

## **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*; and *Millwright Level One*.

## **OBJECTIVES**

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

1. Use ratios and proportions.
2. Solve basic algebra problems.
3. Solve area problems.
4. Solve volume problems.
5. Solve circumference problems.
6. Solve circular speed problems.
7. Use tables.

## **PERFORMANCE TASKS**

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

## **MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and scratch paper

Architect's scale

Engineer's scale

Scissors

Copies of the Quick Quiz\*

Module Examinations\*\*

\* Located in the back of this module.

\*\*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.

## 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.

*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 20 hours are suggested to cover *Intermediate Trade Math*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	Planned Time
<b>Sessions I and II. Measuring and Using Tables and Formulas</b>	
A. Introduction	_____
B. Special Measuring Devices	_____
C. Using Tables	_____
D. Using Ratios and Proportions	_____
E. Laboratory	
Trainees practice using ratios and proportions.	_____
F. Using Formulas	_____
G. Laboratory	
Trainees practice using formulas to solve problems.	_____
<b>Session III. Solving Area Problems</b>	
A. Rectangles	_____
B. Triangles	_____
C. Circles	_____
D. Laboratory	
Trainees practice solving area problems.	_____
<b>Sessions IV and V. Solving Volume Problems</b>	
A. Rectangular Solids	_____
B. Cylinders	_____
C. Spheres	_____
D. Pyramids	_____
E. Cones	_____
F. Laboratory	
Trainees practice solving volume problems.	_____

**Sessions VI and VII. Circumference Problems, Right Triangles, and Weights**

A. Solving Circumference Problems

\_\_\_\_\_

B. Laboratory

Trainees practice solving circumference problems.

\_\_\_\_\_

C. Pythagorean Theorem

\_\_\_\_\_

D. Laboratory

Trainees practice solving right triangles using the Pythagorean theorem.

\_\_\_\_\_

E. Calculating the Weight of an Object

\_\_\_\_\_

F. Laboratory

Trainees practice calculating the weight of an object.

\_\_\_\_\_

**Session VIII. 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.



**Annotated Instructor's Guide****MODULE OVERVIEW**

This module explains the basic skills needed to make a good field sketch to convey information about how parts should be made or assembled. It includes both isometric and orthographic sketching.

**PREREQUISITES**

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; and Millwright Level Two, Module 15201-07.*

**OBJECTIVES**

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

1. Sketch straight lines.
2. Sketch angles.
3. Sketch arcs and circles.
4. Sketch ellipses.
5. Sketch dimensions.
6. Make orthographic sketches.
7. Make pictorial sketches.

**PERFORMANCE TASKS**

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

1. Sketch straight lines.
2. Sketch angles.
3. Sketch arcs and circles.
4. Sketch ellipses.
5. Sketch dimensions.
6. Make orthographic sketches.
7. Make oblique sketches.
8. Make isometric sketches.

**MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils

Paper

Protractors

Various small objects for sketching

Copies of the Quick Quiz\*

Module Examinations\*\*

Performance Profile Sheets\*\*

\* Located in the back of this module.

\*\* Located in the Test Booklet.

## 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 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.

*Architectural Drawing and Light Construction*, 7th Edition. Edward J. Muller, Phillip A. Grav, James G. Fausett. Upper Saddle River, NJ: 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 10 hours are suggested to cover *Field Sketching*. 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Sketching Straight Lines, Angles, Arcs, and Circles</b>	
A. Introduction	_____
B. Sketching Straight Lines	_____
C. Laboratory Trainees practice sketching straight lines. This laboratory corresponds to Performance Task 1.	_____
D. Sketching Angles	_____
E. Laboratory Trainees practice sketching angles. This laboratory corresponds to Performance Task 2.	_____
F. Sketching Arcs and Circles	_____
G. Laboratory Trainees practice sketching arcs and circles. This laboratory corresponds to Performance Task 3.	_____
<b>Session II. Sketching Ellipses and Dimensions</b>	
A. Sketching Ellipses	_____
B. Laboratory Trainees practice sketching ellipses. This laboratory corresponds to Performance Task 4.	_____
C. Sketching Dimensions	_____
D. Laboratory Trainees practice sketching dimensions. This laboratory corresponds to Performance Task 5.	_____

### Session III. Orthographic and Pictorial Sketches

A. Orthographic Sketches

B. Laboratory

Trainees practice making orthographic sketches. This laboratory corresponds to Performance Task 6.

C. Oblique Sketches

D. Laboratory

Trainees practice making oblique sketches. This laboratory corresponds to Performance Task 7.

E. Isometric Sketches

F. Laboratory

Trainees practice making isometric sketches. This laboratory corresponds to Performance Task 8.

### Session IV. 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 how to read orthographic projections, isometric drawings, and schematic drawings. These drawings are used to show piping, hydraulic, and pneumatic systems. These skills will allow trainees to troubleshoot, build, install, and repair mechanical systems.

## **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*; *Millwright Level One*; and *Millwright Level Two*, Modules 15201-07 and 15202-07.

## **OBJECTIVES**

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

1. Explain orthographic projection.
2. Interpret schematic drawings.
3. Interpret isometric drawings.

## **PERFORMANCE TASKS**

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

1. Interpret an orthographic projection.
2. Interpret piping and hydraulic and pneumatic schematic drawings.
3. Interpret isometric drawings.

## **MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen	Drawings of site-specific equipment
Transparencies	Isometric drawings
Blank acetate sheets	Orthographic projections
Transparency pens	Schematic drawings (electrical, piping, hydraulic, pneumatic)
Whiteboard/chalkboard	Several small objects or components for making orthographic projections
Markers/chalk	Performance Profile Sheets*
Pencils	Module Examinations*
Paper	

\* Located in the Test Booklet.

## **SAFETY CONSIDERATIONS**

Ensure that trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit construction sites or utility areas. Ensure all trainees are properly briefed on site-specific safety procedures.

## ADDITIONAL RESOURCES

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

*Blueprint Reading for Construction*, 2004. James A. S. Fatzinger. Upper Saddle River, NJ: Prentice Hall.

*Graphic Communications in Construction*, 2002. Dennis Fukai. Upper Saddle River, NJ: 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 20 hours are suggested to cover *Intermediate Blueprint Reading*. 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I and II. Orthographic Projections</b>	
A. Introduction	_____
B. Orthographic Projections	_____
C. Laboratory	
Trainees practice interpreting an orthographic projection. This laboratory corresponds to Performance Task 1.	_____
<b>Sessions III through V. Interpreting Schematic Drawings</b>	
A. Interpreting Schematic Drawings	_____
B. Piping Schematics	_____
C. Hydraulic and Pneumatic Schematics	_____
D. Laboratory	
Trainees practice interpreting piping and hydraulic and pneumatic schematic drawings. This laboratory corresponds to Performance Task 2.	_____
<b>Sessions VI and VII. Interpreting Isometric Drawings</b>	
A. Interpreting Isometric Drawings	_____
B. Laboratory	
Trainees practice interpreting isometric drawings. This laboratory corresponds to Performance Task 3.	_____
<b>Session VIII. Review and Testing</b>	
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.	

**Annotated Instructor's Guide****MODULE OVERVIEW**

This module explains how to select, inspect, use, and maintain cable cutters, nut splitters, keyseat rules, various gauges, and hardness testers.

**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*; *Millwright Level One*; and *Millwright Level Two*, Modules 15201-07 through 15203-07.

**OBJECTIVES**

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

1. Use torque multipliers.
2. Use cable cutters.
3. Use nut splitters.
4. Use keyseat rules.
5. Use depth gauges.
6. Use bevels.
7. Use telescoping gauges.
8. Use radius gauges.
9. Use drill gauges.
10. Use thickness gauge stock.
11. Use a plasti-gauge.
12. Explain hardness testers.
13. Explain surface roughness testers.

**PERFORMANCE TASKS**

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

1. Demonstrate safe use and maintenance of the following:
  - Torque multipliers
  - Cable cutters
  - Nut splitters
  - Keyseat rules
  - Depth gauges
  - Bevels
  - Telescoping gauges
  - Radius gauges
  - Drill gauges
  - Thickness gauge stock
  - Plasti-gauge

## **MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen	Drill gauges
Transparencies	Drill points
Blank acetate sheets	Metal tapes
Transparency pens	Thickness gauge stock
Whiteboard/chalkboard	Hardness testers
Markers/chalk	Plasti-gauges
Pencils	Micrometers
Paper	Ultrasonic thickness detector
Machinery to be tested	Various work pieces
Torque multipliers	Bolts
Torque wrenches	Cable
Cable cutters	Cast metal
Nut splitters	Lubricant
Keyseat rules	Rusted or frozen nuts
Shrink rules	Steel balls
Steel rules	Test material
Depth gauges	Wood or metal patterns
Bevels	Copies of the Quick Quiz*
Scribers	Module Examinations**
Telescoping gauges	Performance Profile Sheets**
Radius gauges	

\* Located in the back of this module.

\*\*Located in the Test Booklet.

## **SAFETY CONSIDERATIONS**

Ensure that trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use various specialty hand tools. Make sure all trainees are briefed on shop safety procedures and hand tool safety. This module may require trainees to visit construction sites or utility areas. Ensure all trainees are properly briefed on site-specific safety procedures.

## **ADDITIONAL RESOURCES**

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

*Starrett Mechanics Hand Measuring Tools and Precision Instruments*, 2<sup>nd</sup> Edition. Athol, MA: The L.S. Starrett Company.

*The Tools and Rules for Precision Measuring*, Bulletin No. 1211. Athol, MA: The L.S. Starrett Company.

## TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Specialty 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Multipliers, Cutters, and Splitters</b>	
A. Introduction	_____
B. Torque Multipliers	_____
C. Cable Cutters	_____
D. Nut Splitters	_____
E. Keyseat Rules	_____
F. Laboratory	
Trainees practice the safe use and maintenance of specialty millwright tools. This laboratory corresponds to Performance Task 1.	_____
<b>Session II. Gauges</b>	
A. Non-Precision Depth Gauges	_____
B. Bevels	_____
C. Telescoping Gauges	_____
D. Radius Gauges	_____
E. Drill Gauges	_____
F. Thickness Gauge Stock	_____
G. Plasti-Gauge	_____
H. Laboratory	
Trainees practice the safe use and maintenance of specialty millwright tools. This laboratory corresponds to Performance Task 1.	_____
<b>Session III. Testers</b>	
A. Ultrasonic Thickness Detectors	_____
B. Profilometer	_____
C. Hardness Tester	_____
<b>Session IV. Review and Testing</b>	
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 introduces several types of millwright power tools, including pipe threaders, drill presses, bandsaws, sanders, and nibblers. Step-by-step instructions for selecting, using, caring for, and maintaining these tools are included.

## **PREREQUISITES**

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that trainee shall have successfully completed the following: *Core Curriculum*; *Millwright Level One*; and *Millwright Level Two*, Modules 15201-07 through 15204-07.

## **OBJECTIVES**

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

1. Explain power tool safety.
2. Use and care for drill presses.
3. Use and care for hydraulic presses.
4. Use and care for pipe threading machines.
5. Use and care for nibblers.
6. Use and care for bandsaws.
7. Identify and explain belt sanders.
8. Identify and explain Woodruff key seaters.
9. Identify and explain key broaches.
10. Use and care for bearing heaters.
11. Use and care for drills.
12. Perform precision drilling.

## **PERFORMANCE TASKS**

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

1. Demonstrate safe use and maintenance of the following:
  - Drill presses
  - Hydraulic presses
  - Pipe threading machines
  - Nibblers
  - Bandsaws
  - Bearing heaters
  - Drills
2. Perform precision drilling.

## **MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen	Surface grinder
Transparencies	Woodruff key seater
Blank acetate sheets	Key broaches
Transparency pens	Bearing heaters
Whiteboard/chalkboard	End mills
Markers/chalk	Gauges
Pencils	Vises
Paper	Hand drills
Sample work pieces	Magnetic drills
Drill press	Measuring tapes
Drill accessories	Combination wrenches
Drill bits	Squares
Hydraulic press	Stock
Pipe	Table saw
Pipe threading machine	Copies of the Quick Quiz*
Cutting oil	Module Examinations**
Nibblers	Performance Profile Sheets**
Horizontal and vertical bandsaws	
Belt sanders	

\* Located in the back of this module.

\*\*Located in the Test Booklet.

## **SAFETY CONSIDERATIONS**

Ensure that trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use various power tools. Make sure all trainees are briefed on shop safety procedures and power tool safety. This module may require trainees to visit construction sites or utility areas. Ensure all trainees are properly briefed on site-specific safety procedures.

## **ADDITIONAL RESOURCES**

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

[www.dewalt.com](http://www.dewalt.com)

[www.milwaukeeetool.com](http://www.milwaukeeetool.com)

[www.ridgid.com](http://www.ridgid.com)



## TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Millwright Power 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Safety and Drill Presses</b>	
A. Introduction	_____
B. Power Tool Safety	_____
C. Drill Presses	_____
D. Laboratory	
Trainees practice the safe use and maintenance of drill presses. This laboratory corresponds to Performance Task 1.	_____
<b>Session II. Hydraulic Presses</b>	
A. Hydraulic Presses	_____
B. Laboratory	
Trainees practice the safe use and maintenance of hydraulic presses. This laboratory corresponds to Performance Task 1.	_____
<b>Sessions III and IV. Pipe Threading Machines</b>	
A. Loading Pipe	_____
B. Cutting and Reaming Pipe	_____
C. Machine Set Up and Maintenance	_____
D. Threading Pipe	_____
E. Using a Geared Threader	_____
F. Laboratory	
Trainees practice the safe use and maintenance of pipe threading machines. This laboratory corresponds to Performance Task 1.	_____
<b>Session V. Nibblers and Belt Sanders</b>	
A. Nibblers	_____
B. Laboratory	
Trainees practice the safe use and maintenance of nibblers. This laboratory corresponds to Performance Task 1.	_____
C. Belt Sanders	_____
D. Laboratory	
Trainees practice the safe use and maintenance of belt sanders.	_____
<b>Session VI. Bandsaws, Key Broaches, and Bearing Heaters</b>	
A. Bandsaws	_____
B. Laboratory	
Trainees practice the safe use and maintenance of bandsaws. This laboratory corresponds to Performance Task 1.	_____
C. Key Broaches	_____
D. Bearing Heaters	_____
E. Laborator	
Trainees practice the safe use and maintenance of bearing heaters. This laboratory corresponds to Performance Task 1.	_____

**Session VII. Precision Drilling**

A. Work Holding Devices \_\_\_\_\_

B. Drills \_\_\_\_\_

C. Laboratory

Trainees practice the safe use and maintenance of drills. This laboratory corresponds to Performance Task 1. \_\_\_\_\_

D. Precision Drilling \_\_\_\_\_

E. Laboratory

Trainees practice precision drilling. This laboratory corresponds to Performance Task 2. \_\_\_\_\_

**Session VIII. 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.

**Annotated Instructor's Guide****MODULE OVERVIEW**

This module describes the use and inspection of the basic equipment and hardware used in rigging. It describes the signals used by riggers and how to calculate load limits, balance points, and how to control loads. This module will help the millwright understand the requirements and problems of rigging.

**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*; *Millwright Level One*; and *Millwright Level Two*, Modules 15201-07 through 15205-07.

**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:
  - Chain hoists
  - Come-alongs
  - Jacks
  - Tuggers
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.
7. Explain load balancing.

**PERFORMANCE TASKS**

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

1. Identify and explain rigging hardware and equipment.
2. Inspect rigging equipment.
3. Select, use, and maintain the following rigging equipment:
  - Chain hoists
  - Come-alongs
  - Jacks
  - Tugger
4. Explain load balancing.
5. Read and interpret lifting capacity charts.

## MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Samples of wire rope that have failed inspection
Transparencies	Rope for tying knots
Blank acetate sheets	Sample loads for lifting
Transparency pens	Spur-gearred chain hoist
Whiteboard/chalkboard	Electric chain hoist
Markers/chalk	Ratchet-lever hoist or come-along
Pencils and scratch paper	Ratchet jack
Appropriate personal protective equipment	Screw jack
Manufacturers' literature on different rigging hooks	Hydraulic jack
Various rigging hooks with wear, cracks, and corrosion	Tugger
Manufacturers' literature on shackles	Walkie-talkies
Various types of shackles	Throat microphone
Various eyebolts	Hardwired communication system
Various lifting lugs	<i>ASME B30.5 Consensus Standard</i>
Turnbuckles	<i>29 CFR 1926.550</i>
Manufacturers' literature on plate clamps	Completed lift plan
Various rigging plates and links	Crane manufacturers' literature
Various types of slings	Typical teeter-totter and weights
Rigging pocket guide	Quick Quiz*
<i>29 CFR Section 1926.251, Rigging Equipment for Material Handling</i>	Module Examinations**
	Performance Profile Sheets**

\* Located in the back of this module

\*\*Located in the Test Booklet

## SAFETY CONSIDERATIONS

Ensure that 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. This module may require that 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 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.

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

*Rigging*, 2006. National Center for Construction Education and Research. Upper Saddle River, NJ: 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 20 hours are suggested to cover *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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction and Rigging Hardware</b>	
A. Introduction	_____
B. Rigging Hardware	_____
C. Laboratory	
Trainees practice identifying and explaining rigging hardware and equipment. This laboratory corresponds to Performance Task 1.	_____
<b>Session II. Slings and Tag Lines</b>	
A. Slings	
B. Laboratory	
Trainees practice inspecting rigging equipment. This laboratory corresponds to Performance Task 2.	_____
C. Tag Lines	_____
D. Laboratory	
Trainees practice tying knots used in rigging.	_____
<b>Session III. Hoists</b>	
A. Chain Hoists	_____
B. Ratchet-Lever Hoists and Come-Alongs	_____
C. Jacks	_____
D. Tuggers	_____
E. Laboratory	
Trainees practice selecting, inspecting, and using lifting devices. This laboratory corresponds to Performance Task 3.	_____
<b>Session IV. Communication and Safety</b>	
A. Methods of Communication	_____
B. Laboratory	
Trainees practice using and interpreting hand signals.	_____
C. General Rigging Safety	_____
D. Working Around Power Lines	_____
E. Site Safety	_____
F. Emergency Response	_____



## Annotated Instructor's Guide

### MODULE OVERVIEW

This module explains how to establish baseplates and soleplates for machinery. It explains how to locate machine baseplates, including how to lay out the anchor system for the baseplate, prepare the pad, and install the baseplate. Field-verifying a plate installation is also covered.

### PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; and Millwright Level Two, Modules 15201-07 through 15206-07.*

### OBJECTIVES

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

1. Establish baseplate and soleplate locations.
2. Install baseplates and soleplates.
3. Field-verify a baseplate installation.

### PERFORMANCE TASKS

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

1. Establish baseplate and soleplate locations and elevations.
2. Set anchor bolts:
  - Poured-in-concrete
  - Expanding
  - Epoxy
3. Set shim packs.
4. Set up a piano wire jig.
5. Set baseplates and soleplates.
6. Field-verify a baseplate installation.

### 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

Optical theodolite

Blueprints

GPS

Chalk line

Measuring tape

Baseplates and soleplates

Laser level

Optical level and leveling rod

Electronic transit

Poured-in-concrete anchor bolts

Plywood

Drill and bits

Expanding anchor bolts

Air compressor

Screw jacks

Wedge levelers

Screwdrivers

Epoxy anchors

Shim packs

Straightedge

No. 98 levels	Equipment manufacturers' installation instructions
String line level	Grout
Precision square	Planking
Piano wire jigs	Tools for grout application
Wire	Quick Quiz*
Tram plate	Module Examinations**
Rubber hammer	Performance Profile Sheets**
Pinch bars	
Jack bolts	
Feeler gauge	

\* Located in the back of this module

\*\* Located in the Test Booklet

## **SAFETY CONSIDERATIONS**

Ensure that trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use laser levels and to lift baseplates. Ensure that all trainees are briefed on laser safety, lifting safety, and any other shop safety procedures. This module may require that 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 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.

*Surveying with Construction Applications*, 2004. Barry F. Kavanaugh. Upper Saddle River, NJ: 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 15 hours are suggested to cover *Setting Baseplates and Soleplates*. 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction and Establishing Baseplate Locations</b>	
A. Introduction	_____
B. Laying Out Baseplates and Soleplates	_____
C. Establishing Plate Elevation	_____
D. Laboratory	
Trainees practice establishing baseplate and soleplate locations and elevations. This laboratory corresponds to Performance Task 1.	_____
<b>Session II. Setting Anchor Bolts</b>	
A. Setting Poured-in-Concrete Anchor Bolts	_____
B. Setting Expanding Anchor Bolts	_____
C. Setting Epoxy Anchors	_____
D. Laboratory	
Trainees practice setting anchor bolts. This laboratory corresponds to Performance Task 2.	_____
<b>Session III. Setting Shim Packs and Setting Up Piano Wire Jigs</b>	
A. Setting Shim Packs	_____
B. Laboratory	
Trainees practice setting shim packs. This laboratory corresponds to Performance Task 3.	_____
C. Setting Up Piano Wire Jigs	_____
D. Laboratory	
Trainees practice setting up piano wire jigs. This laboratory corresponds to Performance Task 4.	_____
<b>Session IV. Setting Baseplates and Soleplates</b>	
A. Setting Plate	_____
B. Laboratory	
Trainees practice setting baseplates and soleplates. This laboratory corresponds to Performance Task 5.	_____
<b>Sessions V. Field-Verification and Grouting</b>	
A. Field-Verification	_____
B. Laboratory	
Trainees practice field-verification of baseplate installation. This laboratory corresponds to Performance Task 6.	_____
C. Grouting	_____

## Session VI. Review and Testing

### A. Module Review

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### B. Module Examination

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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

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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 describes lubrication and safety and storage. It explains how to select lubricants and identifies additives that may be present in lubricants. It explains how to use lubrication equipment. It identifies sources of information for lubricants and associated hazards, including the MSDS. It covers how to use the MSDS to ensure safe use of a lubricant.

**PREREQUISITES**

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; and Millwright Level Two, Modules 15201-07 through 15207-07.*

**OBJECTIVES**

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

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

## MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	One-shot lubricator
Transparencies	Power-operated lubrication gun
Blank acetate sheets	Transfer pumps
Transparency pens	<i>OSHA Standard 29 CFR 1910.1200</i>
Whiteboard/chalkboard	<i>EPA Standard 40 CFR 260 through 271 and 300 through 302</i>
Markers/chalk	Automatic lubrication equipment
Pencils and scratch paper	Lubrication fittings
Appropriate personal protective equipment	Sample lubrication charts
Hazardous waste paperwork	Sample MSDSs
Hazardous waste containers	Samples of various lubrication oils
Bucket pumps	Samples of various types of greases
Filler pumps	Samples of additives
Gear lube dispensers	Quick Quizzes*
Lever guns	Module Examinations**
Lubrication charts	Performance Profile Sheets**
Note pads	

\*Located in the back of this module

\*\*Located in the Test Booklet

## SAFETY CONSIDERATIONS

Ensure that 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. Ensure that all trainees are briefed on chemical safety and any other shop safety procedures. This module may require that 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.

*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 Product Descriptions*, available through Mobil Lubricant Sales Offices and Suppliers, published yearly.

[www.tricocorp.com/pdf-files/catalog.pdf](http://www.tricocorp.com/pdf-files/catalog.pdf)

## 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 *Lubrication*. 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Sessions I and II. Introduction and Lubricant Safety</b>	
A. Introduction	_____
B. Lubrication Safety	_____
C. OSHA Standards and MSDS	_____
D. Laboratory	
Trainees practice reading and interpreting an MSDS. This laboratory corresponds to Performance Task 1.	_____
E. EPA Standards and Waste Disposal	_____
F. Lubricant Storage	_____
<b>Session III. Properties of Lubricants</b>	
A. Lubricant Film Protection	_____
B. Properties of Lubricants and Greases	_____
C. Selecting Lubricants	_____
D. Additives	_____
E. Lubricating Oils	_____
F. Laboratory	
Trainees practice identifying lubricants. This laboratory corresponds to Performance Task 2.	_____
<b>Session IV. Lubrication Equipment</b>	
A. Manual Lubrication Equipment	_____
B. Power-Operated Lubrication Equipment	_____
C. Lubrication Fittings	_____
<b>Sessions V and VI. Lubrication Methods</b>	
A. Oiling Methods	_____
B. Greasing Methods	_____
C. Laboratory	
Trainees practice using lubrication equipment to apply lubricants. This laboratory corresponds to Performance Task 2.	_____
<b>Sessions VII. Lubrication Charts</b>	
A. Interpreting Lubrication Charts	_____
B. Laboratory	
Trainees practice reading and interpreting a lubrication chart. This laboratory corresponds to Performance Task 3.	_____

## Session VIII. Review and Testing

### A. Module Review

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### B. Module Examination

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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

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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 different types of bearings, including plain, ball, roller, thrust, and guide bearings. It describes bearing mountings, including flanged, pillow block, and takeup bearings. It also covers bearing materials and bearing designation systems.

## **PREREQUISITES**

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that trainee shall have successfully completed the following: *Core Curriculum; Millwright Level One; and Millwright Level Two, Modules 15201-07 through 15208-07.*

## **OBJECTIVES**

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

1. Identify various types of bearings.
2. Identify and explain bearing materials.
3. Identify parts of bearings.
4. Explain bearing designation numbers per manufacturer's specifications.

## **PERFORMANCE TASKS**

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

1. Identify various types of bearings.
2. Identify parts of bearings.

## **MATERIALS AND EQUIPMENT LIST**

Overhead projector and screen	Thrust bearings
Transparencies	Guide bearings
Blank acetate sheets	Flanged bearings
Transparency pens	Pillow block bearings
Whiteboard/chalkboard	Takeup bearings
Markers/chalk	Bearing materials
Pencils and scratch paper	Quick Quizzes*
Appropriate personal protective equipment	Module Examinations**
Plain bearings	Performance Profile Sheets**
Ball bearings	
Roller bearings	

\* Located in the back of this module

\*\* Located in the Test Booklet

## SAFETY CONSIDERATIONS

Ensure that trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require that 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 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.

<http://www.NTNBower.com>

## TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Introduction to Bearings*. 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 trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
<b>Session I. Introduction and Bearings I</b>	
A. Introduction	_____
B. Plain Bearings	_____
C. Ball Bearings	_____
<b>Session II. Bearings II</b>	
A. Roller Bearings	_____
B. Thrust Bearings	_____
<b>Sessions III and IV. Bearings III</b>	
A. Guide Bearings	_____
B. Flanged Bearings	_____
C. Pillow Block Bearings	_____
D. Takeup Bearings	_____
E. Laboratory	
Trainees practice identifying bearings. This laboratory corresponds to Performance Task 1.	_____
<b>Session V. Bearing Materials</b>	
A. Bearing Materials	_____
B. Laboratory	
Trainees practice identifying parts of bearings. This laboratory corresponds to Performance Task 2.	_____



**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.

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.