

Module Overview

This module, an extension of the *Core Curriculum* safety module, identifies general safety considerations that apply to welding and metal cutting. It describes the steps that must be taken to avoid job-related deaths and injuries while establishing and maintaining a safe work environment.

Prerequisites

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

Objectives

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

1. Identify some common hazards in welding.
2. Explain and identify proper personal protection used in welding.
3. Describe how to avoid welding fumes.
4. Explain some of the causes of accidents.
5. Identify and explain uses for material safety data sheets.
6. Explain safety techniques for storing and handling cylinders.
7. Explain how to avoid electric shock when welding.
8. Describe proper material handling methods.

Performance Tasks

This is a knowledge-based module. There are no Performance Tasks.

Materials and Equipment List

Markers/chalk	Various welding gloves
Pencils and scratch paper	Samples of protective welding footwear
Whiteboard/chalkboard	Earplugs
<i>Structural Fitter Level One</i> PowerPoint®	Various welding and cutting helmets with face shields
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com	Welding helmet with auto-darkening lens
Multimedia projector and screen	Full-face supplied-air respirator (SAR)
Desktop or laptop computer	Oxyfuel gas cutting/welding equipment
Appropriate personal protective equipment	Module Examinations*
Leather protective gear	

* Single-module AIG purchases include the printed exam. 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 welding because of the added potential for fire, burns, respiratory problems, and electrical shock. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Arc Welding Safety E205, Latest Edition. Cleveland, OH: Lincoln Electric.

Ventilation Guide for Weld Fumes AWS F32M/F32, Latest Edition. Miami, FL: American Welding Society.

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 2½ hours are suggested to cover *Welding Safety*. You will need to adjust the time required for testing based on your class size and resources. There are no performance tasks for this module.

Topic	Planned Time
Session I. Introduction; Welding Safety Practices; Review and Testing	
A. Introduction	_____
B. Welding Safety Practices	_____
C. Appropriate Personal Protective Equipment	_____
D. Fumes and Gases	_____
E. Confined Space Permits	_____
F. Area Safety	_____
G. Hot Work Permits and Fire Watches	_____
H. Oxyfuel Gas Welding and Cutting Safety	_____
I. Cutting Containers	_____
J. Cylinder Storage and Handling	_____
K. Power Tool Safety	_____
L. Electrical Safety	_____
M. Material Safety Data Sheets	_____
N. Material Handling	_____
O. Safety Planning and Emergency Action Plans	_____
P. Module Review	_____
Q. 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.	

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 the following: *Core Curriculum*.

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 List

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Structural Fitter Level One PowerPoint®

Presentation Slides can be downloaded (with your access code) from www.nccerirc.com

Multimedia projector and screen

Desktop or laptop computer

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 is intended to present thorough resources for task training. The following reference work is suggested for both instructors and motivated trainees interested in further study. This is optional material for continued education rather than for task training.

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 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

This module teaches how to clean base metals for welding and cutting, how to identify and explain joint design, and how to prepare base metal joints for welding.

Prerequisites

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

Objectives

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

1. Clean base metal for welding or cutting.
2. Identify and explain joint design.
3. Explain joint design considerations.
4. Mechanically bevel the edge of a mild steel plate.
5. Thermally bevel the end of a mild steel plate.
6. Select the proper joint design based on a welding procedure specification (WPS) or instructor direction.

Performance Tasks

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

1. Mechanically bevel the edge of a mild steel plate $\frac{1}{4}$ " to $\frac{3}{4}$ " thick at $22\frac{1}{2}$ degrees (or 30 degrees, depending on the equipment available).
2. Thermally prepare a bevel.

Materials and Equipment List

Markers/chalk	Examples of plug and slot welds
Pencils and scratch paper	Examples of fillet welds
Whiteboard/chalkboard	Sections of bar stock to illustrate various joints
<i>Structural Fitter Level One PowerPoint®</i>	An oxyfuel or plasma arcing system or pictures
Presentation Slides can be downloaded	showing how these systems can be used for
(with your access code) from www.nccerirc.com	joint preparation
Multimedia projector and screen	Properly beveled coupons
Desktop or laptop computer	Chipping hammer
Appropriate personal protective equipment	Soapstone
Full face shields	Tape measure
Examples (photos or actual objects) of metals that	Pliers
have and have not been prepared for welding	Files
Examples of surface corrosion on different metals	Framing square
Examples of defects caused by surface	Combination square with protractor head
contamination	Hand scrapers and wire brushes
MSDSs for metal cleaning chemicals	Power grinder with grinding and wire brush
Examples of welding drawings and welding	attachments
procedure specifications	Mechanical beveling equipment for plate
Examples of surfacing welds	Thermal beveling equipment for plate
Photos of surfacing welds before and after being	Module Examinations*
ground down and cleaned	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 any special safety precautions associated with cutting and shaping metal because of the added potential for fire, burns, respiratory problems, and electrical shock. Ensure that trainees are briefed on shop safety procedures.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

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*

www.lincolnelectric.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 12½ hours are suggested to cover *Base Metal Preparation*. 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; Basic Welding Safety; Base Metal Cleaning	
A. Introduction	_____
B. Basic Welding Safety	_____
1. Protective Clothing and Equipment for Preparing Metals	_____
2. Fire/Explosion Prevention	_____
3. Work Area Ventilation	_____
C. Base Metal Cleaning	_____
1. Surface Corrosion	_____
2. Defects Caused by Surface Contamination	_____
3. Mechanical Cleaning	_____
4. Chemical Cleaning	_____
Session II. Joint Design I	
A. Load Considerations	_____
B. Types of Joints	_____
C. Types of Welds	_____
Session III. Joint Design II	
A. Types of Welds (continued)	_____
B. Welding Position	_____
C. Codes and Welding Procedure Specifications	_____
D. Welding Joint Preparation	_____
1. Identify Joint Specification	_____
2. Mechanical Joint Preparation	_____

Session IV. Laboratory; Welding Joint Preparation (Continued)

A. Laboratory

Have trainees practice beveling steel plate by mechanical means. This laboratory corresponds to Performance Task 1.

B. Thermal Joint Preparation

Session V. Laboratory; Review and Testing

A. Laboratory

Have trainees practice beveling steel plate by thermal means. This laboratory corresponds to Performance Task 2.

B. Module Review

C. Module Examination

1. Trainees must score 70% or higher to receive recognition from the 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 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 Training Report Form 200 and submit the results to the Training Program Sponsor.

E. Performance Accreditation Tasks - Have trainees complete PATs 1 and 2 according to the acceptance criteria.

1. Have trainees perform PAT 1, Prepare Plate Joints Mechanically. This task has no AWS EG2.0 reference.
2. Have trainees perform PAT 2, Prepare Plate Joints Thermally. This task corresponds to AWS EG2.0, Module 8 – Thermal Cutting Processes, Unit 2 – Manual OFC Principles, Key Indicators: 4, 5, and 6.

Module Overview

This module teaches the importance of quality workmanship and covers how to find, identify, and avoid weld imperfections while adhering to necessary codes and specifications.

Prerequisites

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

Objectives

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

1. Identify and explain codes governing welding.
2. Identify and explain weld imperfections and their causes.
3. Identify and explain nondestructive examination practices.
4. Identify and explain welder qualification tests.
5. Explain the importance of quality workmanship.
6. Identify common destructive testing methods.
7. Perform a visual inspection of fillet welds.

Performance Tasks

There are no performance tasks for this module.

Materials and Equipment List

Markers/chalk

Pencils and scratch paper

Whiteboard/chalkboard

Structural Fitter Level One PowerPoint®

Presentation Slides can be downloaded (with your access code) from www.nccerirc.com

Multimedia projector and screen

Desktop or laptop computer

Appropriate personal protective equipment

Welding samples showing:

- Porosity
- Inclusions
- Cracks
- Weld metal cracks
- Base metal cracks
- Incomplete joint penetration
- Incomplete fusion
- Undercut
- Arc strikes
- Spatter
- Unacceptable weld profiles

Undercut gauge

Butt weld reinforcement gauge

Fillet weld blade gauge set

Welding coupon examples

Samples of ASME, AWS, API, and ANSI welding codes

Photos of damage to equipment and structures caused by failed welds

Examples of Welding Procedure Specifications and Procedure Qualification Records

Liquid penetrant test kit

Radiograph examples

Tested specimens of good and failed welds

Module Examinations*

* Single-module AIG purchases include the printed exam. 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. Review general safety guidelines associated with welding and refer to the MSDS for liquid penetrant solvent.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

AWS B1.10: Guide for the Nondestructive Inspection of Welds, 1999. Miami, FL: The American Welding Society.

AWS B1.11: Guide for the Visual Inspection of Welds, 2000. Miami, FL: The American Welding Society.

OSHA Standard 1926.351, Arc Welding and Cutting.

Welding Handbook, Volume 1 (2001) and Volume 2 (2004). Miami, FL: The American Welding Society.

AWS D3.5-93R: Guide for Steel Hull Welding, 1993. Miami, FL: The American Welding Society.

AWS D3.6M: Specification for Underwater Welding, 1999. Miami, FL: The American Welding Society.

AWS D3.7: Guide for Aluminum Hull Welding, 2004. Miami, FL: The American Welding Society.

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

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 *Weld Quality*. 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; Codes; Weld Discontinuities	
A. Introduction	_____
B. Codes Governing Welding	_____
1. American Society of Mechanical Engineers	_____
2. American Welding Society	_____
3. American Petroleum Institute	_____
4. American National Standards Institute	_____
5. Marine Codes	_____
C. Basic Elements of Welding Codes	_____
1. Welding Procedure Qualification	_____
2. Welder Performance Qualification	_____
3. Welder Operator Qualification	_____
D. Weld Discontinuities and Their Causes	_____
1. Porosity	_____
2. Inclusions	_____
3. Cracks	_____
4. Incomplete Joint Penetration	_____
5. Incomplete Fusion	_____
6. Undercut	_____
7. Arc Strikes	_____
8. Spatter	_____
9. Acceptable and Unacceptable Weld Profiles	_____

Session II. Nondestructive Examination (NDE) Practices

- A. Visual Inspection
- B. Liquid Penetrant Inspection
- C. Magnetic Particle Inspection
- D. Radiographic Inspection
- E. Ultrasonic Inspection
- F. Electromagnetic (Eddy Current) Inspection
- G. Leak Testing

Session III. Destructive Testing; Welder Performance Qualification Tests

- A. Destructive Testing
- B. Welder Performance Qualification Tests
 - 1. Welding Positions Qualification
 - 2. AWS Structural Steel Code
 - 3. ASME Code
 - 4. Welder Qualification Tests

Session IV. Quality Workmanship; Review and Testing

- A. Quality Workmanship
 - 1. Typical Site Organization
 - 2. Chain of Command
- B. Module Review
- C. Module Examination
 - 1. Trainees must score 70% or higher to receive recognition from the NCCER.
 - 2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.

Module Overview

This module discusses the classification, selection, storage, and control of electrodes that are used for shielded metal arc welding.

Prerequisites

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

Objectives

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

1. Identify factors that affect electrode selection.
2. Explain the American Welding Society (AWS) and the American Society of Mechanical Engineers (ASME) filler metal classification system.
3. Identify different types of filler metals.
4. Explain the storage and control of filler metals.
5. Explain filler metal traceability requirements and how to use applicable code requirements.
6. Identify and select the proper electrode for an identified welding task.

Performance Tasks

There are no performance tasks for this module.

Materials and Equipment List

Markers/chalk	Desktop or laptop computer
Pencils and scratch paper	Appropriate personal protective equipment
Whiteboard/chalkboard	Electrodes of various types
<i>Structural Fitter Level One</i> PowerPoint®	Sample MSDS for an electrode
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com	Sample MSDS for a surface coating
Multimedia projector and screen	Module Examinations*

* Single-module AIG purchases include the printed exam. 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. Review general safety guidelines associated with welding and refer to the MSDS for each electrode type. Point out that many surface coatings produce toxic fumes when heated.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

OSHA Standard 1926.351, Arc Welding and Cutting.

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

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

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

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 2½ hours are suggested to cover *Shielded Metal Arc Welding – Electrodes*. 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; SMAW Electrodes; Review and Examination	
A. Introduction	_____
B. Shielded Metal Arc Welding Electrodes	_____
C. AWS Filler Metal Specification System	_____
1. Classification System	_____
2. Manufacturers' Classification	_____
3. Electrode Sizes	_____
D. Selecting Electrodes	_____
1. Electrode Groups	_____
2. Electrode Selection Considerations	_____
E. Filler Metal Storage and Control	_____
1. Code Requirements	_____
2. Receiving Filler Metal	_____
3. Storing Filler Metal	_____
4. Storage Ovens	_____
F. Filler Metal Traceability Requirements	_____
G. Module Review	_____
H. Module Examination	_____
1. Trainees must score 70% or higher to receive recognition from the NCCER.	
2. Record the testing results on Training Report Form 200 and submit the results to the Training Program Sponsor.	

Module Overview

This module explains the proper setup of arc welding equipment. It describes the methods of striking an arc and how to properly perform a tack weld. Trainees will perform tack weld techniques that include flat, horizontal, vertical, and overhead.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the *Maritime Core Curriculum* and Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09.

Objectives

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

1. Set up proper arc welding equipment.
2. Describe methods of striking an arc.
3. Describe how to properly perform a tack weld.

Performance Tasks

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

1. Set up proper arc welding equipment.
2. Properly strike and extinguish an arc.
3. Perform tack welds in the following positions to be break-tested by the instructor:
 - Flat (1F)
 - Horizontal (2F)
 - Vertical (3F)
 - Overhead (4F)

Materials and Equipment List

Multimedia projector and screen
Structural Fitter Level One PowerPoint®
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Welding safety video (optional)
Appropriate personal protective equipment
Safety goggles
Face shields
Welding helmets
Ear protection
Welding caps
Minimum 8"-high safety boots
Leather/flame retardant clothing
Welding gloves
Respirators
Safety harness

SMAW welding machine
Leads
Welding cables
Ground connectors
Hoses
Lugs
Quick disconnects
Workpiece clamps
Electrode holder
E6010 electrodes $\frac{3}{32}$ " or $\frac{1}{8}$ "
E6011 electrodes $\frac{3}{32}$ " or $\frac{1}{8}$ "
E7018 electrodes $\frac{3}{32}$ " or $\frac{1}{8}$ "
Welding station
Fire extinguisher
Welding coupons
Oxygen cylinder with cap
Fuel gas cylinder with cap
Regulators (oxygen and fuel gas)
Cylinder cart
Tape measure

(continued)

Friction lighter
Wrenches (torch, hose, and regulator)

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. This module requires that the trainees perform tack welding. Ensure that trainees are briefed on fire and shop safety policies prior to performing any work. Emphasize the special safety precautions associated with welding.

Additional Resources

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

Stick Electrode Welding Guide, 2004. Cleveland, OH: The Lincoln Electric Company.
www.lincolnelectric.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 40 hours are suggested to cover *Tack Welding*. 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 Summary; Welding Current	
A. Introduction	_____
B. Safety Summary	_____
1. Protective Clothing and Equipment	_____
2. Fire/Explosion Prevention	_____
3. Work Area Ventilation	_____
4. Lifting Hazards	_____
5. Working at Heights	_____
C. Welding Current	_____
1. Types of Welding Current	_____
2. Polarity	_____
3. Characteristics of Welding Current	_____
Session II. SMAW Machines; Tools for Cleaning Welds	
A. SMAW Machines	_____
1. SMAW Machine Classifications	_____
2. Industrial SMAW Machine Types	_____
3. SMAW Machine Ratings	_____
4. SMAW Cable Terminations	_____

- B. Tools for Cleaning Welds
 - 1. Hand Tools
 - 2. Pneumatic Cleaning and Slag Removal Tools

Sessions III–V. Arc Welding Equipment Setup

- A. Arc Welding Equipment Setup
 - 1. Preparing the Welding Area
 - 2. Preparing Tack Weld Coupons
 - 3. Electrodes
 - 4. Preparing the Welding Machine

B. PT/Laboratory

Have trainees set up the arc welding equipment. This laboratory corresponds to Performance Task 1.

Sessions VI–VIII. Striking an Arc

- A. Striking an Arc
 - 1. Scratching Method
 - 2. Tapping Method
 - 3. Practicing Striking and Extinguishing an Arc

B. PT/Laboratory

Have trainees properly strike and extinguish arcs. This laboratory corresponds to Performance Task 2.

Session IX. Arc Blow; Tack Weld Beads; Fillet Tack Welds

- A. Arc Blow
- B. Tack Weld Beads
 - 1. Practicing Tack Weld Beads with E6010
 - 2. Practicing Tack Weld Beads with E7018
- C. Fillet Tack Welds
 - 1. Fillet Weld Positions
 - 2. Practicing Horizontal Fillet Tack Welds with E6010 (2F Position)
 - 3. Practicing Horizontal Fillet Tack Welds with E7018 (2F Position)
 - 4. Practicing Vertical Fillet Tack Welds with E6010 (3F Position)
 - 5. Practicing Vertical Fillet Tack Welds with E7018 (3F Position)
 - 6. Practicing Overhead Fillet Tack Welds with E6010 (4F Position)
 - 7. Practicing Overhead Fillet Tack Welds with E7018 (4F Position)

Sessions X–XV. Practice Weldments

A. Practice Weldments

B. PT/Laboratory

- 1. Have trainees practice making tack weld beads. This laboratory corresponds to Performance Task 3.
- 2. Have trainees practice making tack welds in the flat (1F), horizontal (2F), vertical (3F), and overhead (4F) positions with E6010 and E7018 electrodes. These laboratories correspond to Performance Task 3.

Session XVI. 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 explains the classifications of fires and the methods used to extinguish them, the duties and responsibilities of the fire watch, and the inspection requirements for the various types of fire extinguishers.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the *Maritime Core Curriculum*, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and 86101-14.

Objectives

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

1. Describe the different classes of fires and the methods used to extinguish them.
2. Explain the duties and responsibilities of a fire watch.
3. Describe the different types of fire extinguishers and their inspection requirements.

Performance Tasks

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

1. Demonstrate the RACE method in response to a simulated fire.
2. Demonstrate the PASS method on a simulated fire.
3. Complete a fire watch test.
4. Select the correct fire extinguisher for different classes of fires.
5. Inspect extinguishers and their components.

Materials and Equipment List

Multimedia projector and screen
Structural Fitter Level One PowerPoint®
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Welding safety video (optional)
29 CFR Part 1915 Subpart B

Fire extinguishers for Class A, B, and C fires
Appropriate personal protective equipment:
Hard hat
Safety glasses
Goggles
Steel-toed boots
Long-sleeved 100-percent cotton shirt
Hearing protection
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. This module requires that the trainees perform simulated fire extinguishing methods.

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 *Fire Watch*. 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; About Fires; Fire Watch Duties and Responsibilities; Fire Extinguishers	
A. Introduction	_____
B. About Fires	_____
1. Classes of Fires	_____
C. Fire Watch Duties and Responsibilities	_____
1. Basic Responsibilities	_____
2. Preparing for Fire Watch Duty	_____
D. Fire Extinguishers	_____
1. Using a Fire Extinguisher	_____
Session II. PT/Laboratory; Review and Testing	
A. PT/Laboratory	
1. Have trainees practice the selection and inspection of fire extinguishers. These laboratories correspond to Performance Tasks 4 and 5.	_____
2. Have trainees practice responding to and extinguishing a fire. These laboratories correspond to Performance Tasks 1 and 2.	_____
3. Have trainees successfully complete a fire watch test. This laboratory corresponds to Performance Task 3.	_____
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 explains how to recognize and identify the components of structural fitter drawings.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the *Maritime Core Curriculum*, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and Modules 86101-14 and 86102-14.

Objectives

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

1. Recognize and identify basic fabrication drawing terms, components, basic lines, symbols, and bills of material.
2. Identify various drawing views such as plan, elevation, section, and details.

Performance Task

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

1. Identify components on a bill of materials and their location on a fabrication drawing.

Materials and Equipment List

Multimedia projector and screen
Structural Fitter Level One PowerPoint®
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard

Markers/chalk
Pencils and scratch paper
Fabrication drawings
Bills of Material
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.

Additional Resources

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

Process Piping Drafting. Rip Weaver. Houston, TX: Gulf Publishing Company.

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 *Introduction to Structural Fitter Drawings*. 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; Common Drawing Elements; Reference Lines	
A. Introduction	_____
B. Common Drawing Elements	_____
1. Title Blocks	_____
2. Scales and Measurements	_____
3. Lines	_____
4. Symbol and Abbreviation Legends	_____
5. Notes	_____
6. Revision Block	_____
7. Proper Care of Drawings	_____
C. Reference Lines	_____
1. Ship's Compartment Identification	_____
Sessions II and III. Drawing Views; Using Drawings	
A. Drawing Views	_____
1. Plan Views	_____
2. Elevation Views	_____
3. Section Views	_____
4. Detail Views	_____
5. Exploded Views	_____
6. Isometric Views	_____
B. Using Drawings	_____
C. PT/Laboratory	_____
Have trainees identify the components on a Bill of Material and then locate them on the fabrication drawing. This laboratory corresponds to Performance Task 1.	
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 explains the role of a fitter in the areas of quality assurance and safety. It also explains how to recognize and identify structural members and calculate their thickness. Additionally, the identification of fitting aids, layout tools and fitting tools will be explained. Trainees will perform proper fit procedures by interpreting drawings and instructions, removing welded fitting aids, applying math and measurements, and using alignment tools.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the *Maritime Core Curriculum*, Modules 29101-09, 29102-09, 29105-09, 29106-09, and 29108-09, and Modules 86101-14 through 86103-14.

Objectives

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

1. Explain the role the fitter plays in quality assurance and safety.
2. Recognize and identify structural members and calculate their thicknesses.
3. Identify layout tools, fitting tools, and fitting aids used to fit up, align, and check plate joints.

Performance Tasks

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

1. Remove welded fittings aids properly.
2. Interpret drawings and verbal instructions for fitting/assembling.
3. Apply math calculations and use standard/metric forms of measurements to lay out and fit parts.
4. Square and mark work surfaces using the 3-4-5 method.
5. Perform proper fit procedures related to fitting tasks in the downhand (flat) position, including:
 - Longitudinals
 - Bulkheads
 - Frames
 - Miscellaneous structural items (chocks, headers, collars, brackets, clips)
6. Fit up plate joints using alignment tools and check for misalignment and poor fit-up.

Materials and Equipment List

Multimedia projector and screen
Structural Fitter Level One PowerPoint®
Presentation Slides can be downloaded (with your access code) from www.nccerirc.com
Desktop or laptop computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate tools and materials for:
Squaring and marking
Lay-out
Fitting
Measuring
Appropriate drawings

Appropriate personal protective equipment
Leather, steel-toed work boots
with at least a 6" top
OSHA-approved safety glasses
Hearing protection
Hard hat
Face shield
Leather gloves
Long-sleeve cotton shirt and long pants
Safety harness
Supplied air respirator
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 your IRC using your access code.

Safety Considerations

This module requires that the trainees perform structural fitting. Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly.

Additional Resources

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

Ship Construction. D.J. Eyres. Burlington, MA: Elsevier.

IPT's Metal Trades and Welding Handbook. Ronald G. Garby and Bruce J. Ashton. Edmonton, Alberta, Canada: IPT Publishing and Training Ltd.

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 40 hours are suggested to cover *Fitting I*. 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; Fitting Safety	
A. Introduction	_____
B. Safety	_____
1. Personal Protective Equipment (PPE)	_____
2. Safety Practices	_____
Session II. Structural Members; Fitting Tools; Fitting Aids; The Importance of Quality	
A. Structural Members	_____
B. Fitting Tools	_____
1. Common Hand Tools	_____
2. Hoisting and Pulling Tools	_____
3. Levels and Squares	_____
4. Grinders	_____
5. Jacks	_____
C. Fitting Aids	_____
1. Using Fitting Aids	_____
2. Removing Fitting Aids	_____
D. The Importance of Quality	_____
1. Determining the Thickness of Plates and Angles	_____
2. Surface Preparation	_____
3. The 3-4-5 Method for Checking Squareness	_____

Sessions III–V. PT/Laboratory

A. PT/Laboratory

1. Have the trainees lay out and fit parts using the appropriate math applications and standard/metric measurements. This laboratory corresponds to Performance Task 3. _____
2. Have the trainees square and mark work surfaces using the 3-4-5 method. This laboratory corresponds to Performance Task 4. _____

Sessions VI–XV. PT/Laboratory

A. PT/Laboratory

1. Have the trainees properly remove welded fitting aids. This laboratory corresponds to Performance Task 1. _____
2. Have the trainees properly interpret drawings and actively listen to verbal instruction. This laboratory corresponds to Performance Task 2. _____
3. Have the trainees perform the proper fitting procedures in the downhand (flat) position on longitudinals, bulkheads, frames, chocks, headers, collars, brackets, and clips. This laboratory corresponds to Performance Task 5. _____
4. Have the trainees properly fit up plate joints using alignment tools and then check for misalignment and poor fit-up. This laboratory corresponds to Performance Task 6. _____

Session XVI. 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. _____