

MODULE OVERVIEW

This module provides a brief history of the millwright trade and describes the work performed by millwrights today. It covers career opportunities, safety practices, and the attitudes and work habits that are important to success in the craft.

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. Describe the types of work performed by millwrights.
2. Identify career opportunities available to millwrights.
3. Explain the purpose and objectives of an apprentice training program.
4. Explain the responsibilities of a millwright.
5. Explain the importance of safety in relation to millwrights.
6. Explain the role of NCCER in the training process.

PERFORMANCE TASKS

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

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Job announcements for millwrights from newspapers or other resources
Transparencies	NCCER Apprentice Training Recognition Forms
Blank acetate sheets	Copy of an employee manual
Transparency pens	<i>OSHA Safety and Health Standards for the Construction Industry</i>
Whiteboard/chalkboard	Basic millwright tools
Markers/chalk	Module Examinations*
Pencils and scratch paper	
Appropriate personal protective equipment	

* Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize basic site safety.

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.

Audel Millwrights and Mechanics Guide, Latest Edition. Thomas B. Davis, Carl A. Nelson. Hoboken, NJ: John Wiley & Sons.

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 *Orientation 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. Orientation to the Trade	
A. Introduction	_____
B. History of the Millwright Trade	_____
C. Coordinating with the Construction Industry	_____
D. Millwright Career Paths	_____
E. Responsibilities of the Employee	_____
Session II. Professional Relations, Tools, Training, Review, and Module Examination	
A. Human Relations	_____
B. Employer and Employee Safety Obligations	_____
C. Tools	_____
D. Your Training Program	_____
E. Review	_____
F. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

MODULE OVERVIEW

This module introduces the various hand tools used in the millwright trade. It explains basic hand tool safety and the methods for selecting, inspecting, using, and maintaining the tools.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Millwright Level One, Module 15101-06*.

OBJECTIVES

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

1. Explain the purpose of each of the tools commonly used by millwrights.
2. Explain how to maintain each of the tools used by millwrights.
3. Demonstrate the proper use of selected millwright tools.

PERFORMANCE TASKS

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

1. Demonstrate the use and care of the following millwright hand tools:
 - Strap wrench/chain wrenches
 - Spanner wrenches
 - Taper gauges
 - Pipe and tubing cutters
 - Honing stones
 - Putty knives/scrapers
 - Drift pins
 - Diagonal cutters
 - Tin snips
 - Taps and dies
 - Thread gauges
 - Scribes
 - Tension meters
 - Sheave gauges
 - Cylinder hones
 - Gear pullers
 - Packing pullers
 - Reamers
 - Inspection mirrors
 - Retaining ring pliers
 - Spiral screw extractors
 - Tap extractors
 - Mallets
 - Alignment pins

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Taper gauges
Transparencies	Pipe and tubing cutters
Blank acetate sheets	Honing stones
Transparency pens	Putty knives/scrapers
Whiteboard/chalkboard	Drift pins
Markers/chalk	Barrel pins
Pencils and scratch paper	Soft steel
Appropriate personal protective equipment	Diagonal cutters
Pictures of various tools (optional)	Tin snips
Damaged or unsafe tools	Taps and dies
Assorted diameters of pipe	Thread gauges
Strap wrench/chain wrenches	Scribes
Spanner wrenches	Tension meters

Sheave gauges	Pipe sections
Cylinder hones	Scrap metal and equipment
Gear pullers	Dull chisels and other tools to sharpen
Packing pullers	Sheet metal
Reamers	Patterns for shapes commonly cut in sheet metal
Inspection mirrors	Old or broken motors, pumps, appliances, or other machines and equipment that trainees can disassemble and reassemble
Retaining ring pliers	Module Examinations*
Spiral screw extractors	Performance Profile Sheets*
Tap extractors	
Mallets	
Sleever and alignment bars	

* Located in the Test Booklet.

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 hand tools. Emphasize basic hand tool safety.

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.

Audel Millwrights and Mechanics Guide, Latest Edition. Thomas B. Davis, Carl A. Nelson. Hoboken, NJ: John Wiley & Sons.

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 *Millwright Hand Tools*. 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, Maintenance, Wrenches and Other Tools	
A. Introduction	_____
B. Hand Tools Safety	_____
C. Use and Care of Tools	_____
D. Wrenches	_____
E. Taper gauges	_____
F. Laboratory – Trainees practice using and caring for tools discussed in this session. This laboratory corresponds to Performance Task 1.	_____
Sessions II and III. Cutting and Other Tools	
A. Pipe and Tubing Cutters	_____
B. Honing Stones	_____
C. Putty Knives/Scrapers	_____
D. Drift Pins	_____
E. Mallets	_____

- F. Diagonal Cutters _____
- G. Tin Snips _____
- H. Taps and Dies _____
- I. Thread Gauges _____
- J. Scribes _____
- K. Laboratory – Trainees practice using and caring for tools discussed in this session. This laboratory corresponds to Performance Task 1. _____

Session IV. Equipment Disassembly and Other Tools

- A. Tension Meters _____
- B. Sheave Gauge _____
- C. Cylinder Hones _____
- D. Gear Puller _____
- E. Packing Pullers _____
- F. Reamers _____
- G. Inspection Mirrors _____
- H. Retaining Ring Pliers _____
- I. Laboratory – Trainees practice using and caring for tools discussed in this session. This laboratory corresponds to Performance Task 1. _____

Session V. Extractors, Other Tools, and Review

- A. Spiral Screw Extractors _____
- B. Tap Extractors _____
- C. Feeler Gauges _____
- D. Alignment Bars _____
- E. Sleeve Bars _____
- F. Laboratory – Trainees practice using and caring for tools discussed in this session. This laboratory corresponds to Performance Task 1. _____
- G. Review _____

Session VI. Module Examination, and Performance Testing

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

MODULE OVERVIEW

This module identifies the various types of fasteners used by millwrights and describes the applications and installation procedures for these fasteners.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Millwright Level One*, Modules 15101-06 and 15102-06.

OBJECTIVES

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

1. Identify and explain the use of threaded fasteners.
2. Identify and explain the use of non-threaded fasteners.
3. Identify and explain the use of anchors.
4. Select the correct fasteners and anchors for given applications.
5. Install fasteners and anchors.

PERFORMANCE TASKS

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

1. Install threaded fasteners.
2. Install non-threaded fasteners.
3. Install fasteners in hardened concrete.
4. Tighten bolts in sequence using proper torque.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Taper, spring, and cotter pins
Transparencies	Pop rivets
Blank acetate sheets	Rivet gun
Transparency pens	Eye bolts
Whiteboard/chalkboard	Inserts
Markers/chalk	One-step anchors
Pencils and scratch paper	Wedge anchors
Appropriate personal protective equipment	Stud bolt anchors
Miscellaneous hand tools used with screws and bolts	Sleeve anchors
Various types of screws and bolts	Hammer-set anchors
Various types of nuts	Threaded rod anchors
Several types of washers	Lead or caulk-in anchors
Torque wrench	Single- and double-expansion anchors
Retaining rings	Manufacturer's literature on anchors
Key	Masonry anchors
Motor	Two-part epoxy anchor
Pin fasteners	Collection of odd screws, bolts, and fasteners
	Thread gauges

Micrometers
Gypsum wallboard (optional)
Plywood (optional)

Weights or other loads
Module Examinations*
Performance Profile Sheets*

* Located in the Test Booklet.

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 hand and power tools. Emphasize basic tool safety.

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.

Audel Millwrights and Mechanics Guide, Latest Edition. Thomas B. Davis, Carl A. Nelson. Hoboken, NJ: John Wiley & Sons.

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 *Fasteners and Anchors*. 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 and Threaded Fasteners	
A. Introduction	_____
B. Thread Standards	_____
C. Bolt and Screw Types	_____
D. Nuts	_____
E. Washers	_____
F. Installing Threaded Fasteners	_____
G. Laboratory – Trainees practice installing threaded fasteners and tightening bolts in sequence using proper torque values. This laboratory corresponds to Performance Tasks 1 and 4.	_____
Session II. Non-threaded Fasteners	
A. Retainer Fasteners	_____
B. Keys	_____
C. Pin Fasteners	_____
D. Blind/Pop Rivets	_____
E. Laboratory – Trainees practice installing non-threaded fasteners. This laboratory corresponds to Performance Task 2.	_____

Session III. Anchors and Other Fastening Mechanisms, and Review

- A. Eye Bolts and Inserts _____
- B. Mechanical Anchors _____
- C. Laboratory – Trainees practice installing fasteners in hardened concrete. This laboratory corresponds to Performance Task 3. _____
- D. Epoxy Anchoring Systems _____
- E. Review _____

Session IV. Module Examination, and Performance Testing

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

MODULE OVERVIEW

This module covers the basic tools and the methods used for layout of various lines, angles, circles, and arcs. It includes instructions for base line layout using the arc method and 3-4-5 method.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Millwright Level One*, Modules 15101-06 through 15103-06.

OBJECTIVES

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

1. Identify layout tools and explain their uses.
2. Lay out base lines using the arc method.
3. Lay out base lines using the 3-4-5 method.
4. Scribe straight lines.
5. Scribe perpendicular lines to base lines using a square.
6. Scribe perpendicular lines to an edge using a combination square.
7. Scribe angled lines using a combination square and a protractor.
8. Scribe circles using dividers and trammel points.
9. Scribe perpendicular lines from base lines using dividers and reference points.
10. Bisect lines using dividers.
11. Divide a line into equal parts.
12. Divide a circle into equal parts.
13. Lay out equipment locations.

PERFORMANCE TASKS

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

1. Lay out perpendicular lines from a reference line using the:
 - Arc method
 - 3-4-5 method
2. Scribe the following:
 - Straight lines
 - Perpendicular lines to a base line using a square
 - Perpendicular lines to an edge using a combination square
 - Angled lines using a combination square
 - Angled lines using a protractor
 - Circles and arcs using dividers
 - Perpendicular lines from base lines using dividers
 - Perpendicular lines from reference points using dividers
3. Bisect angles using dividers.
4. Divide lines into equal parts.
5. Divide circles into equal parts.
6. Lay out equipment locations.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Transfer punch sets
Transparencies	Straightedges
Blank acetate sheets	Compasses with lead or lead pencil holder (optional)
Transparency pens	Large sheet metal piece for each pair of trainees
Whiteboard/chalkboard	4' × 4' sheet of masonite or one-side sanded plywood for each pair of trainees (optional)
Markers/chalk	4' × 8' sheet of masonite board or one-side sanded plywood for each pair of trainees (optional)
Pencils and scratch paper	Equipment layout drawing and building floor blueprint with dimensions and marked reference points (optional)
Appropriate personal protective equipment	Photographs of installation with close-up photographs of reference points and equipment mounting (optional)
Scribers	Tools for measuring equipment elevation (optional)
Steel rules	Module Examinations*
Steel squares	Performance Profile Sheets*
Combination sets	
Protractors	
Dividers	
Trammel points	
Prick punch sets	
Center punch sets	

* Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit industrial sites. Ensure that all trainees are briefed on site safety policy and have appropriate personal protective equipment.

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.

Audel Millwrights and Mechanics Guide. Latest edition. Thomas B. Davis, Carl A. Nelson. Hoboken NJ: John Wiley & Sons.

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 20 hours are suggested to cover *Basic Layout*. 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 and Layout Tools	
A. Introduction	_____
B. Identification of Layout Tools	_____

Session II. Laying Out Base Lines

- A. Arc Method _____
- B. 3-4-5 Method _____
- C. Laboratory – Trainees practice the arc and 3-4-5 method of laying out base lines. This laboratory corresponds to Performance Task 1. _____

Session III. Scribing Straight Lines and Perpendicular Lines

- A. Scribing Straight Lines _____
- B. Scribing Perpendicular Lines to a Base Line Using a Square _____
- C. Scribing Perpendicular Lines to an Edge Using a Combination Square _____
- D. Laboratories – Trainees practice scribing straight and perpendicular lines. These laboratories correspond to portions of Performance Task 2. _____

Session IV. Scribing Angled Lines and Circles Using Squares, Protractors, and Dividers

- A. Scribing Angled Lines Using a Combination Square _____
- B. Scribing Angled Lines Using a Protractor _____
- C. Scribing Circles and Arcs Using a Divider _____
- D. Laboratories – Trainees practice scribing of angled lines, circles, and arcs. These laboratories correspond to portions of Performance Task 2. _____

Session V. Scribing Circles and Perpendicular Lines Using Trammel Points and Dividers

- A. Scribing Circles and Arcs Using Trammel Points _____
- B. Scribing Perpendicular Lines From Base Lines Using a Divider _____
- C. Scribing Perpendicular Lines From a Reference Point Using a Divider _____
- D. Laboratories – Trainees practice scribing of circles, arcs, and perpendicular lines. These laboratories correspond to portions of Performance Task 2. _____

Session VI. Bisecting Angles, Dividing Lines, and Dividing Circles Using Dividers

- A. Bisecting Angles Using a Divider _____
- B. Dividing Lines Into Equal Parts Using a Divider _____
- C. Dividing Circles Into Equal Parts Using a Divider _____
- D. Laboratories – Trainees practice bisecting angles and dividing lines and circles into equal parts. These laboratories correspond to Performance Tasks 3, 4, and 5. _____

Session VII. Locating Equipment

- A. Laying Out Equipment Locations _____
- B. Laboratory – Trainees practice laying out an equipment location. This laboratory corresponds to Performance Task 6. _____

Session VIII. 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 Craft 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 Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module identifies and describes gaskets and O-rings, along with their uses. It provides information for laying out, cutting, and installing gaskets. It also provides information for removing and installing O-rings.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Millwright Level One*, Modules 15101-06 through 15104-06.

OBJECTIVES

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

1. Identify the various types of gaskets and explain their uses.
2. Identify the various types of gasket materials and explain their applications.
3. Lay out, cut, and install a flange gasket.
4. Describe the use of O-rings.
5. Explain the importance of selecting the correct O-ring for an application.
6. Select an O-ring for a given application and install it.

PERFORMANCE TASKS

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

1. Perform a takeoff from a flange for a gasket.
2. Lay out the gasket on gasket material.
3. Cut the inside and outside diameters for the gasket.
4. Cut the bolt holes.
5. Install the gasket and flange bolts.
6. Tighten the flange bolts.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Hand tools for measuring and cutting gaskets
Transparencies	Dividers
Blank acetate sheets	Scribers
Transparency pens	Steel rules
Whiteboard/chalkboard	Adjustable gasket cutters
Markers/chalk	Hole punch sets
Pencils and scratch paper	Mallets
Appropriate personal protective equipment	Compasses with an ink pen holder and ink pens with silver or white ink
Assorted gaskets	Gasket materials or old rubber inner tubes that can be cut up as substitute gasket material
Gasket manufacturer's literature including color coding chart	Old appliances, pumps, or valves with O-ring seals
Pump manufacturer's literature specifying replacement gaskets	Sheet metal
Samples of some of the more common gasket materials	Tin snips
	Bluing

Rags
 Hand tools for assembling and disassembling valves and motors
 Torque wrenches
 Flanges
 Assorted O-rings

Old or broken equipment such as pumps, motors, and old appliances
 O-ring manufacturer's literature
 Module Examinations*
 Performance Profile Sheets*

* Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to work with equipment and cut gaskets. Ensure that all trainees are briefed on hand tool safety and have appropriate personal protective equipment.

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.

Audel Millwrights and Mechanics Guide. Latest edition. Thomas B. Davis, Carl A. Nelson. Hoboken NJ: John Wiley & Sons.

IP's Pipe Trades Handbook. Edmonton, Alberta, Canada: Quebecor Jasper Printing.

Specifications for Gaskets, O-Rings, and Packing. Washington, DC: American National Standards Institute (ANSI).

Specifications for Gaskets, O-Rings, and Packing. West Conshohoken, PA: ASTM International.

Specifications for Gaskets, O-Rings, and Packing. Warrendale, PA: Society of Automotive Engineers.

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 *Gaskets and O-Rings*. 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, Gaskets and Gasket Materials	
A. Introduction	_____
B. Types of Gaskets	_____
C. Gasket Materials	_____
Session II. Fabricating Gaskets	
A. Laying Out a Gasket	_____
B. Laboratory – Trainees practice performing a takeoff, layout, and cutout of flat flange gasket. This laboratory corresponds to Performance Tasks 1, 2, 3, and 4.	_____
C. Tracing a Gasket	_____
D. Machine Gaskets	_____

Session III. Installing Gaskets and O-Rings

- A. Installing Gaskets _____
- B. Laboratory – Trainees practice performing installation of a flat flange gasket. _____
This laboratory corresponds to Performance Tasks 5 and 6.
- C. O-Rings _____
- D. Laboratory – Trainees practice removing and installing an O-ring. _____

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 Craft 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 Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module explains the safety requirements for oxyfuel cutting. It identifies oxyfuel cutting equipment and setup requirements. It explains how to light, adjust, and shut down oxyfuel equipment. Trainees will perform cutting techniques that include straight line, piercing, bevels, and washing.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Millwright Level One*, Modules 15101-06 through 15105-06.

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 cutting equipment.
3. Light and adjust an oxyfuel torch.
4. Shut down oxyfuel cutting equipment.
5. Disassemble oxyfuel equipment.
6. Change empty cylinders.
7. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
8. Operate a motorized, portable oxyfuel gas cutting machine.

Performance Tasks

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

1. Set up, ignite, and shut down oxyfuel equipment.
2. Use oxyfuel equipment to cut a shape from thick steel.
3. Use oxyfuel equipment to perform washing.
4. Perform a pressure drop test.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Appropriate personal protective equipment, including:

Safety goggles

Face shields

Welding helmets

Ear protection

Welding cap

Leather jacket

Leather pants or chaps

Gauntlet-type welding gloves

Respirators

ANSI Z49.1-1999

OSHA 29 CFR 1910.146

Brass valves

MSDS for cutting products

Oxygen cylinder with cap

Fuel gas cylinder with cap

Regulators (oxygen and fuel gas)

Hose set

One-piece cutting torch

- | | |
|--|--|
| Combination cutting torch and torch tips | Friction lighter |
| Assorted acetylene, liquefied fuel gas, and special-purpose cutting torch tips | Tip manuals and tip manufacturer's charts |
| Tip cleaners | Vendor cutting tip chart |
| Tip drills | Wrenches (torch, hose, and regulator) |
| Mechanical guide | Examples of good and bad cuts |
| Cylinder cart | Steel plate: |
| Motorized oxyfuel track cutter | Thin (16 to 10 gauge) |
| Framing squares | Thick (¼ inch to 1 inch) |
| Combination squares with protractor head | Steel pipe |
| Tape measure | Vises and pipe jacks to hold steel for cutting |
| Soapstone | Grinding equipment |
| Penknife | Safety video/DVD (optional) |
| Pliers | TV/VCR/DVD player (optional) |
| Chipping hammer | Module Examinations* |
| | Performance Profile Sheets* |

* Located in the Test Booklet.

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 operate oxyfuel cutting equipment. Ensure that trainees are briefed on fire and shop safety policies prior to performing any work. Emphasize the special safety precautions associated with the use of cylinders and oxyfuel cutting equipment.

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.

Safety in Welding, Cutting, and Allied Processes, ANSI Z49.1-99, 1999. Miami, FL: American Welding Society.
Welder's Handbook, Richard Finch, 1997. New York, NY: The Berkley Publishing Group, 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 *Oxyfuel Cutting*. 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, and Oxyfuel Cutting Equipment	
A. Introduction	_____
B. Oxyfuel Cutting Safety	_____
C. Oxyfuel Cutting Equipment	_____
1. Cylinders, Regulators, and Hoses	_____
2. Cutting Torch, Tips, and Tip Equipment	_____
3. Friction Lighters	_____

- 4. Cylinder Cart
- 5. Soapstone Markers
- 6. Specialized Equipment

Session II. Setting Up Oxyfuel Equipment

- A. Setting Up Oxyfuel Equipment
 - 1. Cylinders
 - 2. Hoses and Regulators
 - 3. Torches and Tips
 - 4. Purging and Testing
- B. Laboratory - Trainees practice setting up oxyfuel equipment.
- C. Laboratory - Trainees practice performing a pressure drop test. This laboratory corresponds to Performance Task 4.

Session III. Torch Operations

- A. Controlling the Oxyfuel Torch Flame
- B. Shutting Down Oxyfuel Equipment
- C. Laboratory - Trainees practice setting up, igniting, and shutting down oxyfuel equipment. This laboratory corresponds to Performance Task 1.
- D. Disassembling Oxyfuel Equipment
- E. Changing Empty Cylinders
- F. Laboratory - Trainees practice disassembling and changing empty cylinders on an oxyfuel cutting outfit.

Sessions IV and V. Performing Cutting Operations, Testing, and Review

- A. Performing Cutting Procedures
- B. Portable Oxyfuel Cutting Machine Operation
- C. Laboratory - Trainees practice cutting a shape from thick steel. This laboratory corresponds to Performance Task 2.
- D. Laboratory - Trainees practice washing with an oxyfuel cutting torch. This laboratory corresponds to Performance Task 3.
- E. Review

Session VI. Module Examination, and Performance Testing

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