

Module 00106

Objectives

1. Identify and describe various types of rigging slings, hardware, and equipment.
 - a. Identify and describe various types of slings.
 - b. Describe how to inspect various types of slings.
 - c. Identify and describe how to inspect common rigging hardware.
 - d. Identify and describe various types of hoists.
 - e. Identify and describe basic rigging hitches and the related Emergency Stop hand signal.

Performance Tasks

1. Demonstrate the proper ASME Emergency Stop hand signal.
2. Demonstrate the ability to report the load capacity of a sling, and if the sling is too damaged to use.

RIGGING PRACTICES

Module 38102 presents basic rigging, which refers to the preparation of a load for movement, as well as the preparation of hardware and other components used to connect the load to the crane. Rigging must be completed safely and effectively, resulting in a reliable connection to the load. An understanding of rigging fundamentals is essential to safely operate cranes and move/position heavy equipment, components, and structures.

Objectives

Learning Objective 1

- Identify and describe various types of rigging hardware.
 - a. Identify and describe various hooks, shackles, eyebolts, and clamps.
 - b. Identify and describe various lugs, turnbuckles, plates, and spreader beams.

Learning Objective 2

- Identify and describe various types of slings and sling hitches.
 - a. Identify and describe wire-rope slings and their proper care.
 - b. Identify and describe synthetic slings and their proper care.
 - c. Identify and describe chain slings and their proper care.
 - d. Explain the significance of sling angles and describe common hitches.
 - e. Describe how to properly rig and handle piping materials and rebar.
 - f. Identify and describe how to use taglines and knots for load control.
 - g. Identify common rigging-related safety precautions.

Learning Objective 3

- Identify and describe how to use various types of hoisting and jacking equipment.
 - a. Identify and describe how to use manual and powered hoisting equipment.
 - b. Identify and describe how to use jacks.

Performance Tasks

Performance Task 1 (Learning Objectives 1 and 2)

- Inspect various types of rigging components and report on the condition and suitability for a task.

Performance Task 2 (Learning Objective 2)

- Configure a sling to produce a single-wrap basket hitch.

Performance Task 3 (Learning Objective 2)

- Configure a sling to produce a double-wrap basket hitch.

Performance Task 4 (Learning Objective 2)

- Configure a sling to produce a single-wrap choker hitch.

Performance Task 5 (Learning Objective 2)

- Configure a sling to produce a double-wrap choker hitch.

Performance Task 6 (Learning Objective 2)

- Select the correct tagline for a specified application.

Performance Task 7 (Learning Objective 2)

- Tie specific instructor-selected knots.

Performance Task 8 (Learning Objective 3)

- Select, inspect, and demonstrate the safe use of the following rigging equipment:
 - Block and tackle
 - Chain hoist
 - Ratchet-lever hoist
 - One or more types of jack

Recommended Teaching Time: 20 Hours

This Lesson Plan (LP) is divided into sections that correspond to the sections in the Trainee Guide module. As you plan your class times, review the objectives, content, and lesson plan outline for the section you plan to teach. Allow sufficient class time for demonstrations, laboratories, field trips, and testing. Each class period should also include time for administrative tasks and periodic breaks.

Be sure to gather the required equipment, materials, visual aids, and answer keys. Using your access code, download the PowerPoint® presentations and Performance Profile Sheets for this module from NCCER's Instructor Resource Center at www.nccerirc.com.

It is advisable to assign the reading of a module section prior to the classroom instruction. The Section Review and Module Review questions may be assigned as homework. At their discretion, instructors may assign additional homework to meet the teaching objectives.

Performance Testing may be administered at any suitable time in the course of the module training. Tasks are graded pass/fail. Trainee performance and proficiency during practice sessions that meets or exceeds the standards for a task can be accepted as Performance Task completion. Complete the Performance Profile Sheet for each trainee.

The final class is generally reserved for a brief review of the module and administering the module examination. For information about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER's Registry is 70% or above for the module exam. Submit the testing results for each trainee to your Training Program Sponsor through the Registry system.

Prerequisites

Core

Safety Considerations

This module requires require trainees to work with and around rigging equipment including various slings, hoists, and jacks. Work in the vicinity of mobile cranes is also possible. Safety must be emphasized at all times. Gloves should be worn at all times when working with slings. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to rigging and the mobile crane environment. Any deficiencies must be corrected to ensure the future safety of all trainees. All practice sessions and Performance Tasks must be completed under your direct supervision.

Equipment, Materials, and Resources

Whiteboard	A varied selection of wire-rope slings (some damaged)
Dry-erase markers	A varied selection of synthetic web slings (some damaged)
Pencils and paper	A varied selection of chain slings (some damaged)
PowerPoint® presentations for Module 38102	A varied selection of lifting hooks (some damaged)
LCD projector and screen	A varied selection of shackles (some damaged)
Computer (Internet access optional)	Lengths of rope sufficient for tying knots
Module Review answer key	Block and tackle (simple or compound)
Module Examinations	Chain hoist
Performance Profile sheets	Ratchet-lever hoist
Appropriate PPE as directed by the instructor or training facility provider, including but not limited to:	Various types of jacks, including a ratchet jack, bottle jack, and a hydraulic jack with an external pump
Safety glasses	Portable gantry or suitable permanent structure from which hoists can be suspended
Proper footwear	
Hearing protection	
Hard hat	

08303

Standards and Specifications

Pipefitting Level Three

Overview

Standards and codes set the stage for the specifics of how pipefitting is conducted. They indicate what kinds of materials to use, how to identify those materials, and what procedures to follow in using them. Understanding these areas is just as important as knowing how to cut and join pipe, because pipefitters must follow the law as outlined in the codes and standards. When expectations change over the course of a project, it is essential to get agreements in writing before modifications are made. Staying in compliance is achievable with an understanding of common rules, applications, and methods of conducting business.

Learning Objective 1

Successful completion of this module prepares trainees to:

Understand state standards and codes relevant to pipefitting and their importance to the craft.

- a. Explain the basis for standards and codes and how they are managed by various organizations.
- b. Describe the coding systems for boiler and pressure vessels, pressure piping, and structural welding.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the content of specifications and how piping components are identified.

- a. Describe the content of specifications and how they might be changed as work progresses.
- b. Describe the content of welding procedure specifications.
- c. Describe how piping components are identified in specifications.

Performance Tasks

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

Recommended Teaching Time: 10.0 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08303
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

08304

Advanced Trade Math

Pipefitting Level Three

Overview

Pipefitters use geometry, trigonometry, and algebra to calculate takeouts, to lay out angled cuts, and to determine the lengths of the sides of figures and offsets. Knowing which formula to use, and at what time, is central to a craftsman's success. Pipefitting calculators are specially designed to assist with each of these functions, yet it is still important to know the manual process for times when equipment is not available. Precise calculations, no matter how they are realized, form the basis for producing a high-quality pipeline.

Learning Objective 1

Successful completion of this module prepares trainees to:

Use trigonometric formulas to determine pipe angles and offsets.

- a. Use the Pythagorean theorem to calculate right triangle line lengths.
- b. Use trigonometric functions to calculate sines, cosines, and tangents.
- c. Use trigonometric functions to calculate other properties of triangles.
- d. Determine angles in triangles when side lengths are known.
- e. Use interpolation to determine numerical values and angles.
- f. Calculate piping takeouts and odd angles using trigonometry.

Performance Tasks

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

Recommended Teaching Time: 25 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08304
- A variety of standard marker sizes
- Poster board

- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

08305

Motorized Equipment Two

Pipefitting Level Three

Overview

Specialized pieces of motorized equipment, including various types of lifts and rigs, are commonly used in pipefitting work. Fall protection measures must be taken prior to starting any job that involves elevation, and trained, certified personnel are required for setup and operation at these sites. Each lift presents its own set of safety considerations, but with careful planning, the risks may be managed.

When working with equipment for cleaning drains and sewer lines, a variety of end tools are available to meet the tasks at hand. After determining the source of a stoppage, a skilled pipefitter will select the most efficient type of equipment and attachment to get things running smoothly again. In both scenarios—using lifts and rigs and cleaning drains and sewer lines—attention to the details of safety and the environment are keys to productive and successful operations.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify mobile elevated work platform safety and inspection requirements.

- a. State mobile elevated work platform safety requirements.
- b. Identify mobile elevated work platform inspection requirements.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify cable lift safety and inspection requirements.

- a. State cable lift safety requirements.
- b. Identify cable lift inspection requirements.

Learning Objective 3

Successful completion of this module prepares trainees to:

Identify and describe other motorized equipment used by pipefitters.

- a. Identify and describe motorized drain-cleaning equipment.
- b. Identify and describe hydraulic torque wrenches.

Performance Tasks

1. Describe a mobile elevated work platform pre-operation inspection.

Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08305
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- MEWP (optional)
- Preoperational inspection form relevant to the lift in use, or any lift

08306

Introduction to Aboveground Pipe Installation

Pipefitting Level Three

Overview

Installing aboveground pipe calls for careful planning and communication regarding the measurement, calculation, cutting, and assembly tasks involved in creating fully functional runs. Aboveground lines do not have the advantage of being supported by the earth of a trench, as with buried pipe, and they often must be raised to avoid obstructions. Because of these two factors, understanding when, where, and how to apply fundamental pipefitting skills becomes more important than ever.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify and describe various flanges and flange facings and how to store such materials.

- a. Identify and describe various flanges.
- b. Identify and describe various flange facings.
- c. Explain how to store and protect piping materials.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify various flange gaskets and explain how to fabricate a gasket.

- a. Identify and describe the applications for various gasket materials.
- b. Identify and describe various types of flange gaskets.
- c. Explain how to fabricate a gasket.

Learning Objective 3

Successful completion of this module prepares trainees to:

Explain how to assemble and install pipe flanges and grooved joints.

- a. Explain how to assemble pipe flanges.

- b. Describe grooved-piping joints and components and explain how they are assembled.
- c. Explain how to lay out pipe sleeves and floor penetrations.

Learning Objective 4

Successful completion of this module prepares trainees to:

Describe the fabrication and installation process of pipe spools.

- a. Explain how to read and interpret spool sheets.
- b. Describe the pipe-spool installation process.

Performance Tasks

1. Identify the following types of flanges:
 - Weld neck
 - Slip-on
 - Blind
 - Socket weld
 - Threaded
 - Lap-joint
 - Cast iron
2. Identify types of gaskets.
3. Lay out and fabricate a gasket.
4. Install flanged piping systems.
5. Assemble a grooved-pipe joint.
6. Lay out floor penetrations.
7. Read spool sheets.

Recommended Teaching Time: 25 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08306
- A variety of standard marker sizes
- Poster board
- Flip chart

- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Examples of flanges, including the following types:
 - Weld neck
 - Slip-on
 - Blind
 - Socket weld
 - Threaded
 - Lap-joint
 - Cast iron

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Examples of gasket materials and types

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Gasket material of choice
- One or more pipe flanges of a chosen pipe size
- Steel rule
- Dividers
- Protractor
- Gasket cutter
- Hole punch of the proper size for the flange in use
- Scissors and/or snips
- Bluing ink (optional)

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Two sections of pipe, each with a mating flange on one end
- Pipe stands and/or vises
- Appropriate flange hardware and gasket
- Drift pin
- Torque wrench

- Appropriately sized sockets and wrenches

Performance Task 5

- Appropriate PPE, as directed by the instructor or training facility provider
- Short sections of pipe with grooved ends or one section of pipe with a compatible grooved fitting
- Compatible grooved-pipe coupling with gasket
- Approved gasket lubricant
- Hand tools for hardware assembly

Performance Task 6

- Appropriate PPE, as directed by the instructor or training facility provider
- Example drawing showing piping penetrations through one or more floors
- Appropriate area where trainees can lay out a floor penetration according to the drawing

Performance Task 7

- Appropriate PPE, as directed by the instructor or training facility provider
- Several spool sheet examples

08307

Field Routing and Vessel Trim

Pipefitting Level Three

Overview

Field routing and vessel trimming require pipefitters to understand more than pipe assembly. Their decisions play a key role in ensuring the safety and overall success of a job. From initial evaluation of the site and piping run to the selection of the proper erection equipment and vessel trim components, this part of their job requires them to have a thorough understanding of the competencies and skills taught in this module.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to prepare to install piping systems in the field.

- a. Explain how to evaluate the route and materials for a piping run.
- b. Explain how to prepare the work area before starting the job.

Learning Objective 2

Successful completion of this module prepares trainees to:

Describe the process of assembling a field piping run.

- a. Describe the process of transporting and erecting piping.
- b. Describe how to install piping test blinds.
- c. Describe how to install temporary spools for hydrotesting.

Learning Objective 3

Successful completion of this module prepares trainees to:

Identify and describe vessel trim components.

- a. Identify and describe vents, drains, and relief valves.
- b. Identify and describe common vessel-mounted instruments and controls.

- c. Identify basic installation procedures for vessel trim.

Performance Tasks

1. Determine spool specifications for field-routing activities.
2. Determine the load weight for erection equipment.
3. Install test blinds.
4. Install temporary hydrotest spools.
5. Identify vessel trim.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08307
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Appropriate set of piping drawings
- Drawing scales

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Appropriate drawings of spools that contain flanges, valves, and/or similar accessories
- Catalog data for valves and other specialties shown on the drawing, or Internet access for individual research

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Two sections of pipe, each with a mating flange on one end
- Pipe stands and/or vises

- Appropriate flange hardware and gaskets (note the need for longer bolts to accommodate the thickness of the test blind)
- Drift pin
- Flange spreader
- Torque wrench
- Appropriately sized sockets and wrenches

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Two sections of pipe, each with a mating flange on one end
- Short spool with flanges on each end for insertion
- Pipe stands and/or vises
- Appropriate flange hardware and gaskets
- Drift pin
- Torque wrench
- Appropriately sized sockets and wrenches

Performance Task 5

- Appropriate PPE, as directed by the instructor or training facility provider
- An assortment of level, pressure, and temperature sensors

08308

Pipe Hangers and Supports

Pipefitting Level Three

Overview

Pipe hangers and supports must be carefully chosen to coordinate with the piping they are designed to support. As with other components of the system, each hanger or support must be installed in a manner that ensures it is not only secure and reliable but located appropriately, too. If one hanger or support structure fails, the load is instantly transferred to the others, increasing their potential for failure, as well. Hangers and supports must not only support the pipe but also the process material that will be flowing through the system. This module will present a variety of pipe hangers and supports along with the knowledge needed to properly install them.

Learning Objective 1

Successful completion of this module prepares trainees to:

Understand the methods used to suspend and support pipe and the standards used to communicate the designed methods to the pipefitter.

- a. Identify and describe various pipe hangers.
- b. Identify and describe various pipe supports.
- c. Explain how to determine the placement of pipe hangers and supports.
- d. Explain how to interpret pipe hanger and support information found on drawings.

Learning Objective 2

Successful completion of this module prepares trainees to:

Identify and describe common types of pipe hanger and support hardware.

- a. Identify and describe common pipe hanger suspension hardware.
- b. Identify and describe how to install toggle bolts and concrete anchors.
- c. Explain how to fabricate a pipe hanger or support bracket.

Learning Objective 3

Successful completion of this module prepares trainees to:

Identify various spring can supports and explain how to install and maintain spring cans.

- a. Identify and describe variable spring can supports.
- b. Identify and describe constant spring can supports.
- c. Explain how to install spring can supports.
- d. Explain how to maintain and replace spring can supports.

Performance Tasks

1. Identify types of pipe hangers.
2. Identify types of connecting units and attachments.
3. Identify types of pipe supports.
4. Read and interpret pipe support drawings and symbols.
5. Install non-expanding concrete fasteners.
6. Install expanding concrete fasteners.
7. Lay out and mark the cut lines required to fabricate a one-piece, 45-degree angle iron bracket.
8. Lay out and mark the cut lines required to fabricate a one-piece, 30- by 60-degree angle iron bracket.
9. Identify spring can support types.
10. Read and interpret spring can support detail sheets.
11. Install spring can supports.
12. Remove the travel stops from a spring can support.
13. Adjust a spring can support to the cold position.

Recommended Teaching Time: 25 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08308
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen

- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Tasks 1 – 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Examples of various pipe hangers
- Examples of various connecting units and attachments
- Examples of various pipe supports

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- One or more sets of drawings that identify hanger locations and provide detail drawings of specific assemblies

Performance Tasks 5 and 6

- Appropriate PPE, as directed by the instructor or training facility provider
- Nonexpanding anchors, for installation
- Expanding anchors, for installation
- Masonry floor or wall suitable for anchor installation
- Hammer drill with appropriate drill bits for the anchors to be installed
- Common hand tools and wrenches appropriate for the anchor hardware

Performance Tasks 7 and 8

- Appropriate PPE, as directed by the instructor or training facility provider
- 1 1/2" angle iron or a similar size, for layout practice
- Tape measures or other suitable measuring tools
- Soapstone

Performance Tasks 9 and 10

- Appropriate PPE, as directed by the instructor or training facility provider
- One or more sets of drawings that contain spring-can support detail sheets
- A variety of variable and constant spring cans or copies of the spring can images provided in the TG, with the captions omitted (optional)

Performance Tasks 11 – 13

- Appropriate PPE, as directed by the instructor or training facility provider
- Overhead beam(s) that will accommodate spring can installation
- Step ladder, if required
- Fall protection harnesses, if required
- Appropriate variable spring cans
- Necessary mounting hardware, including threaded rod as needed

- Section of pipe to suspend
- Portable band saw or other means of cutting threaded rod (optional)
- Common hand tools and wrenches

08309

Testing Piping Systems and Equipment

Pipefitting Level Three

Overview

Once a piping system is installed, it must be tested before it's ready to use. Like many pipefitting activities, testing introduces a number of hazards that must be addressed. Whether performing hydrostatic, steam blow, or head pressure testing, precautions must be taken to reduce the known risks. A good visual inspection of the system is likely to identify certain sets of problems before testing is even begun. When conducting a test, the use of a test report is essential to guiding the overall process. Pipefitters who have mastered installations and repairs are ready to learn about procedures and protocols for testing systems and equipment.

Learning Objective 1

Successful completion of this module prepares trainees to:

Explain how to visually inspect pipe welds.

- a. Describe the steps in a visual weld inspection and factors involved in determining the acceptability of a weld profile.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how visual tests are conducted prior to other testing processes.

- a. Describe the gauges involved in visual weld inspections and how they are used.

Learning Objective 3

Successful completion of this module prepares trainees to:

Explain how to perform various pressure tests before piping systems are placed in service.

- a. State pretest requirements and describe how to prepare for testing.
- b. Explain how piping systems are cleaned prior to testing.
- c. Explain how to perform service and flow tests.

- d. Explain how to perform head pressure tests.
- e. Explain how to perform hydrostatic tests.
- f. Explain how to perform pneumatic tests.
- g. Explain how to perform equipment tests.

Performance Tasks

1. Perform a pretest field inspection using a punch list.
2. Perform service and flow tests and check for leaks.
3. Perform a head pressure test and check for leaks.
4. Prepare for and perform a hydrostatic test on a system or spool.

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08309
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE, as directed by the instructor or training facility provider
- Copies of a punch list form, to document inspection findings (*Figure 10* in this module may be used)
- Piping spool or installed piping system for evaluation
- Drawings for spool or system, to be evaluated
- Ladders, if required
- Fall protection PPE, if required

Performance Task 2

- Appropriate PPE, as directed by the instructor or training facility provider
- Service-connected, low-pressure water system, or a section thereof, with isolating valves
- Ladders, if required

- Fall protection PPE, if required

Performance Task 3

- Appropriate PPE, as directed by the instructor or training facility provider
- Section of installed piping, such as DWV, or a spool piece equipped with an appropriate 10' stand pipe for head pressure testing
- Sufficient water volume available to fill the system or spool for testing
- Calculators
- Ladders, if required
- Fall protection PPE, if required

Performance Task 4

- Appropriate PPE, as directed by the instructor or training facility provider
- Section of installed piping, for testing that can be properly isolated, or a spool piece on a test stand
- Test blinds or plugs, for isolating the tested area, if required
- Appropriate hydrostatic test pump (manually operated or powered as necessary) with pressure gauge
- Hoses and/or pipe and fittings, for pump connection to the tested system
- Suitable water supply
- Common hand tools for hose and pipe connections
- Ladders, if required
- Fall protection PPE, if required