Handling, Storing, and Rigging	_____
3. Bridging	_____
4. End Bearing	_____
C. Erecting Steel Joists	_____
D. Joist Girders	_____
Session II. Laboratory; Review and Testing	
A. Laboratory	_____
1. Have trainees identify selected types, shapes, and grades of bar joists and joist girders. This laboratory corresponds to Performance Task 1.	
2. Have trainees interpret connection details for bar joists and girders. This laboratory corresponds to Performance Task 2.	
3. Have trainees demonstrate the ability to handle, store, and rig different types of bar joists and girders. This laboratory corresponds to Performance Task 3.	
4. Have trainees identify different bridging and mounting devices used with bar joists and joist girders. This laboratory corresponds to Performance Task 4.	
B. Review	_____
C. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	
D. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.	

Module Overview

This module identifies and explains decking types and profiles and how decking is packaged, shipped, and stored. It describes erecting decking and placing concrete safely. The effects of deck penetrations and damage are also covered.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30110-11, 29102-09, 30112-11, and 30113-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain types of decking and deck profiles.
2. Describe how decking is packaged, shipped, and stored.
3. Erect decking and observe job-site safety.
4. Explain the effects of deck penetrations and damage.
5. Demonstrate how to place concrete.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Demonstrate safe lifting methods.
2. Properly place decking.
3. Identify safety precautions for decking operations.
4. Demonstrate proper decking layout.
5. Identify types of decking.

Materials and Equipment

Multimedia projector and screen
Ironworking Level One
PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Bundle tags
OSHA Standard 29 CFR, 1926 Subpart R
Hoist and materials to simulate lifting bundles
Metal decking

Fasteners
Tools for installing fasteners, including:
Screwdriver
Air-driven tools
Powder-actuated tools
Samples of good and bad welds
Welding equipment
Concrete
Tools for mixing and placing concrete
Copies of the Quick Quizzes*
Module Examinations**
Performance Profile Sheets**

* Located in the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may/will require the trainees to work with concrete, lift, and place decking. Emphasize the special safety precautions associated with working with concrete. Discuss lifting safety. This module may/will require the trainees to weld. Emphasize the special safety precautions associated with welding. Ensure that trainees are briefed on the proper site or shop safety and fire procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

SDI Manual of Construction With Steel Deck. Second ed. Fox River Grove, IL: Steel Deck Institute, 2006.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Metal Decking*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Packaging; Erecting Decking and Observing Job-Site Safety	
A. Introduction	_____
1. Composite Floor Deck	_____
2. Roof Deck	_____
3. Cellular Deck	_____
4. Form Deck	_____
B. Laboratory	_____
Have trainees practice identifying types of decking. This laboratory corresponds to Performance Task 5.	
C. Packaging	_____
1. Loading and Shipping	_____
2. Receiving and Unloading	_____
3. Storage and Protection	_____
D. Observing Job-Site Safety	_____
1. General Safety	_____
2. Lifting Safety	_____
3. Safe Working Platform	_____
E. Laboratory	_____
Have trainees practice demonstrating safe lifting methods. This laboratory corresponds to Performance Task 1.	
F. Placing Decking	_____
G. Laboratory	_____
Have trainees practice properly placing decking. This laboratory corresponds to Performance Task 2.	
H. Decking Capacities	_____
I. Laboratory	_____
Have trainees identify safety precautions for decking operations. This laboratory corresponds to Performance Task 3.	

Session II. Fastening and Installing Decking

- A. Attaching Decking
- B. Welding Decking
- C. Shear Studs
- D. Side Lap Connections
- E. Housekeeping

Session III. Deck Damage and Penetrations; Placing Concrete

- A. Deck Damage and Penetrations
- B. Placing Concrete
- C. Laboratory

Have trainees demonstrate proper decking layout. This laboratory corresponds to Performance Task 4.

Sessions IV. Review and Testing

- A. Module Review
- B. Module Examination
 1. Trainees must score 70 percent or higher to receive recognition from NCCER.
 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
- C. Performance Testing
 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

Module Overview

This module identifies the safety hazards associated with field fabrication. It explains how to use common layout tools and fabricate C-shapes, T-shapes, and W-shapes to given dimensions.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Ironworking Level One*, Modules 30101-11 through 30110-11, 29102-09, and 30112-11 through 30114-11.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify safety hazards associated with ironworking fabrication.
2. Use common layout tools.
3. Fabricate angle iron to given dimensions.
4. Fabricate channel iron to given dimensions.
5. Fabricate T-shapes to given dimensions.
6. Fabricate W-shapes to given dimensions.

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Use common layout tools.
2. Fabricate angle iron to given dimensions.
3. Fabricate channel iron to given dimensions.
4. Fabricate T-shapes to given dimensions.
5. Fabricate W-shapes to given dimensions.

Materials and Equipment

Multimedia projector and screen

Ironworking Level One

PowerPoint® Presentation Slides
(ISBN 978-0-13-213795-9)

Computer

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment

Magnetic drill

Scriber

Combination set

Straightedge

Protractor

Dividers

Trammel points

Tri-square

Steel rule

Steel square

Prick punch

Center punch

Band saw

Channel iron

Angle iron

T-shapes

W-shapes

Oxyfuel cutting equipment

Side grinder

Oxyacetylene torch

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module.

** Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires the trainees to use oxyfuel cutting equipment and oxyacetylene torches. Emphasize the special safety precautions associated with using torches. Ensure that trainees are briefed on the proper site or shop safety and fire procedures.

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

Steel Construction Manual, 13th edition. Chicago, IL: American Institute of Steel Construction.

Detailing for Steel Construction, 3rd edition. Chicago, IL: American Institute of Steel Construction.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Field Fabrication One*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Safety; Layout Tools	
A. Introduction	_____
B. Safety	_____
C. Layout Tools	_____
1. Scribes	_____
2. Steel Rules	_____
3. Steel Squares	_____
4. Combination Set	_____
5. Protractors	_____
6. Dividers	_____
7. Trammel Points	_____
8. Prick Punches	_____
9. Center Punches	_____
10. Straightedges	_____
11. Magnetic Drill	_____
Sessions II and III. Layout Tasks	
A. Base Line Layout	_____
B. Scribing Lines	_____
1. Laboratory	_____
Have trainees practice laying out right angles using the arc method and 3-4-5 method.	
2. Laboratory	_____
Have trainees practice scribing parallel, perpendicular, and angled lines.	
C. Divider and Trammel Point Use	
1. Laboratory	_____
Have trainees practice using dividers and trammel points.	

D. Laying Out Bolt Pattern Templates _____

1. Laboratory

Have trainees practice using common layout tools. This laboratory corresponds to Performance Task 1.

Sessions IV and V. Fabrication Tasks

A. Fabricating Angle Iron _____

1. Laboratory _____

Have trainees practice fabricating angle iron to given dimensions. This laboratory corresponds to Performance Task 2.

B. Fabricating Channel Iron _____

1. Laboratory _____

Have trainees practice fabricating channel iron to given dimensions. This laboratory corresponds to Performance Task 3.

C. Fabricating T-Shapes _____

1. Laboratory _____

Have trainees practice fabricating T-shapes to given dimensions. This laboratory corresponds to Performance Task 4.

D. Fabricating W-Shapes _____

1. Laboratory _____

Have trainees practice fabricating W-shapes to given dimensions. This laboratory corresponds to Performance Task 5.

Sessions VI. Review and Testing

A. Module Review _____

B. Module Examination _____

1. Trainees must score 70 percent or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing _____

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.