

MODULE OVERVIEW

This module introduces trainees to the principles, equipment, and methods used to perform the site layout tasks of distance measurement and differential leveling. It also covers the site layout responsibilities of individuals on site, understanding and using site plan drawings, and methods of job site communications.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Carpentry Level One; Carpentry Level Two; and Carpentry Level Three.*

OBJECTIVES

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

1. Describe the major responsibilities of the carpenter relative to site layout.
2. Convert measurements stated in feet and inches to equivalent measurements stated in decimal feet, and vice versa.
3. Use and properly maintain tools and equipment associated with taping.
4. Use manual or electronic equipment and procedures to make distant measurements and perform site layout tasks.
5. Determine approximate distances by pacing.
6. Recognize, use, and properly care for tools and equipment associated with differential leveling.
7. Use a builder's level and differential leveling procedures to determine site and building elevations.
8. Record site layout data and information in field notes using accepted practices.
9. Check and/or establish 90-degree angles using the 3-4-5 rule.

PERFORMANCE TASKS

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

1. Interpret a construction site/plot drawing and relate the man-made and topographical features and other project information to the layout and topography on the actual site.
2. Convert measurements given in feet and inches to equivalent decimal measurements stated in feet, tenths, and hundredths, and vice versa.
3. Properly use taping equipment and procedures to make distance and site layout measurements.
4. Determine the approximate distances by pacing.
5. Set up, adjust, and field test leveling instruments.
6. Use a builder's level, leveling rods, and differential leveling procedures to determine site and building elevations.
7. Record differential leveling data in field notes in accordance with accepted procedures.
8. Use differential leveling and distance measurement procedures to transfer elevations up a structure.
9. Check and/or establish 90-degree angles using the 3-4-5 rule.

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
Site plot plans for selected construction sites
Assortment of hubs, stakes, and laths

continued

Assortment of different colored flagging tape
 Permanent markers for marking stakes
 Field notebooks for recording data
 2" × 4" or 2" × 6" ledger boards
 2" × 4" batter boards
 Nylon string
 Calculator
 100 foot steel tape
 Range poles
 Plumb bobs/gammon reels
 Hand sight levels

Tension spring
 Chaining pins
 Builder's level
 Transit level
 Tripods
 Laser level
 Assortment of leveling rods and accessories
 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 differential leveling equipment. Ensure that all trainees are briefed on field 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. This module may require trainees use laser equipment. Ensure all trainees are briefed on laser safety before using laser equipment.

ADDITIONAL RESOURCES

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

Construction Surveying and Layout: A Step-by-Step Engineering Methods Manual, Wesley G. Crawford. West Lafayette, IN: Creative Construction Publishing, 1995.

Surveying, Jack McCormac. New York, NY: John Wiley & Sons, 1999.

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 22½ hours are suggested to cover *Site Layout I: Distance Measurement and Leveling*. 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 Site Layout	
A. Introduction	_____
B. Building Plan Drawings	_____
C. Characteristics of Contour Lines	_____
D. Laboratory	_____
Trainees practice interpreting a site/plot drawing. This laboratory corresponds to Performance Task 1.	
Session II. Site Control Points and Hand Signals	
A. Site Control Points	_____
B. Communicating with Hand Signals	_____

Sessions III and IV. Distance Measurements

- A. Distance Measurement Tools and Equipment _____
- B. Measuring Distance by Taping _____
- C. Laboratory _____
Trainees practice making measurements by taping. This laboratory corresponds to Performance Task 3.
- D. Converting Distances _____
- E. Laboratory _____
Trainees practice converting measurements. This laboratory corresponds to Performance Task 2.
- F. Estimating Distances by Pacing _____
- G. Laboratory _____
Trainees practice estimating distances by pacing. This laboratory corresponds to Performance Task 4.

Session V. Differential Leveling Equipment

- A. Differential Leveling Tools and Equipment _____
- B. Laboratory _____
Trainees practice setting up, adjusting, and field testing a leveling instrument. This laboratory corresponds to Performance Task 5.

Sessions VI and VII. Basics of Differential Leveling

- A. Basics of Differential Leveling _____
- B. Laboratory _____
Trainees practice using leveling equipment to determine site elevations. This laboratory corresponds to Performance Task 6.
- C. Field Notes _____
- D. Laboratory _____
Trainees practice recording differential leveling data in field notes. This laboratory corresponds to Performance Task 7.

Session VIII. Leveling Applications

- A. Leveling Applications _____
- B. Laboratory _____
Trainees practice using leveling procedures to transfer elevations. This laboratory corresponds to Performance Task 8.
- C. Batter Boards _____
- D. 3-4-5 Rule _____
- E. Laboratory _____
Trainees practice checking or establishing 90-degree angles using the 3-4-5 rule. This laboratory corresponds to Performance Task 9.

Session IX. 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 the carpentry trainee to various cements and other materials that, when mixed together, form various types of concrete. Concrete volume estimates and concrete forms are also covered. In addition, reinforcement materials such as reinforcement bars, bar supports, and welded-wire fabric are discussed.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum*; and *Carpentry Fundamentals Level One*, Modules 27101-06 through 27107-06.

OBJECTIVES

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

1. Identify the properties of cement.
2. Describe the composition of concrete.
3. Perform volume estimates for concrete quantity requirements.
4. Identify types of concrete reinforcement materials and describe their uses.
5. Identify various types of footings and explain their uses.
6. Identify the parts of various types of forms.
7. Explain the safety procedures associated with the construction and use of concrete forms.
8. Erect, plumb, and brace a simple concrete form with reinforcement.

PERFORMANCE TASKS

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

1. Perform volume estimates for concrete quantity requirements.
2. Construct a simple concrete form with reinforcement.

MATERIALS AND EQUIPMENT LIST

Transparencies	Various mechanical splices for reinforcement steel
Markers/chalk	Various sizes, types, and grades of reinforcement materials
Blank acetate sheets	Samples of various types and sizes of wire fabric
Transparency pens	Exterior plywood or plyform
Pencils and scratch paper	Steel tape or rule
Overhead projector and screen	Basic carpenter's toolbox
Whiteboard/chalkboard	Level
Appropriate personal protective equipment	Plumb bob
Hand calculator	String line
Concrete calculator	Duplex nails
Copies of a concrete table	Plan for simple form
Form boards, stakes, braces, ties, and spreaders	Circular saw and extension cord
16-gauge tying wire	Copies of Worksheet 1*
Samples of various aggregates	Module Examinations**
Samples of concrete mix	Performance Profile Sheets**
Various bar supports and accessories	

* Packaged with this Annotated Instructor's Guide.

**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.

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.

Concrete Masonry Handbook for Architects, Engineers, and Builders, Fifth Edition. W.C. Panarese, S.H. Kosmatka, and F.A. Randall, Jr. Portland Cement Association.

The Homeowner's Guide to Building with Concrete, Brick, and Stone. The Portland Cement Association.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Introduction to Concrete, Reinforcing Materials, and Forms*. 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; Concrete and Concrete Materials; Normal Concrete Mix Proportions and Measurements; Special Types of Concrete; Curing Methods and Materials; Concrete Slump Testing	
A. Introduction	_____
B. Concrete and Concrete Materials	_____
1. Portland Cement	_____
2. Aggregates for Concrete	_____
3. Water for Concrete	_____
4. Admixtures for Concrete	_____
C. Normal Concrete Mix Proportions and Measurements	_____
D. Special Types of Concrete	_____
E. Curing Methods and Materials	_____
F. Concrete Slump Testing	_____
Session II. Estimating Concrete Volume; Concrete Reinforcement Materials	
A. Estimating Concrete Volume	_____
1. Rectangular Volume Calculations	_____
2. Circular Volume Calculations	_____
B. Laboratory	_____
Hand out Worksheet 27108-1. Have the trainees complete the Worksheet. This laboratory corresponds to Performance Task 1.	
C. Concrete Reinforcement Materials	_____
1. Reinforcing Bars	_____
2. Bar Supports	_____
3. Splicing Reinforcing Bars	_____
4. Welded-Wire Fabric	_____

Session III. Concrete Forms

A. Concrete Forms

- 1. Form Safety
- 2. Footings
- 3. Wall Forms
- 4. Edge Forms
- 5. Removing Forms

B. Laboratory

Under your supervision, have the trainees erect, plumb, and brace a simple concrete form. This laboratory corresponds to Performance Task 2.

Session IV. Review; Module Examination and Performance Testing

A. Review

B. Module Examination

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

C. Performance Testing

- 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
- 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module covers the tools, equipment, and procedures for handling, placing, and finishing concrete. It also covers the joints made in concrete structures, the use of joint sealants, and form removal procedures. It emphasizes safety procedures for handling, placing, and finishing concrete.

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*; *Carpentry Level One*; *Carpentry Level Two*; and *Carpentry Level Three*, Modules 27301-07 through 27304-07.

OBJECTIVES

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

1. Recognize the various equipment used to transport and place concrete.
2. Describe the factors that contribute to the quality of concrete placement.
3. Demonstrate the correct methods for placing and consolidating concrete into forms.
4. Demonstrate how to use a screed to strike off and level concrete to the proper grade in a form.
5. Demonstrate how to use tools for placing, floating, and finishing concrete.
6. Determine when conditions permit the concrete finishing operation to start.
7. Name the factors that affect the curing of concrete and describe the methods used to achieve proper curing.
8. Properly care for and safely use hand and power tools used when working with concrete.

PERFORMANCE TASKS

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

1. Properly handle, place, and consolidate concrete in selected concrete forms.
2. Use a screed to strike off and level a concrete surface.
3. Use a bullfloat and/or darby to level and smooth a concrete surface.
4. Use an edger to form a radius at the edges of a concrete pad, slab, etc.
5. Use a jointer to make control joints in a concrete surface.
6. Use a hand float and finishing trowel to level high spots, remove imperfections, and smooth a concrete surface.

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
Equipment for moving, placing, and consolidating concrete, including:
Moveable chutes (such as used with mixer trucks)
Drop chutes
Elephant trunk
Wheelbarrow
Power buggy and/or carts
Crane and bucket

Belt conveyor
Concrete pump
Pneumatic gun
Internal vibrator
Rollerbug tamper
Equipment for screeding, leveling, and finishing concrete, including:
Manual/power screeds
Knee boards
Darby floats/bullfloats
Pointed trowels
Edgers
Jointers (groovers)
Power saws
Hand floats
Hand trowels
Finishing machines

Brooms
 Assortment of combination tools
 Pointing and margin trowels
 Cement hammers
 Carborundum rubbing stones
 Sprayers
 Power grinders
 Properly-constructed concrete formworks

Sand
 Boxes to contain wet sand
 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. Concrete dust and its components are caustic; brief trainees on the hazards posed by dry and wet concrete and respiratory and skin protection needed. 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.

American Concrete Institute. www.concrete.org
Cement Association of Canada. www.cement.ca
Portland Cement Association. www.cement.org

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 22½ hours are suggested to cover *Handling and Placing Concrete*. 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. Overview and Joints in Concrete Structures	
A. Introduction	_____
B. Joints in Concrete Structures	_____
Session II. Moving and Handling Concrete	
A. Off-Site Equipment for Mixing and Conveying Concrete	_____
B. On-Site Equipment for Mixing and Conveying Concrete	_____
Sessions III and IV. Placing and Consolidating Concrete in Forms	
A. Placing Concrete in Forms	_____
B. Consolidating Concrete	_____
C. Laboratory	_____
Trainees practice placing, handling, and consolidating concrete in selected concrete forms. This laboratory corresponds to Performance Task 1.	

Session V. Finishing I

A. Screeding

B. Laboratory

Trainees practice using a screed to strike off and level a concrete surface. This laboratory corresponds to Performance Task 2.

C. Leveling Concrete

D. Laboratory

Trainees practice using a bullfloat and/or darby to level and smooth a concrete surface. This laboratory corresponds to Performance Task 3.

Session VI. Finishing II

A. Edging

B. Laboratory

Trainees practice using an edger to form a radius at the edges of a concrete pad or slab. This laboratory corresponds to Performance Task 4.

C. Jointing

D. Laboratory

Trainees practice using a jointer to make control joints in a concrete surface. This laboratory corresponds to Performance Task 5.

E. Floating and Troweling

F. Laboratory

Trainees practice using a hand float and finishing trowel to level high spots, remove imperfections, and smooth a concrete surface. This laboratory corresponds to Performance Task 6.

Session VII.

A. Curing Concrete

B. Joint Sealants

C. Removing Forms

Session VIII. Tools and Safety

A. Other Hand and Power Tools Used When Working with Concrete

B. Safety Precautions

Session IX. Module 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 introduces the trainee to the historic and current methods and procedures used in the masonry trade. Brick and block manufacturing is explained, along with the types of brick and block that are currently used in various types of masonry construction. Knowledge, skill, and ability requirements of a mason are also described. An overview of the basic safety practices and requirements found in the masonry trade is also provided. The trainee is directed in the use of appropriate personal protective equipment, handling hazardous materials, and general work safety. Basic bricklaying techniques are also covered.

RECOMMENDED PREREQUISITES

Core Curriculum

OBJECTIVES

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

1. Discuss the history of masonry.
2. Describe modern masonry materials and methods.
3. Explain career ladders and advancement possibilities in masonry work.
4. Describe the skills, attitudes, and abilities needed to work as a mason.
5. State the safety precautions that must be practiced at a work site, including the following:
 - Safety practices
 - Fall-protection procedures
 - Forklift-safety operations
6. Perform the following basic bricklaying procedures:
 - Mixing of mortar
 - Laying a mortar bed
 - Laying bricks
7. Put on eye protection, respiratory protection, and a safety harness.
8. Use the correct procedures for fueling and starting a gasoline-powered tool.

PERFORMANCE TASKS

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

1. Put on eye protection, respiratory protection, and a safety harness.
2. Demonstrate the ability to properly use a trowel to spread and furrow bed joints and butter head joints.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Various types of brick
Transparencies	Various types of concrete blocks
Whiteboard/chalkboard	Various trowels
Markers/chalk	Mortar mix
Blank acetate sheets	Mortar mixing pan
Transparency pens	Mortar hoe
Pencils and scratch paper	Wheelbarrow
Appropriate personal protective equipment:	Standard bricks
Various types of eye and respiratory protection	Standard concrete blocks
Safety harness and hardware	Module Examinations*
ASTM standards on concrete block and masonry mortar	Performance Profile Sheets*

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize basic site 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. These are optional materials for continued education rather than for task training.

- Building Block Walls – A Basic Guide*, 1988. Herndon, VA: National Concrete Masonry Association
- Bricklaying: Brick and Block Masonry*. Reston, VA: Brick Industry Association.
- Concrete Masonry Handbook*. Skokie, IL: Portland Cement Association.

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 *Introduction to Masonry*. 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 Masonry	
A. Introduction	_____
B. The History of Masonry	_____
C. Masonry Today	_____
1. Clay Products	_____
2. Brick Masonry Terms	_____
D. Concrete Products	_____
1. Block	_____
2. Concrete Brick	_____
3. Other Concrete Units	_____

Session II. Stone, Mortars, Grouts, and Construction Techniques

- A. Stone
- B. Mortars and Grouts
- C. Construction Techniques
 - 1. Wall Structures
 - 2. Modern Techniques
- D. Field trip or presentation on different types of masonry units

Session III. Careers in Masonry

- A. Masonry as a Career
- B. Knowledge, Skills, and Ability
- C. Field trip or presentation on masonry careers

Sessions IV–V. Basic Bricklaying

- A. Preparing Mortar
- B. Spreading Mortar
- C. Picking Up Mortar
- D. Spreading, Cutting, and Furrowing
- E. Buttering Joints
- F. General Rules
- G. Laboratory – Trainees practice spreading and furrowing bed joints and buttering head joints. This laboratory corresponds to Performance Task 2.

Sessions VI–VII. Safety

- A. Safety Practices
 - 1. Personal Protective Equipment
 - 2. Hazards on the Job
 - 3. Hazardous Materials Safety
 - 4. Modern Techniques
 - 5. Weather Hazards
- B. Fall Protection
- C. Forklift Safety
- D. Laboratory – Trainees practice putting on eye protection, respiratory protection, and a safety harness. This laboratory corresponds to Performance Task 1.

Session VIII. 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 introduces the methods and procedures used in masonry unit installation. Topics include basic techniques for laying brick and block, using mortar to bond masonry units, and patterns. Hands-on skill development in constructing wythes and courses is also emphasized.

RECOMMENDED PREREQUISITES

Core Curriculum; Masonry Level One, Modules 28101-04 through 28104-04

OBJECTIVES

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

1. Describe the most common types of masonry units.
2. Describe and demonstrate how to set up a wall.
3. Lay a dry bond.
4. Spread and furrow a bed joint, and butter masonry units.
5. Describe the different types of masonry bonds.
6. Cut brick and block accurately.
7. Lay masonry units in a true course.

PERFORMANCE TASKS

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

1. Lay a dry bond.
2. Accurately cut masonry units with a brick set and masonry hammer, a block set and mash, and a masonry hammer, power saw, and splitter.
3. Spread, edge, and furrow bed joints.
4. Butter masonry units and place them on a bed joint.
5. Lay masonry units in courses that are true for height, level, plumb, and straightness.
6. Build a rackback corner lead.
7. Lay masonry units to the line.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Line blocks
Transparencies	Line pins
Whiteboard/chalkboard	Line trigs
Markers/chalk	Masonry saw
Blank acetate sheets	Masonry power saw
Transparency pens	Mashes
Pencils and scratch paper	Mortar mix
Appropriate personal protective equipment	Mortar pans
ASTM standards for CMUs	Trowels
ASTM standards for concrete bricks	Mason's levels
Bricks	Plumb bobs
Chalkline	Rakers
Crayons or wax markers	Jointers
Medicine dropper	Sledrunners
Spacing jigs	Splitters
Concrete blocks	Masonry brushes
Brick set chisels	Tuckpointers
Block set chisels	MSDS for masonry cleaning solution
Hammers	Module Examinations*
Mason's hammers	Performance Profile Sheets*
Mason's lines	

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize basic job site and 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. These are optional materials for continued education rather than for task training.

Bricklaying: Brick and Block Masonry. Reston, VA: Brick Institute of America.

Building Block Walls—A Basic Guide, 1988. Herndon, VA: National Concrete Masonry Association.

Concrete Masonry Handbook. Skokie, IL: Portland Cement Association.

The ABCs of Concrete Masonry Construction, Videotape, 13:34 minutes. Skokie, IL: Portland Cement Association.

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 60 hours are suggested to cover *Masonry Units and Installation Techniques*. 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, Concrete Masonry, Clay and Other Materials	
A. Introduction	_____
B. Concrete Masonry Materials	_____
C. Clay and Other Materials	_____
Sessions II–III. Setting Up and Laying Out (2 Sessions)	
A. Setting Up	_____
B. Job Layout	_____
C. Laboratory – Trainees practice laying a dry bond. This laboratory corresponds to Performance Task 1.	_____
Sessions IV–VI. Block Head Joints and Bonding Masonry Units (3 Sessions)	
A. Block Head Joints	_____
1. Buttering Blocks	_____
2. Block Bed Joints	_____
3. General Rules	_____
B. Bonding Masonry Units	_____
C. Laboratory – Trainees practice spreading, edging, and furrowing bed joints and buttering bricks and blocks and placing them on a bed joint. This laboratory corresponds to Performance Tasks 3 and 4.	_____
Sessions VII–IX. Cutting Masonry Units (3 Sessions)	
A. Brick Cuts	_____
B. Block Cuts	_____
C. Cutting with Hand Tools	_____
D. Cutting with Saws and Splitters	_____
E. Laboratory – Trainees practice accurately cutting masonry units with a brick set and masonry hammer, a block set and mash, and a masonry hammer, power saw, and splitter. This laboratory corresponds to Performance Task 2.	_____
Sessions X–XIV. Laying Masonry Units (5 Sessions)	
A. Laying Brick in Place	_____
B. Checking Height	_____
C. Checking Level, Plumb, and Straightness	_____
D. Laboratory – Trainees practice laying courses that are true for height, level, plumb, and straightness. This laboratory corresponds to Performance Task 5.	_____
Sessions XV–XIX. Building Corners and Leads (5 Sessions)	
A. Placing Block	_____
B. Laying To the Line	_____
C. Building Corners and Leads	_____
D. Laboratory – Trainees practice building a rackback corner lead and laying to the line. This laboratory corresponds to Performance Tasks 6 and 7.	_____

Sessions XX–XXI. Mortar Joints (2 Sessions)

- A. Joint Finishes _____
- B. Striking the Joint _____
- C. Laboratory – Trainees practice striking mortar joints. _____

Sessions XXII–XXIII. Patching Mortar and Cleaning Masonry Units (2 Sessions)

- A. Patching Mortar _____
 - 1. Pointing _____
 - 2. Tuckpointing _____
 - 3. Laboratory – Trainees practice tuckpointing. _____
- B. Cleaning Masonry Units _____

Session XXIV. 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.

MODULE OVERVIEW

This module introduces the carpentry trainee to residential floor systems. It covers the materials and general methods used to construct floor systems, with emphasis placed on the platform method of floor framing.

PREREQUISITES

Prior to training with this module, it is suggested that the trainee shall have successfully completed *Core Curriculum*; and *Carpentry Fundamentals Level One*, Modules 27101-06 through 27104-06.

OBJECTIVES

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

1. Identify the different types of framing systems.
2. Read and interpret drawings and specifications to determine floor system requirements.
3. Identify floor and sill framing and support members.
4. Name the methods used to fasten sills to the foundation.
5. Given specific floor load and span data, select the proper girder/beam size from a list of available girders/beams.
6. List and recognize different types of floor joists.
7. Given specific floor load and span data, select the proper joist size from a list of available joists.
8. List and recognize different types of bridging.
9. List and recognize different types of flooring materials.
10. Explain the purposes of subflooring and underlayment.
11. Match selected fasteners used in floor framing to their correct uses.
12. Estimate the amount of material needed to frame a floor assembly.
13. Demonstrate the ability to:
 - Lay out and construct a floor assembly
 - Install bridging
 - Install joists for a cantilever floor
 - Install a subfloor using butt-joint plywood/OSB panels
 - Install a single floor system using tongue-and-groove plywood/OSB panels

PERFORMANCE TASKS

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

1. Lay out and construct a floor assembly.
2. Install bridging.
3. Install joists for a cantilever floor.
4. Install a subfloor using butt-joint plywood/OSB panels.
5. Install a single floor system using tongue-and-groove plywood/OSB panels.
6. Estimate the amount of material needed to frame a floor assembly.
7. Given specific floor load and span data, select the proper girder/beam and joist size from a list of available girders/beams/joists.

MATERIALS AND EQUIPMENT LIST

Transparencies	16d box nails for joists and headers
Markers/chalk	8d doublehead box nails
Blank acetate sheets	Pictures, photographs, etc., showing braced, balloon, platform, and post-and-beam framing
Transparency pens	Sets of building working drawings and specifications
Pencils and scratch paper	Examples of several floor plans and specifications
Overhead projector and screen	Pictures/photos of building damage that resulted from defective floor and sill framing (optional)
Whiteboard/chalkboard	Tool box consisting of standard carpenter's hand tools
Appropriate personal protective equipment	Chalkline
Floor adhesive (optional)	Electric drill and assorted drill and flat bits
Beam material	Framing square
Grout	Level
Plywood or OSB butt-joint panels to cover floor area	100' tape
Plywood or OSB (tongue-and-groove, 1/4") to cover floor area	Power circular saw and extension cord
Shim materials	Reciprocating saw
Sill sealer	Tin snips
Steel bridging and instructions	Copies of Worksheets 1 through 3*
Termite shield	Copies of Job Sheets 1 through 5*
2 × 6s for sills	Module Examinations**
2 × 10s for joists and headers	Performance Profile Sheets**
1 × 4s or 2 × 10s for bridging	
8d box nails for bridging	
8d box, screw, or ring shank nails for flooring	

* Packaged with this Annotated Instructor's Guide.

**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.

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.

Builder Tips: Steps to Construct a Solid, Squeak-Free Floor System. Tacoma, WA: APA – The Engineered Wood Association.

Building with Floor Trusses. Madison, WI: Wood Truss Council of America (11-minute DVD or video).

Field Guide for Prevention and Repair of Floor Squeaks. Boise, ID: Trus Joist, a Weyerhaeuser business.

I-Joist Construction Details: Performance-Rated I-Joists in Floor and Roof Framing. Tacoma, WA: APA – The Engineered Wood Association.

Quality Floor Construction. Tacoma, WA: APA – The Engineered Wood Association (15-minute video).

Storage, Handling, Installation & Bracing of Wood Trusses. Madison, WI: Wood Truss Council of America (69-minute DVD or video).

American Wood Council. A trade association that develops design tools and guidelines for wood construction. www.awc.org.

Western Wood Products Association. A trade association representing softwood lumber manufacturers in 12 western states and Alaska. www.wwpa.com

Wood I-Joist Manufacturers Association. An organization representing manufacturers of prefabricated wood I-joist and structural composite lumber. www.i-joist.org

Wood Truss Council of America. An international trade association representing structural wood component manufacturers. www.woodtruss.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 25 hours are suggested to cover *Floor Systems*. 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; Methods of Framing Houses; Building Working Drawings and Specifications	
A. Introduction	_____
B. Methods of Framing Houses	_____
1. Platform Frame	_____
2. Braced Frame	_____
3. Balloon Frame	_____
4. Post-and-Beam Frame	_____
C. Building Working Drawings and Specifications	_____
1. Architectural Drawings	_____
2. Plumbing, Mechanical, and Electrical Plans	_____
3. Reading Blueprints	_____
4. Specifications	_____
Session II. The Floor System	
A. The Floor System	_____
1. Sills	_____
2. Beams/Girders and Supports	_____
3. Floor Joists	_____
4. Bridging	_____
5. Subflooring	_____
Session III. Laying Out and Constructing a Platform Floor Assembly	
A. Laying Out and Constructing a Platform Floor Assembly	_____
1. Checking the Foundation for Squareness	_____
2. Installing the Sill	_____
3. Installing a Beam/Girder	_____
4. Laying Out Sills and Girders for Floor Joists	_____
5. Laying Out Joist Locations for the Partition and Floor Openings	_____
6. Cutting and Installing Joist Headers	_____
7. Installing Floor Joists	_____
8. Framing Opening(s) in the Floor	_____
9. Installing Bridging	_____
10. Installing Subflooring	_____
B. Laboratory	_____
Hand out Worksheets 27105-1 and 27105-2. Have the trainees complete the tasks on the Worksheets. Note the proficiency of each trainee.	

Session IV. Laboratory

A. Laboratory

Hand out Job Sheet 27105-1. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.

Session V. Laboratory

A. Laboratory

Hand out Job Sheet 27105-2. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.

Session VI. Laboratory

A. Laboratory

Hand out Job Sheet 27105-3. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 3.

Session VII. Laboratory

A. Laboratory

Hand out Job Sheet 27105-4. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 4.

Session VIII. Installing Joists for Projections and Cantilevered Floors

A. Installing Joists for Projections and Cantilevered Floors

B. Laboratory

Hand out Job Sheet 27105-5. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 5.

Session IX. Estimating the Quantity of Floor Materials

A. Estimating the Quantity of Floor Materials

1. Sill, Sill Sealer, and Termite Shield
2. Beams/Girders
3. Joists and Joist Headers
4. Bridging
5. Flooring

B. Laboratory

Hand out Worksheet 27105-3. Have the trainees complete the tasks on the Worksheet. This laboratory corresponds to Performance Task 6.

Session X. Guidelines for Determining Proper Girder and Joist Sizes; Review; Module Examination and Performance Testing

A. Guidelines for Determining Proper Girder and Joist Sizes

1. Sizing Girders
2. Sizing Joists

B. Laboratory

Have the trainees select the proper girder/beam and joist size from the tables in the Trainee Module for various floor plans, floor loads, and span data. This laboratory corresponds to Performance Task 7.

C. Review

D. Module Examination

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

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 carpentry trainee to the materials and general procedures used in wall and ceiling framing.

PREREQUISITES

Prior to training with this module, it is suggested that the trainee shall have successfully completed *Core Curriculum*; and *Carpentry Fundamentals Level One*, Modules 27101-06 through 27105-06.

OBJECTIVES

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

1. Identify the components of a wall and ceiling layout.
2. Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and firestops.
3. Describe the correct procedure for assembling and erecting an exterior wall.
4. Identify the common materials and methods used for installing sheathing on walls.
5. Lay out, assemble, erect, and brace exterior walls for a frame building.
6. Describe wall framing techniques used in masonry construction.
7. Explain the use of metal studs in wall framing.
8. Describe the correct procedure for laying out ceiling joists.
9. Cut and install ceiling joists on a wood frame building.
10. Estimate the materials required to frame walls and ceilings.

PERFORMANCE TASKS

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

1. Lay out, assemble, erect, and brace exterior walls.
2. Cut and install ceiling joists on a wood frame building.
3. Estimate the materials required to frame walls and ceilings.

MATERIALS AND EQUIPMENT LIST

Transparencies	Metal brace material
Markers/chalk	Sheathing material
Blank acetate sheets	Joist lumber
Transparency pens	Chalkline
Pencils and scratch paper	25' tape
Overhead projector and screen	Steel tape
Whiteboard/chalkboard	Framing hammer
Appropriate personal protective equipment	Framing square or speed square
8d common nails	Circular saw
16d box nails	Extension cord
Floor plan	4' level
2 × 4 or 2 × 6 framing lumber for studs and joists	6' stepladder
2 × 12 header material	Copies of Job Sheets 1 through 5*
¼" CD plywood for header spacers	Module Examinations**
½" CD plywood	Performance Profile Sheets**
Stock for blocking	

* Packaged with this Annotated Instructor's Guide.

**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.

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.

Builder's Essentials: Advanced Framing Methods. Kingston, MA: R.S. Means Company.

Builder's Essentials: Framing & Rough Carpentry. Kingston, MA: R.S. Means Company.

Framing Floors, Walls and Ceilings. Newton, CT: Taunton Press.

Framing Walls (DVD). Newton, CT: Taunton Press.

Graphic Guide to Frame Construction. Newton, CT: Taunton Press.

Precision Framing for Pros by Pros. Newton, CT: Taunton Press.

The Proper Construction and Inspection of Ceiling Joists and Rafters (DVD and workbook). Falls Church, VA: International Code Council.

Residential Steel Framing Handbook. New York, NY: McGraw-Hill.

International Code Council. A membership organization dedicated to building safety and fire prevention through development of building codes. www.iccsafe.org

National Association of Home Builders. A trade association whose mission is to enhance the climate for housing and the building industry. www.nahb.org

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 *Wall and Ceiling Framing*. 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; Components of a Wall; Laying Out a Wall; Measuring and Cutting Studs; Assembling and Erecting Walls	
A. Introduction	_____
B. Components of a Wall	_____
1. Corners	_____
2. Partition Intersections	_____
3. Headers	_____
C. Laying Out a Wall	_____
1. Laying Out Wall Openings	_____
D. Measuring and Cutting Studs	_____
E. Assembling the Wall	_____
1. Firestops	_____
F. Erecting the Wall	_____
1. Plumbing and Aligning Walls	_____
Session II. Laying Out a Wall	
A. Laying Out a Wall	_____
B. Laboratory	_____
Hand out Job Sheet 27106-1. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.	

Session III. Measuring and Cutting Studs

A. Measuring and Cutting Studs _____

B. Laboratory _____

Hand out Job Sheet 27106-2. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.

Session IV. Assembling Walls

A. Assembling Walls _____

B. Laboratory _____

Hand out Job Sheet 27106-3. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.

Session V. Erecting Walls

A. Erecting Walls _____

B. Laboratory _____

Hand out Job Sheet 27106-4. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.

Session VI. Ceiling Layout and Framing

A. Ceiling Layout and Framing _____

1. Cutting and Installing Ceiling Joists _____

Session VII. Laboratory

A. Laboratory _____

Hand out Job Sheet 27106-5. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.

Session VIII. Estimating Materials; Wall Framing in Masonry; Steel Studs in Framing; Review; Module Examination and Performance Testing

A. Estimating Materials _____

B. Laboratory _____

Have the trainees estimate the materials required to frame example walls and ceilings. This laboratory corresponds to Performance Task 3.

C. Wall Framing in Masonry _____

1. Framing Door and Window Openings in Masonry _____

D. Steel Studs in Framing _____

1. Fabrication _____

E. Review _____

F. Module Examination _____

1. Trainees must score 70 percent or higher to receive recognition from NCCER.

2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

G. 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 carpentry trainee to the methods and procedures used in roof framing.

PREREQUISITES

Prior to training with this module, it is suggested that the trainee shall have successfully completed *Core Curriculum*; and *Carpentry Fundamentals Level One*, Modules 27101-06 through 27106-06.

OBJECTIVES

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

1. Understand the terms associated with roof framing.
2. Identify the roof framing members used in gable and hip roofs.
3. Identify the methods used to calculate the length of a rafter.
4. Identify the various types of trusses used in roof framing.
5. Use a rafter framing square, speed square, and calculator in laying out a roof.
6. Identify various types of sheathing used in roof construction.
7. Frame a gable roof with vent openings.
8. Frame a roof opening.
9. Erect a gable roof using trusses.
10. Estimate the materials used in framing and sheathing a roof.

PERFORMANCE TASKS

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

1. Use a framing square and speed square in laying out a roof.
2. Frame and sheathe a gable roof with an opening.
3. Erect a gable roof using trusses.
4. Estimate the materials used in framing and sheathing a roof.

MATERIALS AND EQUIPMENT LIST

Transparencies	Nails for sheathing
Markers/chalk	H-clips
Blank acetate sheets	Roof trusses
Transparency pens	1 × 6 lumber or plywood for catwalk
Pencils and scratch paper	2 × 4 lumber for braces and stakes
Overhead projector and screen	Sample blueprints
Whiteboard/chalkboard	Chalkline
Appropriate personal protective equipment	String line
Scientific calculator	Steel tape with markings at 16" OC
8d common nails	Framing hammer
8d box nails	Claw hammer
16d box nails	Spreader for lifting trusses (if applicable)
16d common nails	Crane for lifting trusses (if applicable)
Roof framing plan	Rafter framing square
2 × 4 or 2 × 6 framing lumber for rafters and ridgeboards	Sawhorses
Joist and header material for roof opening	Speed square and booklet
½" CD plywood or other sheathing material	Circular saw
	Extension cord

continued

Handsaw
4' level
6' stepladders
Plumb bob and line

Copies of Job Sheets 1 through 6*
Module Examinations**
Performance Profile Sheets**

* Packaged with this Annotated Instructor's Guide.

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SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment.

ADDITIONAL RESOURCES

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

Advanced Framing Methods. Kingston, MA: R.S. Means Company.

Build a Better Home: Roofs. Tacoma, WA: APA – The Engineered Wood Association.

Framing Roofs. Newton, CT: Taunton Press.

Graphic Guide to Frame Construction. Newton, CT: Taunton Press.

Miller's Guide to Framing and Roofing. New York: McGraw-Hill Professional.

New Roof Construction. Sumas, WA: Cedar Shake and Shingle Bureau (15-minute video).

Quality Roof Construction. Tacoma, WA: APA – The Engineered Wood Association (15-minute video).

Roof Framing's Bible: The Complete Pocket Reference to Roof Framing. Jenkintown, PA: M.E.I. Publishing.

Wood Frame Construction Manual. Washington, D.C.: American Wood Council.

American Wood Council. A trade association that develops design tools and guidelines for wood construction. www.awc.org.

Cedar Shake and Shingle Bureau. A trade organization that promotes the common interests of members involved in quality cedar shake and shingle roofing. www.cedarbureau.org.

Western Wood Products Association. A trade association representing softwood lumber manufacturers in 12 western states and Alaska. www.wwpa.com.

Wood I-Joist Manufacturers Association. An organization representing manufacturers of prefabricated wood I-joist and structural composite lumber. www.i-joist.org.

Wood Truss Council of America. An international trade association representing structural wood component manufacturers. www.woodtruss.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 37½ hours are suggested to cover *Roof Framing*. 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; Types of Roofs; Basic Roof Layout	
A. Introduction	_____
B. Types of Roofs	_____
C. Basic Roof Layout	_____
1. Rafter Framing Square	_____
2. Basic Rafter Layout	_____
Session II. Laboratory	
A. Laboratory	_____
Hand out Job Sheet 27107-1. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 1.	
Session III. Erecting a Gable Roof	
A. Erecting a Gable Roof	_____
1. Installing Rafters	_____
Session IV. Laboratory	
A. Laboratory	_____
Hand out Job Sheet 27107-2. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.	
Session V. Framing the Gable Ends; Framing a Gable Overhang	
A. Framing the Gable Ends	_____
B. Framing a Gable Overhang	_____
Session VI. Laboratory	
A. Laboratory	_____
Hand out Job Sheet 27107-3. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.	
Session VII. Framing an Opening in the Roof	
A. Framing an Opening in the Roof	_____
Session VIII. Laboratory	
A. Laboratory	_____
Hand out Job Sheet 27107-4. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.	
Session IX. Installing Sheathing	
A. Installing Sheathing	_____
B. Laboratory	_____
Hand out Job Sheet 27107-5. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 2.	
Session X. Rafter Layout Using a Speed Square	
A. Rafter Layout Using a Speed Square	_____
1. Procedure for Laying Out Common Rafters	_____

Session XI. Truss Construction

- A. Truss Construction
 - 1. Truss Installation
 - 2. Bracing of Roof Trusses

Session XII. Laboratory

- A. Laboratory

Hand out Job Sheet 27107-6. Under your supervision, have the trainees perform the tasks on the Job Sheet. This laboratory corresponds to Performance Task 3.

Session XIII. Determining Quantities of Materials

- A. Determining Quantities of Materials
 - 1. Determine Materials Needed for a Gable Roof
- B. Laboratory

Have the trainees estimate the materials used in framing and sheathing a roof. This laboratory corresponds to Performance Task 4.

Session XIV. Dormers; Plank-and-Beam Framing

- A. Dormers
- B. Plank-and-Beam Framing

Session XV. Metal Roof Framing; Review; Module Examination and Performance Testing

- A. Metal Roof Framing
- B. Review
- C. Module Examination
 - 1. Trainees must score 70 percent or higher to receive recognition from NCCER.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.
- D. Performance Testing
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module covers the common materials used in residential and light commercial roofing, along with the safety practices and application methods for these materials. It includes shingles, roll roofing, shakes, tiles, and metal and membrane roofs, as well as the selection and installation of roof vents.

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 *Core Curriculum; Carpentry Fundamentals Level One*; and *Carpentry Framing and Finishing Level Two*, Module 27201-07.

OBJECTIVES

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

1. Identify the materials and methods used in roofing.
2. Explain the safety requirements for roof jobs.
3. Install fiberglass shingles on gable and hip roofs.
4. Close up a valley using fiberglass shingles.
5. Explain how to make various roof projections watertight when using fiberglass shingles.
6. Complete the proper cuts and install the main and hip ridge caps using fiberglass shingles.
7. Lay out, cut, and install a cricket or saddle.
8. Install wood shingles and shakes on roofs.
9. Describe how to close up a valley using wood shingles and shakes.
10. Explain how to make roof projections watertight when using wood shakes and shingles.
11. Complete the cuts and install the main and hip ridge caps using wood shakes/shingles.
12. Demonstrate the techniques for installing other selected types of roofing materials.

PERFORMANCE TASKS

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

1. Install fiberglass shingles on gable and hip roofs.
2. Close up a valley using fiberglass shingles.
3. Complete the proper cuts and install the main and hip ridge caps using fiberglass shingles.
4. Lay out, cut, and install a cricket or saddle.
5. Install wood shingles and shakes on roofs.
6. Complete the cuts and install the main and hip ridge caps using shakes/shingles.
7. Demonstrate the techniques for installing other selected types of roofing materials.

MATERIALS AND EQUIPMENT LIST

Markers/chalk	Hardboard simulated shingle panels
Pencils and scratch paper	Metal simulated shingle panels
Whiteboard/chalkboard	Slate shingles
<i>Carpentry Level Two</i> PowerPoint® Presentation Slides (ISBN 978-0-13-229138-5)	Roofing tiles
Multimedia projector and screen	Metal roofing
Computer	Synthetic tiles, shakes, and shingles
Appropriate personal protective equipment	Membrane roofing
Composition shingles	Corrugated metal roofing
Architectural shingles	Installation literature on standing-seam metal roofing
Roll roofing material	Scaffolding tags
Wood roofing shingles	Roofing brackets
Wood roofing shakes	Metal drip edge
Wood shingle panels	Flashing

continued

Fiberglass shingles	Power drill
Torch-down roofing material	Caulking gun
Single-ply roofing material	Tin snips
Ice edging	Pry bar
Prepared roof deck for composite shingles with a valley, hip roof intersection, horizontal abutment, and sidewall (all sheathed and with underlay in place)	Utility knife
Prepared roof deck for wood shingles with spaced sheathing and hip roof intersection	Scribing compass
Prepared low-pitch (flat roof) roof with sheathing in place	Drill bit set (regular and masonry)
2 × 4s to build saddle	Framing square
Roofing nails	Claw hammer
Plastic cement	Pneumatic nail guns
Felt underlayment	Shingle hatchet
Weatherproof membrane	Straightedge
Prefabricated soil pipe flashing	Composition shingle knife
Backsaw	Roofing hammer
Power circular saw	Slater's tools
Crowbar	Score and snap tile cutter
Handsaw	Hand grinder with diamond wheel
Carpenter's level	Portable metal brake
Nail apron	Margin trowel
Sliding T-bevel	Scaffolding
Keyhole saw	Materials moving equipment
Pop riveter	Ladders and jacks
Chalkline	Full body harness with lanyard and deceleration devices
Power saber saw	Damaged personal fall protection equipment
Angle square	Propane torch and tank
	Copies of the Quick Quiz*
	Module Examinations**
	Performance Profile Sheets**

* Located at 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 visit construction sites. Ensure that all trainees are briefed on job site safety. This module requires trainees to install roofing. Ensure that all trainees are briefed on tool safety, shop safety, and fall protection as required.

ADDITIONAL RESOURCES

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

Asphalt Manufacturers Association website, www.asphaltroofing.org
 National Roofing Contractors Association website, www.ncra.net
 Roof Coating Manufacturers Association website, www.roofcoating.org

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 25 hours are suggested to cover *Roofing Applications*. 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 Typical Roofing Materials	
A. Introduction	_____
B. Typical Roofing Materials	_____
C. Laboratory	_____
Trainees practice identifying typical roofing materials.	
Session II. Tools and Safety	
A. Tools	_____
B. Safety	_____
C. Laboratory	_____
Trainees practice donning safety equipment.	
Sessions III through V. Preparation for Roofing Applications, Composition Shingle Installation	
A. Preparation for Roofing Applications	_____
B. Composition Shingle Installation: Gable and Hip Roofs	_____
C. Laboratory	_____
Trainees practice installing fiberglass shingles on gable and hip roofs. This laboratory corresponds to Performance Task 1.	
D. Composition Shingle Installation: Valleys	_____
E. Laboratory	_____
Trainees practice closing up a valley using fiberglass shingles. This laboratory corresponds to Performance Task 2.	
F. Composition Shingle Installation: Roof Projections and Flashing	_____
G. Laboratory	_____
Trainees practice installing a cricket or saddle. This laboratory corresponds to Performance Task 4.	
H. Laboratory	_____
Trainees practice installing the main and hip ridge caps using fiberglass shingles. This laboratory corresponds to Performance Task 3.	
Sessions VI and VII. Alternative Roofing Materials I	
A. Roll Roofing Installation	_____
B. Wood Shingles and Shakes	_____
C. Laboratory	_____
Trainees practice installing wood shingles and shakes. This laboratory corresponds to Performance Task 5.	
D. Laboratory	_____
Trainees practice installing the main and hip ridge caps using wood shakes/shingles. This laboratory corresponds to Performance Task 6.	

Sessions VIII and IX. Alternative Roofing Materials II

- A. Common Metal Roofing
- B. Slate and Tile Roofing
- C. Single-Ply Roofing Application
- D. Torch-Down Roofing Application
- E. Laboratory

Trainees practice installing other selected types of roofing materials. This laboratory corresponds to Performance Task 7.

Session X. Ventilation and Ice Edging, Review, and Testing

- A. Roof Ventilation and Ice Edging
- B. Module Review
- C. 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.
- D. Performance Testing
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module covers the various types of exterior siding used in residential construction including wood, metal, vinyl, and cement board siding, and their installation procedures.

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 *Core Curriculum; Carpentry Fundamentals Level One*; and *Carpentry Framing and Finishing Level Two*, Modules 27201-07 through 27203-07.

OBJECTIVES

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

1. Describe the purpose of wall insulation and flashing.
2. Install selected common cornices.
3. Demonstrate lap and panel siding estimating methods.
4. Describe the types and applications of common wood siding.
5. Describe fiber-cement siding and its uses.
6. Describe the types and styles of vinyl and metal siding.
7. Describe the types and applications of stucco and masonry veneer finishes.
8. Describe the types and applications of special exterior finish systems.
9. Install three types of siding commonly used in your area.

PERFORMANCE TASKS

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

1. Install a selected cornice or box cornice using the proper safety precautions.
2. Estimate the amount of lap or panel siding required for a structure.
3. Install three of the most common siding types in your area.

MATERIALS AND EQUIPMENT LIST

Markers/chalk	Samples of various types of wood siding
Pencils and scratch paper	Nails used to secure wood siding
Whiteboard/chalkboard	Samples of vinyl or metal siding
<i>Carpentry Level Two</i> PowerPoint® Presentation Slides (ISBN 978-0-13-229138-5)	Manufacturer's installation instructions for metal and vinyl siding
Multimedia projector and screen	Quantity of one style of vinyl or metal siding
Computer	Various manufactured vinyl or metal siding trim and starter components
Sample of building wrap	Metal and PVC trim coils
MSDS	Samples of various stucco, brick, stone, and synthetic stone veneer
Samples of aluminum and vinyl fascia and soffits and installation instructions	Samples of DEFS/EIFS wall cladding
2 × 4s with different types of tail rafter cuts	1 × 3s for story poles
2 × 4s for lookouts	6" bevel wood siding and/or wood lap siding
2 × 4s for lookout ledger	Board-and-batten siding
2 × 6s for false fascia	Tongue-and-groove siding
1 × 8s for fascia	Shiplap siding
1 × 2s for frieze	Shingles and shakes
Plywood for soffit	Panelized shake or shingle siding
Galvanized 4d box nails for soffit	4 × 8 plywood siding
Galvanized 8d casing nails for fascia	4 × 8 panel and lap-style hardboard/particleboard siding
8d box nails for lookout ledger	
16d box nails for lookouts	

continued

Lap and panel styles of fiber-cement siding
Manufacturer's installation instructions for
fiber-cement siding
Manufacturer's installation instructions for
plywood siding
Caulk
Inside and outside corner materials
Furring strips for starter course
Spacing gauges (fabricated)
Siding gauges (fabricated)
Drip caps
Flashing
Building paper
Nails
Radial arm saw
Framing square
Steel measuring tape
Claw hammer
4' level
Handsaw
Chalkline
Combination square
Water level

Circular saw or table saw
Fine-toothed, carbide-tipped, circular saw blade
Dry-diamond circular saw blade
Sawhorses or cutting table
Electric/pneumatic carbide-tipped power hand
shears
Score-and-snap knife with tungsten carbide tip
Caulking gun
Pliers
Tin snips
Aviation shears
Steel awl
Putty knife
Utility knife
Snaplock punch
Vinyl siding unlocking tool
Nail hole punch
Flat-blade screwdriver
Portable brake
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located at 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 visit construction sites. Ensure that they are briefed on site safety procedures. This module requires trainees to use power tools to perform exterior finishing. Ensure that all trainees are properly briefed on site safety procedures and tool safety.

ADDITIONAL RESOURCES

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

The Vinyl Siding Institute website, www.vinylsiding.org
Cedar Shake & Shingle Bureau website, www.cedarbureau.org

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 35 hours are suggested to cover *Exterior Finishing*. 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, Insulation, Flashing, and Cornices	
A. Introduction	_____
B. Safety	_____
C. Insulation	_____
D. Flashing	_____
E. Cornices	_____
F. Laboratory	_____
Trainees practice installing a cornice. This laboratory corresponds to Performance Task 1.	
Session III. Estimating	
A. Estimating Panel and Board Siding	_____
B. Laboratory	_____
Trainees practice estimating the amount of lap or panel siding required for a structure. This laboratory corresponds to Performance Task 2.	
Sessions IV through VII. Wood Siding	
A. Beveled Siding	_____
B. Board-and-Batten Siding	_____
C. Tongue-and-Groove Siding	_____
D. Shingle Siding or Shakes	_____
E. Plywood Siding	_____
F. Hardboard and Particleboard Siding	_____
G. Laboratory	_____
Trainees practice installing siding. This laboratory corresponds to Performance Task 3.	
Sessions VIII and IX. Fiber-Cement Siding	
A. Types	_____
B. Installation Procedures	_____
C. Laboratory	_____
Trainees practice installing siding. This laboratory corresponds to Performance Task 3.	
Sessions X through XII. Vinyl and Metal Siding	
A. Materials and Components	_____
B. Tools and Equipment	_____
C. Installation Procedures	_____
D. Laboratory	_____
Trainees practice installing siding. This laboratory corresponds to Performance Task 3.	

Session XIII. Exterior Finishes

- A. Stucco (Cement) Finishes
- B. Brick and Stone Veneer
- C. DEFS and EIFS

Session XIV. Review and Testing

- A. Module Review
- B. Module Examination
 - 1. Trainees must score 70% or higher to receive recognition from NCCER.
 - 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
- C. Performance Testing
 - 1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
 - 2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module introduces the Carpentry trainee to the materials and methods used to construct interior and exterior wooden stairs.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum*; and *Carpentry Fundamentals Level One*, Modules 27101-06 through 27109-06.

OBJECTIVES

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

1. Identify the various types of stairs.
2. Identify the various parts of stairs.
3. Identify the materials used in the construction of stairs.
4. Interpret construction drawings of stairs.
5. Calculate the total rise, number and size of risers, and number and size of treads required for a stairway.
6. Lay out and cut stringers, risers, and treads.
7. Build a small stair unit with a temporary handrail.

PERFORMANCE TASKS

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

1. Lay out and build a small stair unit with a handrail to a given rise.

MATERIALS AND EQUIPMENT LIST

Transparencies	Stair gauges
Markers/chalk	Calculator
Blank acetate sheets	2 × 12s for stringers
Transparency pens	2 × 12s for treads
Pencils and scratch paper	1 × 8s for risers
Overhead projector and screen	Handrail and brackets
Whiteboard/chalkboard	8d box nails
Appropriate personal protective equipment	16d box nails
Basic carpenter's toolbox	16d casing nails
Framing square	Stair plans
Level	Copies of Job Sheet 1*
Circular saw and extension cord	Module Examinations**
Hand saw	Performance Profile Sheets**

* Packaged with this Annotated Instructor's Guide.

**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.

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.

- Basic Stairbuilding*. Newton, CT: Taunton Press, Inc. (Book with companion video or DVD.)
- Constructing Staircases, Balustrades & Landings*. New York: Sterling Publishing Co., Inc.
- For Pros By Pros: Building Stairs*. Newton, CT: Taunton Press, Inc.
- Framing Floors and Stairs*. Berkeley, CA: Publishers Group West. (Book with companion video or DVD.)
- A Simplified Guide to Custom Stairbuilding and Tangent Handrailing*. Fresno, CA: Linden Publishing.
- Stair Builders Handbook*. Carlsbad, CA: Craftsman Book Company.
- Staircases*. New York: Watson-Guptill Publications.
- Stair Layout*. Homewood, IL: American Technical Publishers.
- Stairs: Design and Construction*. New York: Birkhauser.
- Arcways, Inc. Builders of custom stairways. www.arcways.com.
- Classic Stairworks, Ltd. Builders of classic custom staircases. www.classicstairworks.com.
- Coffman Stairs, LLC. Hardwood stair parts manufacturer. www.coffmanstairs.com.
- L.J. Smith Stair Systems. Manufacturer of stair products. www.ljsmith.net.

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 *Basic Stair Layout*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Session I. Introduction; Types of Stairs; Stairway Components and Typical Code Requirements	
A. Introduction	_____
B. Types of Stairs	_____
C. Stairway Components and Typical Code Requirements	_____
Session II. Stair Framing	
A. Stair Framing	_____
1. Headroom	_____
2. Stringers	_____
3. Treads and Risers	_____
4. Width Requirement	_____
5. Handrails	_____
6. Stairwells	_____
Session III. Stairway and Stairwell Design and Layout	
A. Stairway and Stairwell Design and Layout	_____
1. Stairway Design	_____
2. Stairwells	_____
3. Laying Out and Cutting a Stringer	_____
4. Reinforced Cutout Stringers	_____

Session IV. Laboratory

A. Laboratory

Hand out Job Sheet 27110-1. Under your supervision, have the trainees lay out and construct a stairway. This laboratory corresponds to Performance Task 1.

Session V. Forms for Concrete Stairs; Review; Module Examination and Performance Testing

A. Forms for Concrete Stairs

B. Review

C. Module Examination

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

D. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.

MODULE OVERVIEW

This module introduces the trainees to the safety rules and regulations for electricians, including the necessary precautions for avoiding various job site hazards.

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; Electrical Level One, Module 26101-08.*

OBJECTIVES

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

1. Recognize safe working practices in the construction environment.
2. Explain the purpose of OSHA and how it promotes safety on the job.
3. Identify electrical hazards and how to avoid or minimize them in the workplace.
4. Explain electrical safety issues concerning lockout/tagout procedures, confined space entry, respiratory protection, and fall protection systems.
5. Develop a task plan and a hazard assessment for a given task and select the appropriate PPE and work methods to safely perform the task.

PERFORMANCE TASKS

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

1. Perform a visual inspection on various types of ladders.
2. Set up a ladder properly to perform a task.
3. Properly don a harness.
4. Perform a hazard assessment of a job such as replacing the lights in your classroom.
 - Discuss the work to be performed and the hazards involved.
 - Locate the phone closest to the work site and ensure that the local emergency telephone numbers are either posted at the phone or known by you and your partner(s).
 - Plan an escape route from the location in the event of an accident.

MATERIALS

Overhead projector and screen	Shorting probes
Transparencies	Safety glasses
Blank acetate sheets	Face shields
Transparency pens	Company safety manual
Whiteboard/chalkboard	GFCI device
Markers/chalk	Company lockout/tagout procedures
Pencils and scratch paper	Step ladders
Copy of the latest edition of the <i>National Electrical Code</i> [®]	Straight ladders
<i>OSHA Electrical Safety Guidelines</i> (pocket guide)	Solvent MSDS
<i>NFPA 70E</i>	Fall arrest system
Various types of personal protective and safety equipment, including:	Safety harnesses
Rubber gloves	Lockout/tagout devices and labels
Insulating blankets	Access to eye wash station
Hot sticks	TV/DVD/VCR player (optional)
Fuse pullers	Safety videos (optional)
	Module Examinations*
	Performance Profile Sheet*

* 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 work with ladders. Make sure that all trainees are briefed on appropriate safety procedures. Emphasize electrical 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. These are optional materials for continued education rather than for task training.

29 CFR Parts 1900-1910, Standards for General Industry. Occupational Safety and Health Administration, U.S. Department of Labor.

29 CFR Part 1926, Standards for the Construction Industry. Occupational Safety and Health Administration, U.S. Department of Labor.

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

Standards for Electrical Safety in the Workplace, Latest Edition. Quincy, MA: National Fire Protection Association.

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 *Electrical Safety*. 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 Electrical Hazards	
A. Introduction	_____
B. Electrical Shock	_____
C. Protective Equipment	_____
D. OSHA	_____
E. <i>NFPA 70E</i>	_____
Session II. Ladders, Lifts, and Lifting	
A. Ladders and Scaffolds	_____
B. Laboratory	_____
Trainees practice visually inspecting ladders. This laboratory corresponds to Performance Task 1.	
C. Laboratory	_____
Trainees practice setting up a ladder. This laboratory corresponds to Performance Task 2.	
D. Lifts, Hoists, and Cranes	_____
E. Lifting	_____
F. Basic Tool Safety	_____
Session III. General Construction Safety Topics	
A. Confined Space Entry Procedures	_____
B. First Aid	_____
C. Solvents and Toxic Vapors	_____
D. Asbestos, Batteries, PCBs, and Vapor Lamps	_____

Session IV. Fall Protection, Hazard Assessment, Review, and Testing

A. Fall Protection

B. Laboratory

Trainees practice donning a safety harness. This laboratory corresponds to Performance Task 3.

C. Hazard Assessment

D. Laboratory

Trainees practice performing a hazard assessment. This laboratory corresponds to Performance Task 4.

E. Module Review

F. 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.

G. 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 trainees to the various types of devices and installation procedures used in residential wiring. It also covers service-entrance and branch circuit calculations and *National Electrical Code*[®] requirements.

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 *Electrical Level One*, Modules 26101-08 through 26110-08.

OBJECTIVES

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

1. Explain the role of the *National Electrical Code*[®] in residential wiring and describe how to determine electric service requirements for dwellings.
2. Explain the grounding requirements of a residential electric service.
3. Calculate and select service-entrance equipment.
4. Select the proper wiring methods for various types of residences.
5. Compute branch circuit loads and explain their installation requirements.
6. Explain the types and purposes of equipment grounding conductors.
7. Explain the purpose of ground fault circuit interrupters and tell where they must be installed.
8. Size outlet boxes and select the proper type for different wiring methods.
9. Describe rules for installing electric space heating and HVAC equipment.
10. Describe the installation rules for electrical systems around swimming pools, spas, and hot tubs.
11. Explain how wiring devices are selected and installed.
12. Describe the installation and control of lighting fixtures.

PERFORMANCE TASKS

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

1. For a residential dwelling of a given size, and equipped with a given list of major appliances, demonstrate or explain how to:
 - Compute lighting, small appliance, and laundry loads.
 - Compute the loads for large appliances.
 - Determine the number of branch circuits required.
 - Size and select the service-entrance equipment (conductors, panelboard, and protective devices).
2. Using an unlabeled diagram of a panelboard (Performance Profile Sheet 3), label the lettered components.
3. Select the proper type and size outlet box needed for a given set of wiring conditions.

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
Copy of the latest edition of the *National Electrical Code*[®]

Calculator
Residential floor plan
Blank worksheet
Various types of GFCIs
Panelboard
Examples of cable, including:
Type NM
Type AC
Type UF
Type SE/USE

Examples of raceways, including:

- Rigid
- IMC
- EMT
- Flexible
- PVC

Various grounding devices

Examples of made-type grounding electrodes

Assortment of metallic and plastic outlet boxes

Assorted types of electrical receptacles

Assortment of switches, including:

- Single-pole
- Three-way
- Four-way
- Photoelectric switches
- Dimmer

Relays

Module Examination*

Performance Profile Sheet*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Emphasize basic site safety. This module may require trainees to visit job sites. Make sure that all trainees 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. These are optional materials for continued education rather than for task training.

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

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 *Residential Electrical Services*. 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. Sizing Electrical Service	
A. Introduction	_____
B. Sizing Electrical Service	_____
C. Sizing Residential Neutral Conductors	_____
D. Sizing the Load Center	_____
E. Laboratory	_____
Trainees practice computing various branch loads. This laboratory corresponds to Performance Task 1.	_____
Session III. Grounding	
A. Grounding Electrical Services	_____
B. Main Bonding Jumper	_____
C. Laboratory	_____
Trainees practice identifying the components of a panelboard. This laboratory corresponds to Performance Task 2.	_____

Session IV. Installation I

- A. Installing the Service Entrance
- B. Panelboard Location
- C. Wiring Methods
- D. Equipment Grounding System
- E. Branch Circuit Layout for Power

Session V. Installation II

- A. Branch Circuit Layout for Lighting
- B. Outlet Boxes
- C. Laboratory
Trainees practice selecting the proper type and size outlet box needed for a given set of wiring conditions. This laboratory corresponds to Performance Task 3.
- D. Wiring Devices
- E. Lighting Control

Session VI. Heating, Pools, Review and Testing

- A. Electric Heating
- B. Residential Swimming Pools, Spas, and Hot Tubs
- C. Module 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 covers the principles of heating, ventilation, and air conditioning, career opportunities in HVAC, and apprenticeship programs.

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*.

OBJECTIVES

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

1. Explain the basic principles of heating, ventilation, and air conditioning.
2. Identify career opportunities available for people in the HVAC trade.
3. Explain the purpose and objectives of an apprenticeship training program.
4. Describe how certified apprentice training can start in high school.
5. Describe what the *Clean Air Act* means to the HVAC trade.
6. Describe types of regulatory codes encountered in the HVAC trade.
7. Identify the types of schedules/drawings used in the HVAC trade.

PERFORMANCE TASKS

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

1. Interpret the following within an HVAC drawing provided by the instructor:
 - Piping
 - Air-handling equipment
 - AC system(s)
 - HVAC component diagram
 - Schematics

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

HVAC drawings for a commercial building
(optional)

Air conditioner

Commercial drawing set

Building codes

Copy of an employee manual

Job announcements for HVAC technicians from

local newspapers (want ads)

NCCER Apprentice Training Recognition Forms

Module Examinations*

Performance Profile Sheets*

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

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

ADDITIONAL RESOURCES

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

Career Opportunities in Heating, Air Conditioning and Refrigeration, Latest Edition. Fairfax, VA: Air Conditioning and Refrigeration Institute (ARI).

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 HVAC*. 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 HVAC	
A. Introduction	_____
B. Heating	_____
C. Ventilation	_____
D. Air Conditioning	_____
Session II. Blueprints, Careers, and Training	
A. Blueprints, Codes, and Specifications	_____
B. Laboratory—Trainees practice identifying various types of prints. This laboratory corresponds to Performance Task 1.	_____
C. Careers in HVAC	_____
D. Types of Training Programs	_____
Session III. Environmental Issues, Review, and Testing	
A. The HVAC Technician and the Environment	_____
B. Module Review	_____
C. 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.	
D. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

MODULE OVERVIEW

This module explains the factors that influence DWV system design and how different types of drains, fittings, vents, and pipe are used to move waste out of a building. Trainees will learn installation requirements that prevent malfunctions in the system.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Plumbing Level One*, Modules 02101-05 through 02111-05.

OBJECTIVES

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

1. Explain how waste moves from a fixture through the drain system to the environment.
2. Identify the major components of a drainage system and describe their functions.
3. Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.
4. Identify the various types of drain, waste, and vent (DWV) fittings and describe their applications.
5. Identify significant code and health issues, violations, and consequences related to DWV systems.

PERFORMANCE TASK

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

1. Sketch a simple DWV system, label its components, and size the pipe.

MATERIALS AND EQUIPMENT LIST

Transparencies	DWV fittings, including:
Markers/chalk	Bends
Blank acetate sheets	Adapters
Transparency pens	Cleanouts
Pencils and scratch paper	Tees
Overhead projector and screen	Wyes
Whiteboard/chalkboard	Increasesers
Appropriate personal protective equipment	Offsets
Copies of your local code	Torpedo level
DWV system design drawings	Plans for a municipal waste treatment plant
P-traps	Plans for a private waste disposal system
Copies of Figure 8 with the callouts covered	Module Examinations*
Drainage fittings made from a variety of materials	Performance Profile Sheets*

* Single-module AIG purchases include the printed exam and performance task sheet. If you have purchased the perfect-bound version of this title, download these materials from the IRC using your access code.

SAFETY CONSIDERATIONS

Ensure that trainees are equipped with appropriate personal protective equipment, and that they are properly instructed on its use. Stress the specific hazards of working with DWV systems, such as exposure to toxic gases, and explain the related necessary safety precautions.

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.

Basic Plumbing with Illustrations, Revised Edition, 1994. Howard C. Massey. Carlsbad, CA: Craftsman Book Company.

Plumbing Systems: Analysis, Design and Construction, 1996. Tim Wentz. 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 *Introduction to Drain, Waste, and Vent (DWV) Systems*. 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. DWV Systems, Fixtures, Drains, and Traps	
A. DWV Systems	_____
B. Fixture Drains	_____
C. Types of Traps	_____
D. Parts of Traps	_____
Session II. Installation Requirements	
A. Trap Installation Requirements	_____
B. Why a Trap Loses Its Seal	_____
Session III. Vents, Drains, and Fittings	
A. Vents	_____
B. Sizing Drains and Vents	_____
C. Fittings and Their Applications	_____
Session IV. DWV System Design	
A. Grade	_____
B. Building Drain	_____
C. Building Sewer	_____
D. Sewer Main	_____
E. Waste Treatment	_____
F. Code and Health Issues	_____
G. Review	_____
H. 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.	
I. 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 various types of materials, schedules, and applications of plastic piping. Trainees will learn how to determine the appropriate types of fittings, valves, hangers, and supports needed for plastic piping. Trainees will learn to properly measure, cut, and join plastic piping.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Plumbing Level One*, Modules 02101-05 through 02105-05.

OBJECTIVES

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

1. Identify types of materials and schedules of plastic piping.
2. Identify proper and improper applications of plastic piping.
3. Identify types of fittings and valves used with plastic piping.
4. Identify and determine the kinds of hangers and supports needed for plastic piping.
5. Identify the various techniques used in hanging and supporting plastic piping.
6. Properly measure, cut, and join plastic piping.
7. Explain proper procedures for the handling, storage, and protection of plastic pipes.

PERFORMANCE TASKS

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

1. Select correct types of materials for plastic piping systems.
2. Identify types of fittings and valves and their uses.
3. Select the appropriate personal protective equipment for working with plastic piping.
4. Properly measure, cut, and join plastic piping.
5. Select the correct hanger or support for the application.

MATERIALS AND EQUIPMENT LIST

Transparencies	Tools for cutting pipe
Markers/chalk	Deburring tools
Blank acetate sheets	Miter box
Transparency pens	Plastic saw for cutting PVC pipe
Pencils and scratch paper	CPVC or PVC cement or all-purpose cement con-
Overhead projector and screen	forming to <i>ASTM F-493</i> standards
Whiteboard/chalkboard	PVC bell-and-spigot pipe
Appropriate personal protective equipment	Lubricant
Copies of your local code	Tools used to join PEX tubing, including:
Flexible pipe	Insert and crimp-ring system
Pipe labels	Tubing cutter
Sections of plastic pipe, including:	Hand-crimping tool
ABS (acrylonitrile-butadiene-styrene)	Go-no-go gauge
PVC (polyvinyl chloride)	Cutter designed for plastic tubing
CPVC (chlorinated polyvinyl chloride)	PEX ring
PE (polyethylene)	Expander tool
PEX (cross-linked polyethylene)	Mechanical joints and clamps
PB (polybutylene)	Compression collars
Sample material safety data sheets (MSDS) for plastic pipe	Tools for the butt-fusion method, including:
Tools for measuring	Temperature indicator stick
	Heating tool

Fusion timer
 Socket face
 Cold ring
Manufacturers Standardization Society's MSS40
 hanger standard

National Fire Protection Association (NFPA)
Chapter 13
 Module Examinations*
 Performance Profile Sheets*
 Copies of Quick Quiz**

* 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.

** Located at the end of this module.

SAFETY CONSIDERATIONS

Ensure that trainees are equipped with appropriate personal protective equipment, and that they are properly instructed on its use. Emphasize safety precautions specific to pipe-cutting operations. Stress the importance of following manufacturers' recommendations when cutting or sawing pipe or when using any flame, heat, or power tools. Remind trainees of the environmental and physical hazards related to working with ignition sources and hazardous substances such as primer and cement.

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.

Pipefitter Level Two, 1998. NCCER. Upper Saddle River, NJ: Prentice Hall.

Basic Plumbing with Illustrations, Revised, 1994. Howard C. Massey. Carlsbad, CA: Craftsman Book Company.

Plumber's Handbook, Revised Edition, 1998. Howard C. Massey. Carlsbad, CA: Craftsman Book Company.

Plumbing: Design and Installation, Second Edition, 2002. L. V. Ripka. Homewood, IL: American Technical Publishers.

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 *Plastic Pipe and Fittings*. 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 Plastic Pipe	
A. Advantages and Disadvantages	_____
B. Properties	_____
C. Sizing	_____
D. Labeling	_____
E. Manufacturers	_____
Session II. Plastic Pipe and Fittings	
A. Types of Plastic Pipe	_____
B. Laboratory – Trainees practice identifying types of plastic pipes. This laboratory corresponds to Performance Task 1.	_____
C. Material Storage and Handling	_____
D. Water Supply Fittings	_____

- E. DWV Fittings _____
- F. Laboratory – Trainees practice identifying fittings and valves and their uses. _____
This laboratory corresponds to Performance Task 2. _____

Session III. Measuring, Cutting, and Joining

- A. Measuring _____
- B. Cutting _____
- C. Joining _____
- D. Laboratory – Trainees practice measuring, cutting, and joining plastic piping. Trainees must select appropriate personal protective equipment. _____
This laboratory corresponds to Performance Tasks 3 and 4. _____

Session IV. Pipe Supports and Pressure Testing

- A. Hangers _____
- B. Fasteners _____
- 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 (Task 5) _____
 - 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 discusses the materials, schedules, and properties of copper piping, fittings, and valves. Trainees will learn how to measure, ream, cut, join, and groove copper piping, as well as how to hang and support copper piping.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Plumbing Level One*, Modules 02101-05 through 02105-05.

OBJECTIVES

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

1. Identify the types of materials and schedules used with copper piping.
2. Identify the material properties, storage, and handling requirements of copper piping.
3. Identify the types of fittings and valves used with copper piping.
4. Identify the techniques used in hanging and supporting copper piping.
5. Properly measure, ream, cut, and join copper piping.
6. Identify the hazards and safety precautions associated with copper piping.

PERFORMANCE TASKS

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

1. Select correct types of materials for copper piping systems.
2. Identify types of fittings and valves and their uses.
3. Select the appropriate personal protective equipment for working with copper piping.
4. Correctly measure, cut, ream, join, and groove copper piping.
5. Select the correct hanger or support for the application.

MATERIALS AND EQUIPMENT LIST

Transparencies	Copper cutter
Markers/chalk	Handheld tube cutter
Blank acetate sheets	Internal tube cutter
Transparency pens	Sizing tool
Pencils and scratch paper	Tools to form sweat joints, compression joints, and flare joints
Overhead projector and screen	Variety of soldering tools, including an acetylene torch
Whiteboard/chalkboard	Tools to roll groove and cut groove copper pipe
Appropriate personal protective equipment	Pipe attachments for wood-frame construction
Copies of your local code	<i>National Fire Protection Association (NFPA)</i>
Access to a fire extinguisher	<i>Chapter 13</i>
Sections of copper pipe	<i>Manufacturers Standardization Society MSS40</i>
Tee-pulling tool	hanger standards
Fittings and valves, including:	Pressure gauge
Water supply fittings	Test plug
Water supply valves	Module Examinations*
DWV fittings	Performance Profile Sheets*
Alternative fittings	
Tools for measuring copper pipe	

* 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 that they are properly instructed on its use. Emphasize safety precautions specific to pipe-cutting operations. Stress the importance of following manufacturers' recommendations when cutting or sawing pipe or when using any flame, heat, or power tools. Remind trainees of the environmental and physical hazards related to soldering work.

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.

The Copper Tube Handbook, 1995. New York: Copper Development Association.

Engineering Lab, Inc. website: www.engineeringlab.com, *Flux, Solder, and Cleaning* (Online Course), <http://www.engineeringlab.com/fluxsolder.html>, reviewed July 2003.

Modern Plumbing, 1997. E. Keith Blankenbaker. Tinley Park, IL: The Goodheart-Willcox Company, Inc.

Modern Refrigeration and Air Conditioning, 1996. Andrew D. Althouse, Carl H. Turnquist, and Alfred F. Bracciano. Tinley Park, IL: The Goodheart-Willcox Company, Inc.

Pipefitter's Handbook, Third Edition, 1967. Forrest R. Lindsey. New York: Industrial Press, Inc.

Plumbing and Mechanical website: www.pmmag.com, *Throw Away Your Torches*, Julius Ballanco, P.E. http://www.pmmag.com/CDA/ArticleInformation/features/BNP_Features_Item/0,2379,5020,00.html, publication date: June 2000, reviewed July 2003.

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 *Copper Pipe and Fittings*. 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 Copper Pipe	
A. Types	_____
B. Sizing	_____
C. Labeling	_____
D. Applications	_____
E. Material Storage and Handling	_____
F. Performance Testing (Task 1)	_____
Session II. Fittings and Valves	
A. Water Supply Fittings	_____
B. Water Supply Valves	_____
C. DWV Fittings	_____
D. Alternative Fittings	_____
E. Performance Testing (Task 2)	_____
Session III. Measuring, Cutting, Bending, Joining, and Grooving	
A. Measuring	_____
B. Cutting	_____
C. Bending	_____
D. Joining	_____

E. Grooving

F. Performance Testing (Tasks 3 and 4)

Session IV. Installing, Insulating, and Pressure Testing

A. Types of Pipe Hangers and Supports

B. Performance Testing (Task 5)

C. Insulating Pipes

D. Pressure Testing

E. Review

F. 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.

G. 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.
