

MODULE OVERVIEW

This module covers the history of the trade and the kinds of work and work environments workers would find in the field. It describes the apprenticeship, training programs, and career opportunities. The responsibilities and characteristics a worker should possess are also described.

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 industrial maintenance craftworkers.
2. Identify career opportunities available to industrial maintenance craftworkers.
3. Explain the purpose and objectives of an apprentice training program.
4. Explain the responsibilities and characteristics of a good industrial maintenance craftworker.
5. Explain the importance of safety in relation to industrial maintenance craftworkers.
6. Explain the role of NCCER in the training process.

PERFORMANCE TASKS

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

MATERIALS AND EQUIPMENT LIST

| | |
|---|---|
| Overhead projector and screen | Job announcements for maintenance craftworkers from local newspapers (want ads) |
| Transparencies | NCCER Apprentice Training Recognition Forms |
| Blank acetate sheets | <i>OSHA Safety and Health Standards for the Construction Industry</i> |
| Transparency pens | Videos on lifting safety and materials storage |
| Whiteboard/chalkboard | TV/VCR/DVD player |
| Markers/chalk | Copies of the Trade Terms Quiz * |
| Pencils and scratch paper | Module Examinations** |
| Appropriate personal protective equipment | |
| Copy of an employee manual | |

* 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 trainees are equipped with appropriate personal protective equipment and know how to use it properly.

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. This is optional material for continued education rather than for task training.

<http://www.plant-maintenance.com/index.shtml>

<http://www.doleta.gov>

<http://www.impomag.com/scripts/default.asp>

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 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. The Industrial Maintenance Trade | |
| A. Introduction | _____ |
| B. The Industrial Maintenance Trade | _____ |
| C. Coordinating with the Construction Industry | _____ |
| D. Career Paths | _____ |
| E. Employee Responsibility and Human Relations | _____ |
| F. Tools | _____ |
| G. Safety | _____ |
| H. Your Training Program | _____ |
| I. Review | _____ |
| J. Module Examination | _____ |
| 1. Trainees must score 70% 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 provides an introduction to the hand and power tools used in industrial maintenance. It covers safety procedures and techniques for use of these tools.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum* and *Industrial Maintenance E & I Technician Level One*, Module 40101-07.

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 industrial maintenance craftworkers.
2. Describe how to maintain each of the tools used by industrial maintenance craftworkers.
3. Demonstrate the proper use and basic maintenance of selected industrial maintenance tools.

PERFORMANCE TASKS

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

1. Correctly use a pipe vise.
2. Correctly use a pipe threading machine.
3. Correctly use a cut-off machine.
4. Correctly use a portable power drive.
5. Demonstrate inspection and basic maintenance of tools chosen by the instructor.

MATERIALS AND EQUIPMENT LIST

| | |
|---|-------------------------|
| Overhead projector and screen | Mallets |
| Transparencies | Steel hammers |
| Blank acetate sheets | Soft steel |
| Transparency pens | Diagonal cutters |
| Whiteboard/chalkboard | Tin snips |
| Markers/chalk | Taps and dies |
| Pencils and scratch paper | Scribers |
| Appropriate personal protective equipment | Tension meters |
| Pictures of various tools (optional) | Sheave gauges |
| Damaged or unsafe tools | Cylinder hones |
| Assorted diameters of pipe | Gear pullers |
| Strap wrench/chain wrenches | Packing pullers |
| Spanner wrenches | Reamers |
| Taper gauges | Inspection mirrors |
| Pipe and tubing cutters | Retaining ring pliers |
| Honing stones | Spiral screw extractors |
| Putty knives/scrapers | Tap extractors |
| Drift pins | Dial indicator |
| Barrel pins | Feeler gauge |

| | |
|---|---|
| Sleever and alignment bars | Pipe vise |
| Pipe sections | Pipe threading machine and die set |
| Scrap metal and equipment | Operator's manual for pipe threading machine |
| Sheet metal | Portable power drive |
| Patterns for shapes commonly cut in sheet metal | Geared threader and universal drive shaft |
| Old or broken motors, pumps, appliances, or other machines and equipment that trainees can disassemble and reassemble | Cutting oil |
| Pipe sections | Nipple chuck kit |
| Portable band saw and blades | Assorted hand tools for maintaining equipment |
| Grinders | Copies of the Quick Quiz * |
| Grinder accessories | Module Examinations** |
| | Performance Profile Sheet** |

* 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 hand and power tools. Ensure that all trainees are briefed on hand and power tools safety and any 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.

Tools and Their Uses, Latest Edition. Naval Education and Training Program and Development Center. Washington, DC: US Government Printing Offices.

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 *Tools of the Trade*. 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 Hand Tools | |
| A. Introduction | _____ |
| B. Hand Tools Safety | _____ |
| C. Use and Care of Hand Tools | _____ |
| D. Laboratory – Trainees practice using and caring for selected hand tools. This laboratory corresponds to Performance Tasks 1 and 5. | _____ |
| Session II. Power Tools, Review, and Performance Testing | |
| A. Power Tool Safety | _____ |
| B. Power Tools | _____ |
| C. Laboratory – Trainees practice using a pipe threading machine, cut-off machine, and portable power drive. This laboratory corresponds to Performance Tasks 2 through 4. | _____ |
| D. Review | _____ |
| E. Module Examination | _____ |
| 1. Trainees must score 70% 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. | |
| F. 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 hardware and systems used by an industrial maintenance craftperson. It also describes various types of anchors and supports, their applications, and how to install them safely.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum*; and *Industrial Maintenance E & I Technician Level One*, Modules 40101-07 and 40102-07.

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 selected screws.
3. Install selected anchors.
4. Install selected toggle bolts.

MATERIALS AND EQUIPMENT LIST

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

Two-part epoxy anchor
Collection of odd screws, bolts, and fasteners
Thread gauges
Micrometers
Gypsum wallboard (optional)
Plywood (optional)

Weights or other loads
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheet**

* 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 hand and power tools. Emphasize basic tool safety.

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. This is optional material for continued education rather than for task training.

<http://www.Thomasglobal.com>

<http://www.confast.com>

<http://www.boltdepot.com/fastenerinformation>

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 *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, Threaded Fasteners, and Non-Threaded Fasteners | |
| A. Introduction | _____ |
| B. Thread Standards | _____ |
| C. Bolt and Screw Types | _____ |
| D. Nuts and Washers | _____ |
| E. Installing Threaded Fasteners | _____ |
| F. Laboratory – Trainees practice installing threaded fasteners, screws, and toggle bolts. This laboratory corresponds to Performance Tasks 1, 2, and 4. | _____ |
| G. Non-Threaded Fasteners | _____ |
| H. Special Threaded Fasteners | _____ |
| Session II. Anchors, Review, and Testing | |
| A. Mechanical Anchors | _____ |
| B. Epoxy Anchoring Systems | _____ |
| C. Laboratory – Trainees practice installing anchors. This laboratory corresponds to Performance Task 3. | _____ |
| D. Review | _____ |
| E. Module Examination | _____ |
| 1. Trainees must score 70% 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. | |
| F. 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. | |

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains the safety requirements for oxyfuel cutting. It identifies oxyfuel cutting equipment and provides instruction for setting up, lighting, and using the equipment. It includes straight line cutting, piercing, beveling, and washing.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40103-07.

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. State the safety precautions for using oxyfuel equipment.
3. Set up oxyfuel cutting equipment.
4. Light and adjust an oxyfuel torch.
5. Shut down oxyfuel cutting equipment.
6. Disassemble oxyfuel equipment.
7. Change empty cylinders.
8. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
9. Apply a rosebud flame to remove frozen components (also for preheat and expanding larger fittings).
10. 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 oxyfuel equipment.
2. Light and adjust an oxyfuel torch.
3. Shut down and disassemble oxyfuel cutting equipment.
4. Perform oxyfuel cutting:
 - Straight line and square shapes
 - Piercing and slot cutting
 - Bevels
 - Washing
5. Operate a track burner.

MATERIALS AND EQUIPMENT LIST

| | |
|--|--|
| Overhead projector and screen | Tip cleaners |
| Transparencies | Tip drills |
| Blank acetate sheets | Mechanical guide |
| Transparency pens | Cylinder cart |
| Whiteboard/chalkboard | Motorized oxyfuel track cutter |
| Markers/chalk | Framing squares |
| Pencils and scratch paper | Combination squares with protractor head |
| Appropriate personal protective equipment | Tape measure |
| Safety goggles | Soapstone |
| Face shields | Penknife |
| Welding helmets | Pliers |
| Ear protection | Chipping hammer |
| Welding cap | Friction lighter |
| Leather jacket | Tip manuals and tip manufacturer's charts |
| Leather pants or chaps | Vendor cutting tip chart |
| Gauntlet-type welding gloves | Wrenches (torch, hose, and regulator) |
| Respirators | Examples of good and bad cuts |
| <i>ANSI Z49.1-1999</i> | Steel plate |
| <i>OSHA 29 CFR 1910.146</i> | Thin (16 to 10 gauge) |
| Brass valves | Thick (¼ inch to 1 inch) |
| MSDS for cutting products | Steel pipe |
| Oxygen cylinder with cap | Vises and pipe jacks to hold steel for cutting |
| Fuel gas cylinder with cap | Grinding equipment |
| Regulators (oxygen and fuel gas) | Safety video/DVD (optional) |
| Hose set | TV/VCR/DVD player (optional) |
| One-piece cutting torch | Copies of the Trade Terms Quiz* |
| Combination cutting torch and torch tips | Module Examinations** |
| Assorted acetylene, liquefied fuel gas, and special-purpose cutting torch tips | 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 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 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.

Safety in Welding, Cutting, and Allied Processes, ANSI Z49.1-99, 1999. 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 17½ 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. Purgings and Testing | _____ |
| B. Laboratory – Trainees practice setting up oxyfuel equipment. This laboratory corresponds to Performance Task 1. | _____ |
| Sessions III and IV. Torch Operations | |
| A. Controlling the Oxyfuel Torch Flame | _____ |
| B. Shutting Down Oxyfuel Equipment | _____ |
| C. Laboratory – Trainees practice lighting, adjusting, and shutting down the equipment. This laboratory corresponds to Performance Tasks 2 and 3. | _____ |
| D. Disassembling Oxyfuel Equipment | _____ |
| E. Changing Empty Cylinders | _____ |
| F. Laboratory – Trainees practice disassembling the equipment. This laboratory corresponds to Performance Task 3. | _____ |
| Sessions IV and V. Performing Cutting Operations | |
| A. Performing Cutting Procedures | _____ |
| B. Laboratory – Trainees practice oxyfuel cutting. This laboratory corresponds to Performance Task 4. | _____ |

Session VI. Portable Cutting Machine Operation

- A. Portable Oxyfuel Cutting Machine Operation _____
- B. Laboratory – Trainees practice operating a track burner. This laboratory corresponds to Performance Task 5. _____

Session VII. Review and Testing

- A. Review _____
- B. Module Examination _____
 - 1. Trainees must score 70% 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 introduces types of gaskets and gasket material, types of packing and packing material, and types of O-ring material. It also explains the use and choice of gaskets, packing, and O-rings, and teaches how to fabricate a gasket.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40104-07.

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.
7. Describe the uses and methods of packing.

PERFORMANCE TASKS

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

1. Lay out and install a gasket.
2. Cut and install packing.
3. Install O-rings.

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
Assorted gaskets
Gasket manufacturer's literature including color coding chart
Pump manufacturer's literature specifying replacement gaskets
Samples of some of the more common gasket materials
Hand tools for measuring and cutting gaskets
Dividers
Scribers
Steel rules
Adjustable gasket cutters
Hole punch sets
Mallets

Compasses with an ink pen holder and ink pens with silver or white ink
Gasket materials or old rubber inner tubes that can be cut up as substitute gasket material
Various types of packing
Old appliances, pumps, or valves with packing seals
Sheet metal
Tin snips
Bluing
Rags
Hand tools for assembling and disassembling valves and motors
Torque wrenches
Flanges
Old or broken equipment such as pumps, motors, and old appliances
Assorted O-rings
Packing manufacturer's literature
Copies of Quick Quiz*
Module Examinations**
Performance Profile Sheet**

* 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 trainees to work with equipment and cut gaskets. Ensure that all trainees are briefed on hand tool safety and have appropriate personal protection 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. This is optional material for continued education rather than for task training.

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

Specifications for Gaskets, O-Rings, and Packing. West Conshohocken, PA: American Society for Testing and Materials.

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 Packing*. 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 and Installing Gaskets | |
| A. Laying Out a Gasket | _____ |
| B. Tracing a Gasket | _____ |
| C. Machine Gaskets | _____ |
| D. Installing Gaskets | _____ |
| E. Laboratory – Trainees practice laying out and installing a gasket. This laboratory corresponds to Performance Task 1. | _____ |
| Session III. Installing Packing and O-Rings | |
| A. Packing | _____ |
| B. Laboratory – Trainees practice cutting and installing packing. This laboratory corresponds to Performance Task 2. | _____ |
| C. O-Rings | _____ |
| D. Laboratory – Trainees practice installing an O-ring. This laboratory corresponds to Performance Task 3. | _____ |

Session IV. Review and Testing

A. Review

B. Module Examination

1. Trainees must score 70% 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 how to use ratios and proportions, solve basic algebra, area, volume, and circumference problems, and solve for right triangles using the Pythagorean theorem.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40105-07.

OBJECTIVES

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

1. Identify and explain the use of special measuring devices.
2. Use tables of weights and measurements.
3. Use formulas to solve basic problems.
4. Solve area problems.
5. Solve volume problems.
6. Solve circumference problems.
7. Solve right triangles using the Pythagorean theorem.

PERFORMANCE TASKS

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

MATERIALS AND EQUIPMENT LIST

| | |
|-------------------------------|---------------------------|
| Overhead projector and screen | Pencils and scratch paper |
| Transparencies | Architect's scale |
| Blank acetate sheets | Engineer's scale |
| Transparency pens | Copies of the Quick Quiz* |
| Whiteboard/chalkboard | Module Examinations** |
| Markers/chalk | |

* 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.

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. This is optional material for continued education rather than for task training.

Pipe Fitter's Math Guide, 1989. Johnny Hamilton. Clinton, NC: Construction Trade Press.

Applied Construction Math, Latest Edition. Upper Saddle River, NJ: Prentice Hall Publishing.

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 *Craft-Related Mathematics*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

| Topic | Planned Time |
|--|--------------|
| Sessions I and II. Measuring and Using Tables and Formulas | |
| A. Introduction | _____ |
| B. Special Measuring Devices | _____ |
| C. Using Tables | _____ |
| D. Using Ratios and Proportions | _____ |
| E. Using Formulas | _____ |
| Session III. Solving Area Problems | |
| A. Rectangles | _____ |
| B. Triangles | _____ |
| C. Circles | _____ |
| Session IV. Solving Volume Problems | |
| A. Rectangular Solids | _____ |
| B. Cylinders | _____ |
| C. Spheres | _____ |
| D. Pyramids | _____ |
| E. Cones | _____ |
| Session V. Solving Circumference Problems and Right Triangles | |
| A. Solving Circumference Problems | _____ |
| B. Pythagorean Theorem | _____ |
| Session VI. 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 Craft Training Report Form 200, and submit the results to the Training Program Sponsor. | |

MODULE OVERVIEW

This module introduces the trainee to plot plans, structural drawings, elevation drawings, as-built drawings, equipment arrangement drawings, P&IDs, isometric drawings, spool sheets, and detail sheets.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40106-07.

OBJECTIVES

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

1. Explain the basic layout of a blueprint.
2. Describe the information included in the title block of a blueprint.
3. Identify the types of lines used on blueprints.
4. Identify common symbols used on blueprints.
5. Understand the use of architect's and engineer's scales.
6. Demonstrate the use of an architect's scale.

PERFORMANCE TASKS

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

1. Identify parts of a drawing:
 - Title block
 - Scales and measurements
 - Symbols and abbreviations
 - Notes
 - Revision blocks
 - Coordinates
2. Interpret the following:
 - Drawing indexes
 - Line lists
3. Identify the following types of drawings:
 - Plot plans
 - Structural drawings
 - Elevation and section drawings
 - P&IDs
 - Schematics
 - Circuit diagrams
 - Orthographic drawings

MATERIALS AND EQUIPMENT LIST

| | |
|---|---------------------------------|
| Overhead projector and screen | Circuit diagrams |
| Transparencies | Architect's scale |
| Blank acetate sheets | Engineer's scale |
| Transparency pens | Metric scale |
| Whiteboard/chalkboard | Digital scaling tool (optional) |
| Markers/chalk | Schematics |
| Pencils and scratch paper | Exploded diagrams |
| Appropriate personal protective equipment | Specifications |
| Set of blueprints | Calculators |
| Site plan | Copies of the Quick Quizzes* |
| Floor plan | Module Examinations** |
| Cross sections and detail drawings | 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.

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.

American Electrician's Handbook, 2002. Terrell Croft, Winfred Summers. New York, NY: McGraw-Hill.

National Electrical Code® Handbook, Latest Edition. Quincy, MA: National Fire Protection Association.

The Pipefitter's Bluebook, Latest Edition. W.V. Graves. Clinton, NC: Construction Trades Press.

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 *Construction 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 |
|---|--------------|
| Sessions I and II. Identifying and Interpreting Drawings | |
| A. Introduction | _____ |
| B. Blueprint Layout | _____ |
| C. Scale Drawings | _____ |
| D. Analyzing Drawings | _____ |
| E. Laboratory – Trainees practice identifying parts of drawings. This laboratory corresponds to Performance Task 1. | _____ |
| F. Drafting Lines | _____ |
| G. Laboratory – Trainees practice interpreting drawing indexes and line lists. This laboratory corresponds to Performance Task 2. | _____ |
| Sessions III through IV. Identifying Different Types of Drawings | |
| A. Circuit Diagrams | _____ |
| B. Scale Drawings | _____ |
| C. Site Plans | _____ |
| D. Floor Plans | _____ |
| E. Elevation and Section Drawings | _____ |
| F. P&IDs | _____ |
| G. Schematics | _____ |
| H. Exploded Diagrams | _____ |
| I. Writing Specifications | _____ |
| J. Laboratory – Trainees practice identifying different types of drawings. This laboratory corresponds to Performance Task 3. | _____ |
| Session V. 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 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 centrifugal, rotary, reciprocating, metering, and vacuum pump operation and installation methods, as well as types of drivers. It also covers net positive suction head and cavitation.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & i technician Level One, Modules 40101-07 through 40107-07.*

OBJECTIVES

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

1. Identify and explain centrifugal pumps.
2. Identify and explain rotary pumps.
3. Identify and explain reciprocating pumps.
4. Identify and explain metering pumps.
5. Identify and explain vacuum pumps.
6. Explain net positive suction head and cavitation.
7. Identify types of drivers.

PERFORMANCE TASKS

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

1. Identify centrifugal pumps.
2. Identify rotary pumps.
3. Identify reciprocating pumps.
4. Identify metering pumps.
5. Identify vacuum pumps.

MATERIALS AND EQUIPMENT LIST

| | |
|---|---|
| Overhead projector and screen | Small object |
| Transparencies | Several types of reciprocating pumps |
| Blank acetate sheets | Hot water bottle with small hose |
| Transparency pens | Several types of metering pumps |
| Whiteboard/chalkboard | Various types of vacuum pumps |
| Markers/chalk | Manufacturer's installation instructions for a pump |
| Pencils and scratch paper | Copies of the Quick Quizzes* |
| Appropriate personal protective equipment | Module Examinations** |
| Various types of centrifugal pumps | Performance Profile Sheets** |
| Various types of rotary pumps | |
| Glass of water | |

* 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. If you require trainees to visit power plants or utility areas, ensure that they are briefed on site 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.

Mechanical and Electrical Systems in Building, Third Edition. Upper Saddle River, NJ: Prentice Hall Publishing.

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 *Pumps and Drivers*. 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. Identifying Pumps I | |
| A. Introduction | _____ |
| B. Centrifugal Pumps | _____ |
| C. Laboratory – Trainees practice identifying centrifugal pumps. This laboratory corresponds to Performance Task 1. | _____ |
| D. Rotary Pumps | _____ |
| E. Laboratory – Trainees practice identifying rotary pumps. This laboratory corresponds to Performance Task 2. | _____ |
| F. Reciprocating Pumps | _____ |
| G. Laboratory – Trainees practice identifying reciprocating pumps. This laboratory corresponds to Performance Task 3. | _____ |
| H. Metering Pumps | _____ |
| I. Laboratory – Trainees practice identifying metering pumps. This laboratory corresponds to Performance Task 4. | _____ |

Session II. Pumps II, Cavitation, Drivers, Review and Testing

- A. Vacuum Pumps _____
- B. Laboratory – Trainees practice identifying vacuum pumps. This laboratory corresponds to Performance Task 5. _____
- C. Cavitation _____
- D. Installing Pumps _____
- E. Drivers _____
- F. Module Review _____
- G. Module Examination _____
 - 1. Trainees must score 70% 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.
- H. 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.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module identifies and provides installation methods for different types of valves. It also covers valve storage and handling.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40108-07.

OBJECTIVES

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

1. Identify types of valves that start and stop flow.
2. Identify types of valves that regulate flow.
3. Identify valves that relieve pressure.
4. Identify valves that regulate the direction of flow.
5. Explain how to properly store and handle valves.
6. Explain valve locations and positions.

PERFORMANCE TASKS

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

1. Identify types of valves that start and stop flow.
2. Identify types of valves that regulate flow.
3. Identify valves that relieve pressure.
4. Identify valves that regulate the direction of flow.
5. Demonstrate how to properly store and handle valves.
6. Demonstrate valve locations and positions.

MATERIALS AND EQUIPMENT LIST

| | |
|---|-------------------------------|
| Overhead projector and screen | Angle valves |
| Transparencies | Y-type valves |
| Blank acetate sheets | Butterfly valves |
| Transparency pens | Diaphragm valves |
| Whiteboard/chalkboard | Needle valves |
| Markers/chalk | Control valves |
| Pencils and scratch paper | Safety valves |
| Appropriate personal protective equipment | Pressure-relief valves |
| Gate valves with various types of bonnets and stems | Various types of check valves |
| Knife gate valve | Swing check valves |
| Ball valves | Lift check valves |
| Venturi-type and top-entry ball valves | Ball check valves |
| Various types of plug valves | Butterfly check valves |
| Plug lubricants | Foot valves |
| Globe valves | Gear operators |
| | Chain operators |

Electric motor-driven actuators
 Pneumatic and hydraulic actuators
 Photograph or picture of valve boxes
 Manufacturers' literature on pressure-relief valves
 Backflow preventer

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. If you require trainees to visit construction sites or utility areas, ensure that they are briefed on site 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. This is optional material for continued education rather than for task training.

Choosing the Right Valve. New York, NY: Crane Company.

Piping Pointers; Application and Maintenance of Valves and Piping Equipment. New York, NY: Crane 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 5 hours are suggested to cover *Valves*. 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 to Valves | |
| A. Introduction | _____ |
| B. Valves That Start and Stop Flow | _____ |
| C. Laboratory – Trainees practice identifying valves that start and stop flow. This laboratory corresponds to Performance Task 1. | _____ |
| D. Valves that Regulate Flow and Pressure | _____ |
| E. Laboratory – Trainees practice identifying valves that regulate flow. This laboratory corresponds to Performance Task 2. | _____ |
| F. Valves That Relieve Pressure | _____ |
| G. Laboratory – Trainees practice identifying valves that relieve pressure. This laboratory corresponds to Performance Task 3. | _____ |
| H. Valves That Regulate the Direction of Flow | _____ |
| I. Laboratory – Trainees practice identifying valves that regulate the | _____ |

Session II. Installation, Applications, Review, and Testing

- A. Valve Actuators _____
- B. Storing and Handling Valves _____
- C. Laboratory – Trainees practice properly handling and storing valves.
This laboratory corresponds to Performance Task 5. _____
- D. Installing Valves _____
- E. Valve Selection, Types, and Applications _____
- F. Valve Markings _____
- G. Laboratory – Trainees practice identifying valve locations and
positions. This laboratory corresponds to Performance Task 6. _____
- H. Module Review _____
- I. Module Examination _____
 - 1. Trainees must score 70% 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.
- J. Performance Testing _____
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive
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 introduces the basic test equipment that an industrial maintenance E & I technician might use, including tachometers, pyrometers, strobe meters, voltage testers, and automated diagnostic tools.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40109-07.

OBJECTIVES

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

1. Explain the operation of and describe the following pieces of test equipment:
 - Tachometers
 - Pyrometers
 - Multimeters
 - Automated diagnostic tools
 - Wiggy[®] voltage tester
 - Stroboscope
2. Explain how to read and convert from one scale to another using the above test equipment.
3. Define frequency and explain the use of a frequency meter.

PERFORMANCE TASKS

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

1. Demonstrate the use of the following pieces of test equipment:
 - Tachometer
 - Pyrometer
 - Multimeter
 - Voltage tester
 - Strobe light
2. Demonstrate the use of automated diagnostic tools chosen by the instructor.

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

Gloves

Rubber sleeves

Rubber blankets

Test circuits

Volt-ohm-milliammeter and operator's manual

Digital multimeter and operator's manual

continued

Clamp-type multimeter and operator's manual
 Frequency meter and operator's manual
 Tachometer and operator's manual
 Voltage tester and operator's manual
 Strobe light and operator's manual

Pyrometer and operator's manual
 Company safety manual
 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 test equipment. Ensure that all trainees are briefed on electrical 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 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.

Electronics Fundamentals, Thomas L. Floyd. New York: Prentice Hall.

Principles of Electric Circuits, Thomas L. Floyd. New York: Prentice Hall.

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 *Introduction to Test Instruments*. 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 Meters I | |
| A. Introduction | _____ |
| B. Volt-Ohm-Milliammeter | _____ |
| C. Digital Meters | _____ |
| D. Laboratory – Trainees practice using selected test equipment. This laboratory corresponds to Performance Task 1. | _____ |
| Session II. Meters II and Safety | |
| A. Frequency Meter | _____ |
| B. Continuity Tester | _____ |
| C. Voltage Tester | _____ |
| D. Laboratory – Trainees practice using selected test equipment. This laboratory corresponds to Performance Task 1. | _____ |
| E. Safety | _____ |

Session III. Troubleshooting Motors, Review, and Testing

A. Troubleshooting Motors

B. Laboratory – Trainees practice using selected automated diagnostic tools.
This laboratory corresponds to Performance Task 2.

C. Review

D. Module Examination

1. Trainees must score 70% 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.

E. 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 introduces the maintenance craftworker to the equipment and techniques of material handling, and to the basic knowledge required for rigging and communicating with riggers.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40110-07.

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. Inspect common rigging equipment.
3. Select, use, and maintain special rigging equipment, including:
 - Jacks
 - Block and tackle
 - Chain hoists
 - Come-alongs
4. Tie knots used in rigging.
5. Use and understand the correct hand signals to guide a crane operator.
6. Identify basic rigging and crane safety procedures.

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
3. Tie knots used in rigging.
4. Determine the center of gravity of a load.
5. Properly attach rigging hardware for routine lifts.
6. Use and interpret hand signals.
7. Perform sling tension calculations.

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
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 beam clamps
Manufacturer's literature on plate clamps
Various rigging plates and links
Various types of slings
Rigging pocket guide
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
Walkie-talkies
Throat microphone
Hardwired communication system
ASME B30.5 Consensus Standard
29 CFR 1926.550
Completed lift plan
Crane manufacturer's literature
Typical teeter-totter and weights
Various lifting eyebolts
Rigging hardware
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 requires trainees to use various types of hoists, jacks, and tuggers. Ensure that all trainees are briefed on lifting safely and any other shop safety procedures. If you require trainees to visit job sites, ensure that trainees are briefed on site safety policies.

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.

Machinery's Handbook, Latest Edition. Erik Oberg, Franklin D. Jones, Holbrook L. Horton, and Henry H. Ryffel. New York, NY: Industrial Press Inc.

Occupational Safety and Health Standards for the Construction Industry, 29 CFR Part 1926. 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 15 hours are suggested to cover *Material Handling and Hand Rigging*. 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 |
|--|--------------|
| Sessions I and II. Introduction and Rigging Hardware | |
| A. Introduction | _____ |
| B. Rigging Hardware | _____ |
| C. Laboratory – Trainees practice attaching rigging hardware for routine lifts. This laboratory corresponds to Performance Task 5. | _____ |
| D. Determining Sling Tension | _____ |
| E. Laboratory – Trainees practice calculating sling tension. This laboratory corresponds to Performance Task 7. | _____ |
| F. Slings | _____ |
| G. Laboratory – Trainees practice performing a safety inspection on hooks, slings, and other rigging equipment. This laboratory corresponds to Performance Task 1. | _____ |
| H. Tag lines | _____ |
| I. Laboratory – Trainees practice tying knots used in rigging. This laboratory corresponds to Performance Task 3. | _____ |
| Session III. Block and Tackle and Hoists | |
| A. Block and Tackle | _____ |
| B. Chain Hoists | _____ |
| C. Ratchet-Lever Hoists and Come-Alongs | _____ |
| D. Jacks | _____ |
| E. Tuggers | _____ |
| F. Laboratory – Trainees practice selecting, inspecting, and using special rigging equipment. This laboratory corresponds to Performance Task 2. | _____ |

Sessions IV and V. Cranes

- A. Cranes _____
- B. Laboratory – Trainees practice using and interpreting hand signals. This laboratory corresponds to Performance Task 6. _____
- C. General Rigging Safety _____
- D. Laboratory – Trainees practice determining the center of gravity. This laboratory corresponds to Performance Task 4. _____
- E. Working Around Power Lines _____
- F. Site Hazards and Emergency Response _____
- G. Using Cranes to Lift Personnel _____
- H. Lift Planning _____
- I. Crane Component Terminology _____

Session VI. Review and Testing

- A. Review _____
- B. Module Examination _____
 - 1. Trainees must score 70% 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 procedures and methods of operation for motorized support equipment, including forklifts, manlifts, compressors, and generators.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum*; and *Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40111-07.

OBJECTIVES

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

1. State the safety precautions associated with the use of motor-driven equipment in industrial plants.
2. Explain the operation and applications of the following motor-driven equipment commonly used in industrial plants:
 - Portable generators
 - Air compressors
 - Portable pumps
 - Aerial lifts
 - Forklifts
 - Mobile cranes
3. Operate and perform preventive maintenance on the following equipment:
 - Portable generators
 - Air compressors
 - Aerial lifts

PERFORMANCE TASKS

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

1. Describe an aerial lift inspection.

MATERIALS AND EQUIPMENT LIST

| | |
|---|---|
| Overhead projector and screen | Portable air compressor and accessories |
| Transparencies | Portable air compressor operator's manual |
| Blank acetate sheets | 29 CFR 1926.453 |
| Transparency pens | Aerial lift operator's manual |
| Whiteboard/chalkboard | Pallet jack and pallets |
| Markers/chalk | Copies of the Quick Quiz* |
| Pencils and scratch paper | Module Examinations** |
| Appropriate personal protective equipment | Performance Profile Sheets** |
| Portable generators and accessories | |
| Portable generator operator's manual | |

* 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 mobile and support equipment. Review hazards associated with each type of equipment and general precautions needed when operating mobile and support 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.

Construction Equipment Guide, Latest Edition. New York, NY: John Wiley & Sons.

Machinery's Handbook, Latest Edition. Erik Oberg, Franklin D. Jones, Holbrook L. Horton, and Henry H. Ryffel. New York, NY: Industrial Press, 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 10 hours are suggested to cover *Mobile and Support Equipment*. 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 Generators | |
| A. Introduction | _____ |
| B. Safety Precautions | _____ |
| C. Generators | _____ |
| Session II. Air Compressors and Aerial Lifts | |
| A. Air compressors | _____ |
| B. Aerial Lifts | _____ |
| C. Laboratory – Trainees describe an aerial lift inspection. This laboratory corresponds to Performance Task 1. | _____ |
| Session III. Forklifts and Cranes | |
| A. Forklifts | _____ |
| B. Cranes | _____ |

Session IV. Review, Module Examination, and Performance Testing

A. Review

B. Module Examination

1. Trainees must score 70% 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.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains lubrication safety, storage, and classifications. It also explains selecting lubricants, additives, lubrication equipment, and lubricating charts.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum*; and *Industrial Maintenance E & I Technician Level One*, Modules 40101-07 through 40112-07.

OBJECTIVES

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

1. Explain OSHA hazard communication as pertaining to lubrication.
2. Read and interpret a material safety data sheet (MSDS).
3. Explain the EPA hazardous waste control program.
4. Explain lubricant storage.
5. Explain lubricant classification.
6. Explain lubricant film protection.
7. Explain properties of lubricants.
8. Explain properties of greases.
9. Explain how to select lubricants.
10. Identify and explain types of additives.
11. Identify and explain types of lubricating oils.
12. Identify and use lubrication equipment to apply lubricants.
13. Read and interpret a lubrication chart.

PERFORMANCE TASKS

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

1. Read and interpret an MSDS.
2. Identify and use lubricating equipment to apply lubricants.
3. Read and interpret a lubrication chart.

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

MSDS for lubricants

Lubricants with various viscosities

Heat source

Various types of grease

Product literature for lubricants with additives or lubricant additives

Lubricating oils or product literature on lubricating oils

Manual lubricating equipment:

Lever gun

Transfer pump

Gear lube dispenser

Bucket pump

Power-operated lubrication equipment

Lubrication fittings
 Lubrication chart
 Old or broken equipment, such as pumps or motors, and corresponding lubrication charts

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 lubricants and lubricating equipment. Review hazards associated with each type of lubricant and additive and general precautions needed when using, storing, and disposing of lubricants.

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.

Shell Lubricants Handbook, available through Shell Lubricant Sales Offices and Suppliers, published yearly.

Chevron Salesfax Digest, available through Chevron Lubricant Sales Offices and Suppliers, published yearly.

Mobil Brief Products Descriptions, available through Mobil Lubricant Sales Offices and Suppliers, published yearly.

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 *Lubrication*. 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 and Safety | |
| A. Introduction | _____ |
| B. Lubrication Safety and OSHA standards | _____ |
| C. MSDS | _____ |
| D. Laboratory – Trainees practice reading and interpreting an MSDS. This laboratory corresponds to Performance Task 1. | _____ |
| E. EPA Programs | _____ |
| F. Storing Lubricants | _____ |
| Session II. Lubricants | |
| A. Lubricant Film Protection | _____ |
| B. Properties of Lubricants | _____ |
| C. Properties of Grease | _____ |
| D. Selecting Lubricants | _____ |
| E. Additives | _____ |
| F. Lubricating Oils | _____ |

Sessions III and IV. Equipment and Methods

- A. Manual Lubricating Equipment _____
- B. Power-Operated Lubricating Equipment _____
- C. Lubrication Fittings _____
- D. Lubricating Methods _____
- E. Laboratory – Trainees practice identifying and using lubricating equipment to apply lubricants. This laboratory corresponds to Performance Task 2. _____
- F. Lubrication Charts _____
- G. Laboratory – Trainees practice reading a lubrication chart. This laboratory corresponds to Performance Task 3. _____

Session V. Review, Module Examination, and Performance Testing

- A. Review _____
- B. Module Examination _____
 - 1. Trainees must score 70% 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.

