Building Materials, Fasteners, and Adhesives

Module Two (27102-13) provides an overview of the building materials used by carpenters, including lumber, engineered wood products, concrete, and steel framing materials. The module also describes the various fasteners, anchors, and adhesives used in construction.

Objectives

Learning Objective 1
- Identify various types of building materials and describe their uses.
  a. State the uses of various types of hardwoods and softwoods.
  b. Describe common lumber defects.
  c. Identify the different grades of lumber and describe uses for each.
  d. Explain how treated lumber differs from nontreated lumber.
  e. Describe how plywood is manufactured and cite common applications for plywood on a construction project.
  f. Identify uses of hardboard.
  g. Identify uses of particleboard.
  h. Identify uses of high- and medium-density overlay plywood.
  i. Describe how oriented strand board differs from particleboard and cite common applications for OSB.
  j. Cite common applications for mineral fiberboard.
  k. State the uses of various types of engineered lumber.
  l. Identify applications for wood I-beams
  m. List advantages of glulam lumber over conventional solid lumber.
  n. Describe the composition of concrete and explain how hydration occurs.
  o. List uses of concrete masonry units for a construction project.
  p. Identify where metal framing members may be used in a structure.

Learning Objective 2
- List safety precautions associated with building materials.
  a. List general safety guidelines for working with building materials.
  b. Cite safety precautions for working with wood building materials.
  c. Cite safety precautions for working with concrete building materials.
  d. Cite safety precautions for working with metal building materials.

Learning Objective 3
- Describe the proper method of handling and storing building materials.
  a. List basic material-handling guidelines.
  b. Describe how to handle and store wood building materials.
  c. Describe how to handle and store concrete building materials.
  d. Describe how to handle and store metal building materials.

Learning Objective 4
- Explain how to calculate the quantities of lumber, panel, and concrete products using industry-standard methods.
  a. Calculate lumber quantities.
  b. Calculate panel quantities.
  c. Calculate the volume of concrete required for rectangular and cylindrical shapes.

Learning Objective 5
- Describe the fasteners, anchors, and adhesives used in construction and explain their uses.
  a. Identify various types of nails and cite uses for each.
  b. Identify applications for staples.
  c. Identify various types of screws and cite uses for each.
  d. Describe uses for hammer-driven pins and studs.
  e. Identify various types of bolts and cite uses for each.
  f. Identify various types of mechanical anchors and cite uses for each.
  g. Identify various types of bolt anchors and explain how each is installed.
  h. Identify various types of screw anchors and cite uses for each.
  i. Identify various types of hollow-wall anchors and cite uses for each.
  j. List the types of glues and adhesives used in construction.
Safety Considerations
This module requires that trainees demonstrate the safe and proper installation of drop-in anchors. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under supervision. Each trainee must use required PPE and follow safe tool practices and procedures.
Classroom Equipment and Materials

- Whiteboard/Chalkboard
- Markers/Chalk
- Pencils and paper
- **Carpentry Level One** PowerPoint® Presentation Slides
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing various building materials and fasteners (optional)
- TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

- **Personal protective equipment (PPE):**
  - Hard hat
  - Safety glasses
  - Gloves
  - Hearing protection
  - Face shield
  - Respiratory protection
- Cut portion of a tree trunk
- Tape measure
- Samples of lumber with grade stamps, natural defects, and manufacturing defects
- Samples of panel products containing grade stamps, including plywood, OSB, particleboard, hardboard, and mineral fiberboard
- Drill and bits
- Handsaw
- Plywood Specification and Grade Guide
- Samples of engineered lumber products, including wood I-beams, glulam, LVL, and PSL
- Photos of commercial construction projects
- Samples of concrete masonry units
- Samples of steel framing members
- Bags of portland cement
- Sand
- Water
- Blank job hazard analysis (JHA) forms
- Small loads for lifting demonstration
- Wood materials
- Samples of boards that equal one board foot
- Calculator or smartphone calculator app
- Set of plans (optional)
- Scraps of wood, steel-metal framing, and concrete
- Hammer
- Assorted nails
- Manual stapler
- Assorted staples
- Standard screwdriver
- Wood screws
- Power screwdriver
- Sheet-metal screws
- Masonry bits
- Machine and lag screws
- Concrete/masonry and deck screws
- Drywall and drive screws
- Hammer-driven pins
- Assorted bolts and nuts
- Advertisements for anchors and adhesives
- Assorted anchors and adhesives
- Ventilation fan

Additional Resources

This module presents thorough resources for task training. The following resource materials are suggested for further study:


There are a number of online resources available for trainees who would like more information on building materials, fasteners, and adhesives. A search for additional information may be assigned as homework to interested trainees.
Building Materials, Fasteners, and Adhesives

SESSION ONE

Session One reviews dimension lumber, plywood, and other panel products.

1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of the module.
3. Discuss the various types of wood building materials, including plywood and other panel products.
4. Have trainees identify various wood building materials and note their applications.

SESSION TWO

Session Two introduces engineered lumber products, their manufacture, and their applications.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss how engineered lumber has changed the way some buildings are constructed.
3. Have trainees identify engineered lumber products and their applications.

SESSION THREE

Session Three reviews concrete, concrete masonry construction, and steel framing materials.

1. Show Session Three PowerPoint® presentation slides.
2. Review the ingredients in concrete and explain that varying the amounts of these ingredients will impart different characteristics and properties to the concrete.
3. Explain the benefits of concrete masonry construction.
4. Discuss the applications of steel framing members in commercial construction.

SESSION FOUR

Session Four discusses the proper and safe handling and storage of building materials.

1. Show Session Four PowerPoint® presentation slides.
2. Emphasize the importance of safety on the job site, including safety when handling and storing building materials.
3. Review job hazard analysis (JHA) and its importance.
4. Review general safety, followed by safety with wood, concrete, and steel building materials.
5. Discuss the safe handling and storage of building materials.

SESSION FIVE

Session Five discusses the calculation of lumber, panel, and concrete quantities.

1. Show Session Five PowerPoint® presentation slides.
2. Explain board foot measurements, and describe how board feet are calculated.
3. Discuss area and how it is calculated. Explain that area is a very common construction calculation.
4. Discuss volume and how it is calculated. Describe applications for volume calculations.

SESSION SIX

Session Six reviews common fasteners used by carpenters.

1. Show Session Six PowerPoint® presentation slides.
2. Discuss nail types and nail sizes.
3. Discuss staples and their applications.
4. Discuss screw types and their applications.
5. Discuss bolts and their applications.
Session Seven introduces common anchors and adhesives used by carpenters.

1. Show Session Seven PowerPoint® presentation slides.
2. Discuss common anchors and adhesives used on construction projects.
3. Emphasize the importance of proper ventilation and PPE when applying some types of adhesives.

Session Eight is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Seven.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Lesson Plans for Module 27103-13

HAND AND POWER TOOLS

The Trainee Guide for *Carpentry Level One* is available as an NCCERconnect ebook. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

Module Three (27103-13) provides detailed descriptions of the hand tools and portable power tools used by carpenters. Emphasis is on safe and proper operation of tools, as well as care and maintenance.

**Objectives**

**Learning Objective 1**
- Identify the hand tools commonly used by carpenters.
  - a. Describe the safe use and maintenance of levels.
  - b. Describe the safe use and maintenance of squares.
  - c. Describe the safe use and maintenance of planes.
  - d. Describe the safe use and maintenance of clamps.
  - e. Describe the safe use and maintenance of hand saws.

**Learning Objective 2**
- Identify the power tools commonly used by carpenters.
  - a. Describe the general safe use and maintenance of power tools.
  - b. Describe the safe use of power saws.
  - c. Describe the safe use of drill presses.
  - d. Describe the safe use of routers and laminate trimmers.
  - e. Describe the safe use of portable power planes.
  - f. Describe the safe use of power metal shears.
  - g. Describe the safe use of pneumatic and cordless nailers and staplers.

**Performance Tasks**

**Performance Task 1 (Learning Objective 1)**
Demonstrate the safe and proper use of the following hand tools:
- Level
- Square
- Clamp
- Saw

**Performance Task 2 (Learning Objective 2)**
Demonstrate or describe the safe and proper use of five of the following power tools:
- Circular saw
- Portable table saw
- Compound miter saw
- Drill press
- Router/laminate trimmer
- Portable power plane
- Power metal shears
- Pneumatic nailer/stapler

**Teaching Time: 10 hours**

(Four 2.5-Hour Classroom Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

Core Curriculum

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
### Safety Considerations
This module requires that trainees demonstrate the safe use of hand and power tools. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

### Classroom Equipment and Materials
- Whiteboard/Chalkboard
- Markers/Chalk
- Pencils and paper
- Carpentry Level One
- PowerPoint® Presentation
- Slides
- LCD projector and screen
- Computer
- Copies of the Module
- Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing various hand and power tools (optional)
- TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing
#### Personal protective equipment (PPE):
- Hard hat
- Safety glasses
- Gloves
- Hearing protection
- Face shield
- Respiratory protection

#### Levels:
- spirit, carpenter’s, line, water, builder’s, auto, transit, laser

#### Squares:
- combination, miter, try, sliding T-bevel, drywall, framing, rafter, Speed Square™

#### Planes:
- block, jack, smoothing, jointer

#### Clamps:
- C-clamp, hand-screw, locking C-clamp, spring, quick, web, pipe

#### Handsaws:
- rip, crosscut, hacksaw, backsaw, dovetail, compass, coping, drywall

#### Copies of blank job hazard analysis (JHA) forms

#### Portable circular saw

#### Portable table saw

#### Featherboards and pushsticks

#### Power miter saw

#### Compound mitre saw

#### Abrasive saws

### Equipment and Materials for Laboratories and Performance Testing
- Assortment of power saw blades
- Assortment of clamps
- Extension cords
- GFCIs
- Chalkline
- Folding rule or tape measure
- Pieces of crown molding approximately 4” in length
- 1 × 4 stock approximately 18” to 24” in length
- 2 × 4s approximately 18” to 24” in length
- 2 × 4s approximately 4’ in length
- 6” × 12” pieces of ¾” plywood
- 3-foot lengths of ½” rebar
- Drill press
- Router/laminate trimmer
- Portable power plane
- Power metal shears
- Pneumatic/cordless nailers and staplers
- Fasteners (nails and staples) designed for the pneumatic tools being used
- Angle iron, steel rebar, or pipe for cutting
- Laminate samples
- Scraps of wood

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


**Framing Floors, Walls and Ceilings.** Newtown, CT: Taunton Press.

**Framing Walls (DVD).** Newtown, CT: Taunton Press.

**Graphic Guide to Frame Construction.** Newtown, CT: Taunton Press.

**International Code Council.** A membership organization dedicated to building safety and fire prevention through development of building codes, [http://www.iccsafe.org](http://www.iccsafe.org)

**National Association of Home Builders.** A trade association whose mission is to enhance the climate for housing and the building industry, [http://www.nahb.org](http://www.nahb.org)

**Precision Framing for Pros by Pros.** Newtown, CT: Taunton Press.

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

There are a number of online resources available for trainees who would like more information on carpentry hand and power tools. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

### Session One

Session One introduces hand tools commonly used by carpenters.

1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of hand tools.
3. Emphasize general safety precautions when using hand tools.
4. Identify the various hand tools commonly used by carpenters and identify applications for each.

### Session Two

Session Two introduces power saws commonly used by carpenters.

1. Show Session Two PowerPoint® presentation slides.
2. Provide an overview of power tools.
3. Emphasize general safety precautions when using power saws.
4. Identify the various power saws used by carpenters and identify applications for each.

### Session Three

Session Three introduces other power tools commonly used by carpenters.

1. Show Session Three PowerPoint® presentation slides.
2. Emphasize general safety precautions when using power tools other than saws.
3. Identify the various power tools used by carpenters, other than saws, and identify applications for each.

### Session Four

Session Four is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Three.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module Five (27105-13) describes the layout and construction procedures for floor systems, including how to read and interpret construction drawings and specifications, and how to identify different types of framing systems, floor system components, and floor system materials. It also covers how to estimate the amount of materials needed for a floor assembly and on some common alternative floor systems.

**Objectives**

**Learning Objective 1**
- Read and interpret specifications and drawings to determine floor system requirements.
  a. Explain the importance of specifications.
  b. List items commonly shown on architectural drawings.
  c. Describe information typically shown on structural drawings.
  d. Explain the importance of referencing mechanical, electrical, and plumbing plans.
  e. Describe the proper procedure for reading a set of prints.

**Learning Objective 2**
- Identify the different types of framing systems.
  a. Describe the general components of a platform-framed structure.
  b. List differences between platform framing and balloon framing.
  c. Describe the characteristics of post-and-beam framing.

**Learning Objective 3**
- Identify floor system components.
  a. Define *sill plate* and describe its role in floor framing.
  b. List and recognize different types of beams and girders and supports.
  c. List and recognize different types of floor joists.
  d. List and recognize different types of bridging.
  e. Explain the purposes of subfloor and underlayment.

**Learning Objective 4**
- Describe the construction methods for floor systems, and identify floor system materials.
  a. Describe how to check a foundation for squareness.
  b. Name the methods used to lay out and fasten sill plates to the foundation.
  c. Describe the proper procedure for installing a beam or girder.
  d. Describe how to lay out sill plates and girders for floor joists.
  e. Describe how to lay out and install floor joists for partitions and floor openings.
  f. Identify different types of bridging and describe how to properly install each type.
  g. Describe how to properly install subfloor.
  h. Explain how to install joists for projections or cantilevered floors.

**Learning Objective 5**
- Estimate the amount of material needed for a floor assembly.
  a. Describe how to estimate the amount of sill plate, sill sealer, and termite shield.
  b. Describe how to estimate the amount of beam or girder material.
  c. Describe how to estimate the amount of lumber needed for joists and joist headers.
  d. Describe how to estimate the amount of bridging required.
  e. Describe how to estimate the amount of subfloor material required.

**Learning Objective 6**
- Identify some common alternative floor systems.

**Performance Tasks**

**Performance Task 1 (Learning Objective 4)**
- Lay out and construct a floor assembly, including a rough opening and subfloor material.

**Performance Task 2 (Learning Objective 5)**
- Estimate the amount of material to frame a floor assembly from a set of plans.

**Teaching Time: 25 hours**
(Ten 2.5-Hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.
Prerequisites
Core Curriculum

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations
This module requires that trainees demonstrate the safe construction of a floor assembly. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Carpentry Level One PowerPoint® Presentation Slides
LCD projector and screen
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing floor systems (optional)
TV/DVD player (optional)

Equipment and Materials for Laboratories and Performance Testing
Personal protective equipment (PPE):
- Hard hat
- Safety glasses
- Gloves
- Hearing protection
Foundation plans
Sets of construction drawings
Photographs of wood-framed buildings
Photos of different types of girders
Joist span tables
Local building codes
Joist hangers
2 x 8 or 2 x 10 floor joists
Wood I-joists
Floor trusses
Wood cross-bridging
Solid bridging
Metal cross-bridging
International Residential Code®
Manufactured panels (OSB, waferboard, composite board, structural particleboard)

Additional Resources
There are a number of online resources available for trainees who would like more information on building materials, fasteners, and adhesives. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into ten 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**
Session One covers reading specifications and drawings to determine floor system requirements.
1. Show Session One PowerPoint® presentation slides.
2. Discuss what is included in written specifications.
3. Explain and demonstrate how to interpret architectural drawings.
4. Demonstrate how to interpret a typical wall section.
5. Discuss the interpretation of structural drawings, MEP plans, and prints.

**SESSION TWO**
Session Two introduces framing system terminology and different types of frames.
1. Show Session Two PowerPoint® presentation slides.
2. Discuss framing system terminology.
3. Discuss platform frames.
4. Discuss balloon frames.
5. Discuss fire stops.
6. Discuss post-and-beam frames.

**SESSION THREE**
Session Three introduces some floor system components.
1. Show Session Three PowerPoint® presentation slides.
2. Discuss floor system component terminology, the purpose of floor systems, and information provided about them in prints and specifications.
3. Discuss the use and installation of sill plates.
4. Identify the different types of girders and supports.
5. Discuss the spacing required between posts or columns, and discuss post caps and anchors.

**SESSION FOUR**
Session Four introduces floor joists, bridging, and subfloors.
1. Show Session Four PowerPoint® presentation slides.
2. Explain the purposes of and installation of floor joists.
3. Discuss the different kinds of joists.
4. Discuss floor trusses.
5. Explain the purpose and types of bridging.
6. Discuss the different types of subfloors and their uses.

**SESSION FIVE**
Session Five covers checking a foundation for squareness, and sill plate and girder installation.
1. Show Session Five PowerPoint® presentation slides.
2. Introduce the sequence of constructing a platform floor assembly.
3. Explain and demonstrate how to check a foundation for squareness.
4. Explain and demonstrate how to install a sill plate.
5. Explain and demonstrate how to install a girder.
Session Six covers laying out sill plates and girders, when additional joists are needed, installation of rim joists and floor joists, and framing floor openings.

1. Show Session Six PowerPoint® presentation slides.
2. Explain and demonstrate how to lay out sill plates and girders for joists.
3. Discuss additional joists needed to accommodate loadbearing partitions, floor openings, and so on.
4. Explain and demonstrate how to install rim joists and floor joists.
5. Review the procedure for framing an opening.

Session Seven covers installation of cross-bridging, solid bridging, subfloors, and joists for cantilevered floors.

1. Show Session Seven PowerPoint® presentation slides.
2. Discuss the installation of wood cross-bridging, metal cross-bridging, and solid bridging.
3. Explain how to install a subfloor.
4. Introduce the installation of joists for cantilevered floors.

Session Eight introduces estimating the amount of materials needed for a floor assembly.

1. Show Session Eight PowerPoint® presentation slides.
2. Discuss the items included in a material takeoff for a floor system.
3. Explain and demonstrate how to determine the amount of sill plate, sill sealer, and/or termite shield required.
4. Explain and demonstrate how to determine the quantity of girder material needed.
5. Explain and demonstrate how to determine the number of floor joists needed in a frame and the amount of material needed for the header joists.
6. Explain and demonstrate how to calculate the total amount of bridging needed.
7. Explain and demonstrate how to calculate the number of subfloor panels or boards needed.

Session Nine introduces some common alternative floor systems.

1. Show Session Nine PowerPoint® presentation slides.
2. Discuss some common alternative floor systems.
3. Discuss the method of casting and precasting concrete floors.
4. Discuss access floors.

Session Ten is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Nine.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
**Lesson Plans for Module 27111-13**

**WALL SYSTEMS**

The Trainee Guide for *Carpentry Level One* is available as an NCCERconnect ebook. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

**Module Six (27111-13)** describes the procedures for laying out and framing walls, including roughing-in door and window openings, constructing corners and partition Ts, bracing walls, and applying sheathing. The module also includes estimating materials required to frame walls.

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### Objectives

**Learning Objective 1**
- Identify the components of a wall system.
  - a. Identify methods used to construct corner posts.
  - b. Describe how to frame partition intersections.
  - c. Explain the purpose of headers and describe how they are constructed.
  - d. Describe how metal-framed walls are constructed.

**Learning Objective 2**
- Describe the procedure for laying out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and fire-stops.
  - a. Describe how to properly lay out a wood frame wall.
  - b. Explain how to lay out wall openings.

**Learning Objective 3**
- Describe the correct procedure to assemble, erect, and brace exterior walls for a frame building.
  - a. List the steps involved in assembling a wall.
  - b. Identify where fire stops are to be installed and explain how they are installed.
  - c. List the four steps involved in erecting a wall.

**Learning Objective 4**
- Describe wall framing techniques used in masonry construction.

**Learning Objective 5**
- Describe the correct procedure to estimate the materials required to frame walls.
  - a. Explain how to estimate the amount of lumber required for soleplates and top plates.
  - b. Describe how to estimate the number of studs required.
  - c. Explain how to calculate the amount of material needed for a header.
  - d. Describe how to estimate the amount of diagonal bracing required.

**Learning Objective 6**
- Identify alternative wall systems.
  - a. Describe how concrete walls are constructed.
  - b. Explain the difference between standard interior wall systems and alternative interior wall systems.

### Performance Tasks

**Performance Task 1** (Learning Objective 2)
- Lay out a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and fire-stops.

**Performance Task 2** (Learning Objective 3)
- Assemble and erect a wood frame wall, including plates, corner posts, door and window openings, partition Ts, bracing, and fire-stops.

**Performance Task 3** (Learning Objective 3)
- Correctly install sheathing on a wall.

**Performance Task 4** (Learning Objective 5)
- Estimate the materials required to frame walls.

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**Teaching Time: 10 hours**
*(Four 2.5-Hour Classroom Sessions)*

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

*Core Curriculum*

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.
Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.

**Safety Considerations**

This module requires trainees to demonstrate the safe framing of walls. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

### Classroom Equipment and Materials

- Whiteboard/Chalkboard
- Markers/Chalk
- Pencils and paper
- Carpentry Level One PowerPoint®
- Presentation Slides
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing wall framing systems (optional)
- TV/DVD player (optional)

### Equipment and Materials for Laboratories and Performance Testing

- Personal protective equipment (PPE):
  - Hard hat
  - Safety glasses
  - Gloves
  - Hearing protection
- Photographs or drawings that show specific types of building construction in various stages of completion
- Photographs of corner construction
- Set of prints with information pertinent to wall framing
- Residential construction drawings
- Stock for blocking
- 8d common nails
- 16d box nails
- 2 × 4 or 2 × 6 framing lumber for studs and joists
- 2 × 12 header material
- 1⁄4" CD plywood for header spacers
- ½" CD plywood
- 25' tape measure
- Carpenter’s pencil
- Chalkline
- Framing hammer
- Pneumatic/cordless framing nailer
- Framing square or Speed Square™
- Circular saw
- Compound miter saw
- Extension cord
- Illustration of a wall cutaway or wall section from a set of construction drawings
- 4' level
- Calculator or smartphone calculator app
- Copies of blank job hazard analysis (JHA) forms
- Banding or cleats
- 6' stepladder
- Metal brace material
- Sheathing material

### Additional Resources

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

- *Framing Floors, Walls and Ceilings*. Newtown, CT: Taunton Press.
- *Framing Walls (DVD)*. Newtown, CT: Taunton Press.
- *Precision Framing for Pros by Pros*. Newtown, CT: Taunton Press.
- *National Association of Home Builders*. A trade association whose mission is to enhance the climate for housing and the building industry, http://www.nahb.org

There are a number of online resources available for trainees who would like more information on laying out and framing walls. A search for additional information may be assigned as homework to interested trainees.
The Lesson Plan for this module is divided into four 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces wall frame terminology and wall frame layout.
1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of the module.
3. Discuss wall frame terminology.
4. Explain and demonstrate how to lay out a wood frame wall.

**SESSION TWO**

Session Two covers the assembly, erection, and bracing of wood frame walls.
1. Show Session Two PowerPoint® presentation slides.
2. Discuss how to determine lengths of studs.
3. Review general safety and discuss safety pertinent to wall assembly.
4. Discuss and demonstrate how to assemble a wall frame.
5. Discuss and demonstrate how sheathing is fastened to wall frames.
6. Describe the methods of furring and framing for masonry walls.

**SESSION THREE**

Session Three introduces estimating material quantities for wood frame walls.
1. Show Session Three PowerPoint® presentation slides.
2. Identify wall frame components that will be included in the estimate.
3. Discuss how to estimate each wall frame component.
4. Work in small groups to calculate estimates.

**SESSION FOUR**

Session Four is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Three.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Supervisor.
Lesson Plans for Module 27112-13
CEILING AND ROOF FRAMING

The Trainee Guide for Carpentry Level One is available as an NCCERconnect ebook. Contact your NCCER customer service representative at 1-888-622-3720 for more information.

Module Seven (27112-13) provides an overview of ceiling and roof framing, including the components of ceiling and roof framing, the different types of roofs used in residential construction, and the use of trusses in basic roof framing. The methods for laying out rafters, erecting a gable roof, framing a basic gable end wall, and installing roof sheathing are introduced. It also provides instruction on how to estimate the amount of materials needed for a material takeoff for a roof.

Objectives

Learning Objective 1
• Identify the components of ceiling framing.
  a. Describe the correct procedure for laying out ceiling joists.
  b. Describe how to cut and install ceiling joists on a wood frame building.
  c. Describe how to estimate the number of ceiling joists required for a building.

Learning Objective 2
• Identify common types of roofs used in residential construction.

Learning Objective 3
• Identify the components and define the terms associated with roof framing.
  a. Identify the two types of dormers.
  b. Describe how to use a framing square and a Speed Square™ for roof framing.

Learning Objective 4
• Describe the methods used to lay out a common rafter.
  a. Explain how to lay out rafter locations.
  b. Describe how to determine the length of a common rafter.
  c. Explain the correct procedure for laying out and cutting a common rafter.

Learning Objective 5
• Describe how to erect a gable roof.
  a. Describe how to install rafters.

Learning Objective 6
• Describe how to frame a basic gable end wall.
  a. Describe how to frame a gable overhang.
  b. Explain how to frame an opening in a roof.

Learning Objective 7
• Recognize the use of trusses in basic roof framing.
  a. Identify the various types and components of trusses.
  b. Identify the basics of truss installation.
  c. Identify the basics of truss bracing.

Learning Objective 8
• Describe the basics of roof sheathing installation.

Learning Objective 9
• Describe how to perform a material takeoff for a roof.
  a. Determine the materials needed for a gable roof.

Performance Tasks

Performance Task 1 (Learning Objective 1)
• Lay out ceiling joists.

Performance Task 2 (Learning Objective 1)
• Cut and install ceiling joists for a wood frame building.

Performance Task 3 (Learning Objective 1)
• Estimate the number of ceiling joists required for a building.

Performance Task 4 (Learning Objective 4)
• Lay out common roof rafters.

Performance Task 5 (Learning Objective 5)
• Cut and install roof rafters for a gable roof.

Performance Task 6 (Learning Objective 6)
• Frame a gable end wall.

Performance Task 7 (Learning Objective 7)
• Erect a gable roof using trusses.

Performance Task 8 (Learning Objective 8)
• Sheath a gable roof with an opening.

Performance Task 9 (Learning Objective 9)
• Perform a material takeoff for a roof.

Teaching Time: 47.5 hours
(Nineteen 2.5-Hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.
Prerequisites
Core Curriculum

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerinc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.

Safety Considerations
This module requires that trainees demonstrate the safe framing of ceilings and roofs. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

Classroom Equipment and Materials
Whiteboard/Chalkboard
Markers/Chalk
Pencils and paper
Carpentry Level One PowerPoint® Presentation Slides
LCD projector and screen
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing ceiling and roof framing systems (optional)
TV/DVD player (optional)

Equipment and Materials for Laboratories and Performance Testing
Personal protective equipment (PPE):
- Hard hat
- Safety glasses
- Gloves
- Hearing protection
- Face shield
- Respiratory protection
Photographs or drawings that show building construction in various stages of completion
Calculator or smartphone calculator app
2 x 4, 2 x 6, or 2 x 8 framing lumber
Carpenter’s pencil
Measuring tape
4’ level
Plywood
1x lumber
Circular saw
Compound miter saw
2 x 6 strongback or 1 x 4 ribband
8d common nails
16d box nails
Framing hammer
Pneumatic/cordless framing nailer
Extension cord
Photographs of different types of roofs
Manufacturer’s instructions for the Speed Square™
Rafter square
Speed Square™
Framing square
Hacksaw
Sawhorses
Scrap lumber (1 x 2 or 1 x 4)
Photos or illustrations of intersecting roofs that include two gable sections and a gable and hip combination
Four-wall, low wall assembly with double top plate (for use in constructing a gable roof)
Roof plans requiring openings and corresponding engineer’s specifications
Copies of blank job hazard analysis (JHA) forms
Skylight or roof window
Set of rafters for a small roof
Fall protection equipment such as peak anchors and lifelines, lifts, scaffolds, and ladders
Truss placement diagram
Temporary roof braces for trusses
Roof sheathing (OSB or plywood panels)
H-clips
Roof underlayment
Drip edges
Heavy felt
Coated sheets
Shims
Roofing plan for a building
Additional Resources
This module presents thorough resources for task training. The following resource material is suggested for further study:


Cedar Shake and Shingle Bureau. A trade organization that promotes the common interests of members involved in quality cedar shake and shingle roofing, [http://www.cedarbureau.org](http://www.cedarbureau.org)

*Framing Roofs*. Newtown, CT: Taunton Press.


Western Wood Products Association. A trade association representing softwood lumber manufacturers in 12 western states and Alaska, [http://www2.wwpa.org](http://www2.wwpa.org)


There are a number of online resources available for trainees who would like more information on framing ceilings and roofs. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into nineteen 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces ceiling components and laying out ceiling joists.

1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of the module.
3. Discuss roof trusses.
4. Explain the purposes of ceiling joists.
5. Explain how to lay out and splice ceiling joists.

**SESSION TWO**

Session Two introduces cutting, installing, and estimating ceiling joists.

1. Show Session Two PowerPoint® presentation slides.
2. Explain how to cut ceiling joists to the proper length.
3. Discuss and demonstrate ribbands and stongbacks.
4. Explain how to estimate the amount of lumber needed for ceiling joists.

**SESSION THREE**

Session Three introduces types of roofs, roof framing components, and roof layout terminology.

1. Show Session Three PowerPoint® presentation slides.
2. Describe the most common types of roofs used for residential construction.
3. Identify and describe roof framing components.
4. Define terminology related to roof layout.
5. Discuss dormers.

**SESSION FOUR**

Session Four introduces rafter framing tools.

1. Show Session Four PowerPoint® presentation slides.
2. Describe a rafter square and how to use one.
3. Describe the Speed Square™ and how to use it.

**SESSION FIVE**

Session Five introduces laying out rafter locations and determining rafter lengths.

1. Show Session Five PowerPoint® presentation slides.
2. Demonstrate how to make tail cuts and plumb cuts on rafters.
3. Explain the steps of laying out rafter locations.
4. Explain the steps of determining the required length of a rafter.

**SESSION SIX**

Session Six introduces two procedures for laying out and cutting common rafters.

1. Show Session Six PowerPoint® presentation slides.
2. Explain the rafter square method.
3. Explain the Speed Square™ method.
SESSION SEVEN

Session Seven introduces the procedure for laying out and erecting hips and valleys.

1. Show Session Seven PowerPoint® presentation slides.
2. Provide an overview for laying out and erecting hips and valleys.
3. Review the procedure for finding the length of a hip rafter using a rafter square.
4. Review the procedure for laying out a hip rafter.
5. Review the procedure for laying out a hip jack rafter using a rafter square.
6. Review the procedure for laying out a hip rafter using a Speed Square™.

3. Discuss the use of double headers and double trimmer rafters when framing an opening in a roof.

SESSION ELEVEN

Session Eleven introduces how to frame a gable end wall.

1. Show Session Eleven PowerPoint® presentation slides.
2. Review the necessity for venting when constructing attics.
3. Explain the method of framing a gable end opening.

SESSION TWELVE

Session Twelve introduces the framing of a gable overhang.

1. Show Session Twelve PowerPoint® presentation slides.
2. Discuss gable overhangs.
3. Review the two methods for framing a gable overhang.

SESSION THIRTEEN

Session Thirteen introduces the use of trusses in roof framing.

1. Show Session Thirteen PowerPoint® presentation slides.
2. Present an overview of roof trusses.
3. Discuss the use of trusses in residential and commercial construction.
4. Discuss the advantages of prefabricated trusses.
5. Describe types of trusses.
6. Discuss the handling of trusses.
Session Outline for 27112-13
CEILING JOIST AND ROOF FRAMING

SESSION FOURTEEN
Session Fourteen introduces the installation of trusses.
1. Show Session Fourteen PowerPoint® presentation slides.
2. Discuss the safety issues associated with installing trusses.
3. Review the use of framing plans.
4. Discuss the purpose of girders.

SESSION FIFTEEN
Session Fifteen introduces the bracing of trusses.
1. Show Session Fifteen PowerPoint® presentation slides.
2. Discuss permanent and temporary truss bracing.
3. Discuss the use of prefabricated metal trusses.

SESSION SIXTEEN
Session Sixteen introduces the basics of roof sheathing installation.
1. Show Session Sixteen PowerPoint® presentation slides.
2. Provide an overview of sheathing, including purpose, common materials, and application process.
3. Discuss underlayments and metal drip edges.

SESSION SEVENTEEN
Session Seventeen introduces roof sheathing.
1. Show Session Seventeen PowerPoint® presentation slides.
2. Discuss the importance of ensuring that the rafters are the same length before installing the sheathing.
3. Review all safety precautions required when installing sheathing on a sloping roof and when working around roof openings.
4. Discuss felt underlayment.

SESSION EIGHTEEN
Session Eighteen covers estimating amounts of materials needed for a gable roof.
1. Show Session Eighteen PowerPoint® presentation slides.
2. Provide an overview of the estimating process.
3. Describe the components of a material takeoff.
4. Explain the steps of estimating the amount of lumber needed for rafters on a gable roof.
5. Explain the steps of estimating the amount of lumber needed for the ridgeboard on a gable roof.
6. Explain the steps of estimating the number of sheathing panels needed for a gable roof.

SESSION NINETEEN
Session Nineteen is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Eighteen.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.
Module Eight (27109-13) introduces the building envelope system and its components. The module describes the various types of windows, skylights, and exterior doors and provides instructions for installing them. It also includes instructions for installing weather stripping and locksets.

Objectives

Learning Objective 1
• Identify the components of the building envelope.
  a. Describe various ways that air infiltration can be minimized or prevented.
  b. Identify various types of fixed, sliding, and swinging windows.
  c. Identify the common types of exterior doors and explain how they are constructed

Learning Objective 2
• State the requirements for a proper window installation.
  a. Explain when jamb extensions are used.
  b. Identify common considerations when framing in glass blocks.

Learning Objective 3
• State the requirements for a proper door installation.
  a. Identify the differences between residential and commercial doors.

Learning Objective 4
• Identify the various types of locksets used on exterior doors and explain how they are installed.

Performance Tasks

Performance Task 1 (Learning Objective 2)
• Prepare a rough opening for proper window installation.

Performance Task 2 (Learning Objective 3)
• Prepare a rough opening for proper door installation.

Performance Task 3 (Learning Objective 4)
• Install a lockset.

Teaching Time: 12.5 hours
(Five 2.5-hour Classroom Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from www.nccerirc.com. The passing score for submission into NCCER’s Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires that trainees demonstrate the safe installation of windows, doors, and locksets. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

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**Classroom Equipment and Materials**

- Whiteboard/Chalkboard
- Markers/Chalk
- Pencils and paper
- *Carpentry Level One* PowerPoint® Presentation Slides
- LCD projector and screen
- Computer
- Copies of the Module Examination and Performance Profile Sheets
- Vendor-supplied videos/DVDs showing various windows, skylights, and exterior doors (optional)
- TV/DVD player (optional)

**Equipment and Materials for Laboratories and Performance Testing**

- Personal protective equipment (PPE):
  - Hard hat
  - Safety glasses
  - Gloves
  - Hearing protection
- Photographs of older buildings
- Building wrap
- Small plywood panels with 10" × 18" openings
- Nails with large heads, nails or screws with plastic washers or 1"-wide staples
- Hammer
- Stapler
- Contractor’s tape or sealants
- Utility knife
- Tape measure
- Photographs of buildings with a variety of window arrangements
- Stock double-hung window
- Manufacturers’ catalogs or photographs of local buildings with examples of bay windows or skylights
- Manufacturers’ catalogs or photographs of local buildings with examples of doors
- Weather stripping
- Tin snips
- Nail
- Awl
- Nail set
- Screwdriver
- Threshold
- Drill and drill bits
- Coping saw
- Set of basic residential plans
- Prehung window
- Hand levels
- Handsaw
- Framing square
- Combination square
- Shims
- Screws
- Insulation and/or expanding foam
- Manufacturers’ catalogs showing various types of windows
- 30" level
- Caulking gun and sealer
- Carpenter’s pencil
- Door unit
- 16d finishing nails
- Wood screws
- Photographs of local residences
- Boring jig and jig bit
- Mortise marker
- Lockset installation template
- Lockset
- Sandpaper
- Chisel
- Manufacturers’ catalogs showing various types of locksets

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**Additional Resources**

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

- The National Fenestration Rating Council (NFRC). The nation’s recognized authority for measuring and evaluating window energy performance, [http://www.nfrc.org](http://www.nfrc.org)
- Window & Door magazine. An information source for manufacturers, distributors, and dealers of windows and doors, [http://www.windowanddoor.com](http://www.windowanddoor.com)

There are a number of online resources available for trainees who would like more information on the building envelope system and its components. A search for additional information may be assigned as homework to interested trainees.
The lesson plan for this module is divided into five 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

**SESSION ONE**

Session One introduces the building envelope and its components.
1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of the module.
3. Discuss building envelope terminology.
4. Identify building envelope components.

**SESSION TWO**

Session Two introduces trainees to window installation.
1. Show Session Two PowerPoint® presentation slides.
2. Demonstrate the proper installation of a prehung window.
3. Discuss the use of glass block in a building

**SESSION THREE**

Session Three introduces trainees to door installation.
1. Show Session Three PowerPoint® presentation slides.
2. Demonstrate the proper installation of prehung doors.

**SESSION FOUR**

Session Four introduces trainees to proper installation of locksets.
1. Show Session Four PowerPoint® presentation slides.
2. Demonstrate the proper installation of locksets.

**SESSION FIVE**

Session Five is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Four.) Answer any questions that trainees may have.
1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Supervisor.
Tools of the Plumbing Trade
Annotated Instructor’s Guide

Module Overview
This module reviews the basic plumbing tools used to measure, lay out, cut, drill, bore, and ream. Trainees will learn how to safely use, properly care for, and maintain plumbing tools.

Objectives
Upon completion of this module, the trainee will be able to do the following:
1. Identify the basic hand and power tools used in the plumbing trade.
2. Demonstrate the proper use of plumbing tools.
3. Demonstrate the ability to select the proper tool(s) for tasks.
4. Demonstrate proper maintenance and storage for hand and power tools.
5. Describe the safety requirements for using power and hand tools common to the plumbing trade.

Performance Tasks
Under the supervision of the instructor, the trainee should be able to do the following:
1. Identify plumbing tools.
2. Properly use plumbing tools.
3. Demonstrate proper maintenance and storage of hand and power tools.

Materials and Equipment
Computer
Markers/chalk
Pencils and paper
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your local code
Plumber’s toolbox (refer to the list in the appendix)
Sections of iron pipe
Damaged and unsafe tools
Measuring and layout tools
Variety of squares, including:
   Speed
   Combination
   Framing
Levels and precision measuring tools
Torpedo level
Plumb bob
Chalkline
Tooth-edged cutting tools, including:
   Hacksaws
   Reciprocating saws
   Portable band saws
   Abrasive saws
Saw blades: 18, 14, and 32 teeth per inch
Wood and cold chisels
Metal stud punch
Chisel with mushroomed head
Variety of smooth-edged cutting tools
Keel crayon
Soapstone
Variety of drills, including:
   Portable electric
   Offset
   Cordless
   Cordless multitool
Drill bits
Die tool sets
Soldering tools
Variety of wrenches, including:
   Pipe
   Pipe tongs
   Strap
   Spud
   Open-end
   Adjustable
   Basin
   Monkey
   Torque
   Pliers
   Maul
   Wood-splitting wedge
   Sections of wood
   Hollow-shank screwdriver
   Bits
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. Remind trainees that any tool can be dangerous if used carelessly, and that power tools are only to be used under proper supervision. Before beginning hands-on training with any new tool, review the relevant proper handling and use procedures.

**Additional Resources**

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


**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 2 1/2 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 *Tools of the Plumbing Trade*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<tr>
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<td>C. Measuring and Layout Tools</td>
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<td>D. Leveling Tools</td>
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<td><strong>Session II. Plumbing Tools, Part Two</strong></td>
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<td>A. Smooth-Edged Cutting Tools</td>
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<td>B. Drilling and Boring Tools</td>
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<td>C. Electric Pipe-Threading Machine</td>
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<td>D. Soldering Tools</td>
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<td><strong>Session III. Plumbing Tools, Part Three</strong></td>
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<tr>
<td>A. Extension Cords</td>
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<td>B. Tools for Assembly and Holding</td>
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<td>C. Hammers</td>
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<td>D. Screwdrivers</td>
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</tbody>
</table>
Session IV. Plumbing Tools, Part Four; Review and Testing

A. Vises

B. Calculator

C. Review

D. 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.

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 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.

Objectives

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

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

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 support and spacing for the application.

Materials and Equipment

Computer


Appropriate personal protective equipment

Copies of your local code

Flexible pipe

Pipe labels

Sections of plastic pipe, including:

- ABS (acrylonitrile-butadiene-styrene)
- PVC (polyvinyl chloride)
- CPVC (chlorinated polyvinyl chloride)
- PE (polyethylene)
- PEX (cross-linked polyethylene)
- PB (polybutylene)

Sample material safety data sheets (MSDS) for plastic pipe

Tools for measuring

Tools for cutting pipe

Deburring tools

Miter box

Plastic saw for cutting PVC pipe

CPVC or PVC cement or all-purpose cement conforming to ASTM F-493 standards

PVC bell-and-spigot pipe

Lubricant

Tools used to join PEX tubing, including:

- Insert and crimp-ring system
- Tubing cutter
- Hand-crimping tool
- Go-no-go gauge

Cutter designed for plastic tubing

PEX ring

Expander tool

Mechanical joints and clamps

Compression collars

Tools for the butt-fusion method, including:

- Temperature indicator stick
- Heating tool
- Fusion timer
- Socket face
- Cold ring

Manufacturers Standardization Society’s MSS40 hanger standard

National Fire Protection Association (NFPA) 13

Copies of the Quick Quiz*

Module Examinations**

Performance Profile Sheets**

*Located at the back of this 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 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 presents thorough resources for task training. The following resource material is suggested for further study.


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 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.

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<td>C. Sizing</td>
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<td>E. Manufacturers</td>
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<td>Sessions II-III. Plastic Pipe and Fittings</td>
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<td>A. Types of Plastic Pipe</td>
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<td>B. PT/Laboratory</td>
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<tr>
<td>Have trainees practice identifying types of plastic pipes. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>C. Material Storage and Handling</td>
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<td>D. Water Supply Fittings</td>
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<td>E. DWV Fittings</td>
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<tr>
<td>F. PT/Laboratory</td>
<td></td>
</tr>
<tr>
<td>Have trainees practice identifying fittings and valves and their uses. This laboratory corresponds to Performance Task 2.</td>
<td></td>
</tr>
</tbody>
</table>
Session IV. Measuring, Cutting, and Joining

A. Measuring
B. Cutting
C. Joining
D. PT/Laboratory
   Have 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 V. Pipe Supports and Pressure Testing; Review and 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 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 Training Report Form 200, and submit the results to the Training Program Sponsor.
Module Overview

This module discusses the materials commonly used to make fixtures, the most common types of fixtures, and the types of faucets available. Trainees will learn how each type of fixture and faucet operates, as well as how to choose the proper fixtures and faucets for a variety of installations.

Objectives

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

1. Identify the basic types of materials used in the manufacture of plumbing fixtures.
2. Identify common types of sinks, lavatories, and faucets.
3. Identify common types of bathtubs and showers.
4. Identify common types of toilets, urinals, and bidets.
5. Identify and describe common types of drinking fountains and water coolers.
6. Identify common types of appliances connected by a plumber.

Performance Task

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

1. Identify the most commonly installed fixtures and appliances.

Materials and Equipment

- Computer
- Plumbing Level One PowerPoint® Presentation Slides (ISBN 978-0-13-292164-0)
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- Appropriate personal protective equipment
- Copies of your local code
- A variety of porcelain, cast iron, sheet steel, stainless steel, and plastic fixtures
- A variety of photos of fixtures
- Faucet for wheelchair-accessible lavatory
- Electric eye
- A variety of flushing devices
- Directional tee with an internal baffle
- Tools for fixture and faucet installation, including:
  - Basin wrench
  - Spud wrench
  - Seat wrench
  - Crescent wrench
  - Basket strainer wrench
  - Shower valve socket wrench
  - Smooth-jawed crescent wrench
  - Screwdrivers
- Americans with Disabilities Act of 1990 (ADA) Standards for Accessible Design
- 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 back of this instructor’s guide.

Safety Considerations

Ensure that trainees are equipped with appropriate personal protective equipment, and that they are properly instructed on its use.
Additional Resources

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


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 Plumbing Fixtures. 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.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session I. Fixtures and Faucets, Part One</td>
<td></td>
</tr>
<tr>
<td>A. Introduction to Fixtures and Faucets</td>
<td></td>
</tr>
<tr>
<td>B. Materials Used to Make Fixtures</td>
<td></td>
</tr>
<tr>
<td>C. Sinks and Lavatories</td>
<td></td>
</tr>
<tr>
<td>D. Bathtubs</td>
<td></td>
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<tr>
<td>E. Shower Stalls</td>
<td></td>
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<tr>
<td>F. Water Closets</td>
<td></td>
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<tr>
<td>Session II. Fixtures and Faucets, Part Two</td>
<td></td>
</tr>
<tr>
<td>A. Urinals</td>
<td></td>
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<tr>
<td>B. Bidets</td>
<td></td>
</tr>
<tr>
<td>C. Food Waste Disposers</td>
<td></td>
</tr>
<tr>
<td>D. Domestic Dishwashers</td>
<td></td>
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<tr>
<td>E. Laundry Trays</td>
<td></td>
</tr>
<tr>
<td>Session III. Fixtures and Faucets, Part Three; Review and Testing</td>
<td></td>
</tr>
<tr>
<td>A. Service Sinks and Mop Basins</td>
<td></td>
</tr>
<tr>
<td>B. Floor Drains and Floor Sinks</td>
<td></td>
</tr>
<tr>
<td>C. Drinking Fountains and Water Coolers</td>
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<tr>
<td>D. Faucets</td>
<td></td>
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<tr>
<td>E. PT/Laboratory</td>
<td></td>
</tr>
<tr>
<td>Have each trainee identify the most commonly installed fixtures and appliances. This laboratory corresponds to Performance Task 1.</td>
<td></td>
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<tr>
<td>F. Review</td>
<td></td>
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<tr>
<td>G. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from NCCER.</td>
<td></td>
</tr>
<tr>
<td>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</td>
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<tr>
<td>H. Performance Testing</td>
<td></td>
</tr>
<tr>
<td>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.</td>
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<tr>
<td>2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.</td>
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</tbody>
</table>
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.

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 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 an isometric drawing of a simple DWV system and label its components.

Materials and Equipment

Computer

*Plumbing Level One* PowerPoint® Presentation


Markers/chalk

Pencils and paper

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your local code

DWV system design drawings

P-traps

Copies of Figure 8 with the callouts covered

Drainage fittings made from a variety of materials

DWV fittings, including:

- Bends
- Adapters
- Cleanouts
- Tees
- Wyes
- Increasers
- Offsets

Torpedo level

Plans for a municipal waste treatment plant

Plans for a private waste disposal system

Module Examinations*

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

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.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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</thead>
<tbody>
<tr>
<td><strong>Session I. DWV Systems, Fixtures, Drains, and Traps</strong></td>
<td></td>
</tr>
<tr>
<td>A. DWV Systems</td>
<td></td>
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<tr>
<td>B. Fixture Drains</td>
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<tr>
<td>C. Types of Traps</td>
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<tr>
<td>D. Parts of Traps</td>
<td></td>
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<tr>
<td><strong>Session II. Installation Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>A. Trap Installation Requirements</td>
<td></td>
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<tr>
<td>B. Why a Trap Loses Its Seal</td>
<td></td>
</tr>
<tr>
<td><strong>Session III. Vents, Drains, and Fittings</strong></td>
<td></td>
</tr>
<tr>
<td>A. Vents</td>
<td></td>
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<tr>
<td>B. Sizing Drains and Vents</td>
<td></td>
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<tr>
<td>C. Fittings and Their Applications</td>
<td></td>
</tr>
<tr>
<td><strong>Session IV. DWV System Design; Review and Testing</strong></td>
<td></td>
</tr>
<tr>
<td>A. Grade</td>
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<tr>
<td>B. Building Drain</td>
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<tr>
<td>C. Building Sewer</td>
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<tr>
<td>D. Sewer Main</td>
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<tr>
<td>E. Waste Treatment</td>
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<tr>
<td>F. Code and Health Issues</td>
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<tr>
<td>G. PT/Laboratory</td>
<td></td>
</tr>
<tr>
<td>Have trainees sketch an isometric drawing of a simple DWV system and label its components. This laboratory corresponds to Performance Task 1.</td>
<td></td>
</tr>
<tr>
<td>H. Review</td>
<td></td>
</tr>
<tr>
<td>I. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from NCCER.</td>
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</tr>
<tr>
<td>2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.</td>
<td></td>
</tr>
<tr>
<td>J. Performance Testing</td>
<td></td>
</tr>
<tr>
<td>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.</td>
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</tr>
<tr>
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</tr>
</tbody>
</table>
Module Overview

This module discusses the processes in which water is distributed. Trainees will learn to identify the components and functions of a water distribution system, as well as explain the relationships among the components.

Objectives

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

1. Describe the process by which water is distributed in municipal, residential, and private water systems.
2. Identify the major components of a water distribution system, and describe the function of each component.
3. Explain the relationships between components of a water distribution system.

Performance Task

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

1. Sketch an isometric drawing of a simple water distribution system and label its components.

Materials and Equipment

Computer

Plumbing Level One PowerPoint® Presentation


Markers/chalk

Pencils and paper

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your local code

Copies of Figure 4 with the callouts covered

Sample water distribution piping diagram

Attachments, including:

Stems

Discs

Seat rings

Disc holders or guides

Wedges

Bushings

A variety of valves, including:

Gate valves

Globe valves

Angle valves

Ball valves

Check valves

Pressure regulator valves

Supply stop valves

Temperature and pressure relief valves

Drafting paper

Drawings of the hypothetical DWV systems completed by trainees for the module, “Introduction to DWV Systems”

Module Examinations*

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


### 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 2 1/2 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 Water Distribution 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.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session I. Introduction</strong></td>
<td></td>
</tr>
<tr>
<td>A. Sources of Water</td>
<td></td>
</tr>
<tr>
<td>B. Water Treatment</td>
<td></td>
</tr>
<tr>
<td><strong>Session II. Supply and Distribution</strong></td>
<td></td>
</tr>
<tr>
<td>A. Materials</td>
<td></td>
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<tr>
<td>B. Service Line from a Private Water Supply</td>
<td></td>
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<tr>
<td>C. Service Line from a Public Water Main</td>
<td></td>
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<tr>
<td><strong>Session III. Cross-Connection</strong></td>
<td></td>
</tr>
<tr>
<td>A. Cross-Connection</td>
<td></td>
</tr>
<tr>
<td>B. Backflow Preventers</td>
<td></td>
</tr>
<tr>
<td>C. Valves</td>
<td></td>
</tr>
<tr>
<td>D. Types of Valves</td>
<td></td>
</tr>
<tr>
<td><strong>Session IV. Building Distribution; Review and Testing</strong></td>
<td></td>
</tr>
<tr>
<td>A. Locating Components</td>
<td></td>
</tr>
<tr>
<td>B. Sizing the Main Supply Lines</td>
<td></td>
</tr>
<tr>
<td>C. Fixtures and Faucets</td>
<td></td>
</tr>
<tr>
<td>D. PT/Laboratory</td>
<td></td>
</tr>
<tr>
<td>Have trainees sketch an isometric drawing of a simple water distribution system and label its components. This laboratory corresponds to Performance Task 1.</td>
<td></td>
</tr>
<tr>
<td>E. Review</td>
<td></td>
</tr>
<tr>
<td>F. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from NCCER.</td>
<td></td>
</tr>
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<td>F. Performance Testing</td>
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</tr>
</tbody>
</table>
Lesson Plans for Module 26102-17

ELECTRICAL SAFETY

Module Two (26102-17) discusses electrical hazards and describes the various types of personal protective equipment (PPE) used to reduce injuries. It also covers the standards related to electrical safety and the OSHA lockout/tagout rule.

Objectives

Learning Objective 1
• Identify electrical hazards and their effects.
  a. Understand the effects of electrical shock on the human body.
  b. Verify that circuits are de-energized.

Learning Objective 2
• Use PPE to reduce the risk of injury.
  a. Identify OSHA requirements for protective equipment.
  b. Select and use protective equipment.

Learning Objective 3
• Identify the standards that relate to electrical safety.
  a. Apply OSHA requirements in the workplace.
  b. Understand the purpose of NFPA 70E®.

Learning Objective 4
• Recognize the safety requirements for various hazards.
  a. Identify the safety hazards associated with ladders, scaffolds, and lift equipment.
  b. Avoid back injuries by practicing proper lifting techniques.
  c. Demonstrate basic tool safety.
  d. Identify confined space entry procedures.
  e. Work safely with dangerous materials.
  f. Select and use appropriate fall protection.

Performance Tasks

Performance Task 1
(Learning Objectives 2 and 4)
• Properly select and use PPE.

Performance Task 2
(Learning Objective 4)
• Describe the safety requirements for an instructor-supplied task, such as replacing the lights in your classroom.
  – Discuss the work to be performed and the hazards involved.
  – If a ladder is required, perform a visual inspection on the ladder and set it up properly.
  – Ensure that local emergency telephone numbers are either posted or known by you and your partner(s).
  – Plan an escape route from the location in the event of an accident.

Note
NFPA 70®, National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Quincy, MA.

Teaching Time: 10 hours
(Four 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum

Before You Begin
As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint Presentations® and Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
Safety Considerations

This module provides an overview of safe working procedures. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any safety hazards. Remind trainees that the safety procedures on each job site may be more stringent than OSHA or NEC® requirements.

Classroom Equipment and Materials

<table>
<thead>
<tr>
<th>Equipment and Materials for Laboratories and Performance Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whiteboard and markers</td>
</tr>
<tr>
<td>Pencils and paper</td>
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<tr>
<td>DVD player</td>
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<tr>
<td>LCD projector and screen</td>
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<tr>
<td>Computer</td>
</tr>
<tr>
<td>Internet access during class (optional)</td>
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<tr>
<td>Copy of the latest edition of the National Electrical Code®</td>
</tr>
<tr>
<td>OSHA Electrical Safety Guidelines (pocket guide)</td>
</tr>
<tr>
<td>NFPA 70E, Standard for Electrical Safety in the Workplace®</td>
</tr>
<tr>
<td>Company safety manual</td>
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<tr>
<td>Solvent MSDS</td>
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<tr>
<td>Module Review answer key</td>
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<tr>
<td>Module Examinations</td>
</tr>
<tr>
<td>Performance Profile Sheets</td>
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<tr>
<td>Access to eye wash station</td>
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<tr>
<td>Various types of personal protective and safety equipment, including:</td>
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<tr>
<td>Rubber gloves</td>
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<tr>
<td>Insulating blankets</td>
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<tr>
<td>Hot sticks</td>
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<tr>
<td>Fuse pullers</td>
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<tr>
<td>Shorting probes</td>
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<tr>
<td>Safety glasses/goggles</td>
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<tr>
<td>Face shields</td>
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<tr>
<td>Hard hats</td>
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<tr>
<td>GFCI device</td>
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<tr>
<td>Company lockout/tagout procedures</td>
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<tr>
<td>Lockout/tagout devices and labels</td>
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<tr>
<td>Work gloves</td>
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<tr>
<td>Stepladders</td>
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<tr>
<td>Straight ladders</td>
</tr>
<tr>
<td>Fall arrest system</td>
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<tr>
<td>Safety harnesses</td>
</tr>
</tbody>
</table>

Additional Resources

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


There are a number of online resources available for trainees who would like more information on electrical safety. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
# Session Outline for Module 26102-17

## Electrical Safety

The Lesson Plan for this module is divided into four 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

### Session One

Session One covers Sections 1.0.0 through 3.2.0, and describes procedures for identifying electrical hazards, using appropriate personal protective equipment, and identifying the standards that govern safety in the workplace.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with construction safety.
3. Describe the effects of electrical shock on the human body.
4. Explain how to verify that circuits are de-energized.
5. Identify OSHA requirements for protective equipment.
6. Demonstrate how to select and use protective equipment.
7. Identify the standards that govern safety in the workplace.

### Session Two

Session Two covers Sections 4.0.0 through 4.3.2, and describes procedures for identifying the safety requirements for working at elevations, lifting, and tool use.

1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with scaffold hazards.
3. Identify the safety hazards associated with ladders and scaffolds.
4. Identify the safety hazards associated with lifts, hoists, and cranes.
5. Demonstrate how to avoid back injuries by practicing proper lifting techniques.
6. Demonstrate basic tool safety.

### Sessions Three & Four

Sessions Three & Four cover Sections 4.4.0 through 4.6.3, and describe procedures for confined spaces, dangerous materials, and fall protection. In addition, this session includes a review of the complete module and administration of the module exam.

1. Show the Sessions Three & Four PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with fall hazards.
3. Identify confined space entry procedures.
4. Describe how to work safely with dangerous materials.
5. Demonstrate how to select and use appropriate fall protection.
6. Have the trainees complete the tasks in Performance Tasks 1 and 2.
7. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
8. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.

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**The Lesson Plan for this module is divided into four 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.**
Module Five (26105-17) describes the purpose of the NEC® and explains how to use it to find the installation requirements for various electrical devices and wiring methods. It also provides an overview of the National Electrical Manufacturers Association and Nationally Recognized Testing Laboratories.

**Objectives**

**Learning Objective 1**
- Explain the purpose and history of the NEC®.
  a. Trace the history of the NEC®.
  b. Identify the roles of other organizations.

**Learning Objective 2**
- Navigate the NEC®.
  a. Identify the chapters in the NEC®.
  b. Use the NEC® to find specific installation requirements.

**Performance Tasks**

**Performance Task 1 (Learning Objective 2)**
- Use NEC Article 90 to determine the scope of the NEC®. State what is covered by the NEC® and what is not.

**Performance Task 2 (Learning Objective 2)**
- Find the definition of the term feeder in the NEC®.

**Performance Task 3 (Learning Objective 2)**
- Look up the NEC® specifications that you would need to follow if you were installing an outlet near a swimming pool.

**Performance Task 4 (Learning Objective 2)**
- Find the minimum wire bending space required for two No. 1/0 AWG conductors installed in a junction box or cabinet and entering opposite the terminal.

**Note**

NFPA 70®, National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Quincy, MA.

**Teaching Time: 7.5 hours**
(Three 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

Core Curriculum

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint Presentations® and Performance Profile Sheets from www.nccerinc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
Additional Resources

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


There are a number of online resources available for trainees who would like more information on navigating the National Electrical Code®. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
Session Outline for Module 26105-17

INTRODUCTION TO THE NATIONAL ELECTRICAL CODE®

The Lesson Plan for this module is divided into three 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

SESSION ONE

Session One covers Section 1.0.0, and describes the purpose and history of the NEC®.
1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with the role of the NFPA.
3. Trace the history of the NEC®.
4. Identify the roles of other organizations.

SESSIONS TWO & THREE

Sessions Two & Three cover Section 2.0.0, and describe procedures for navigating the NEC®. In addition, this session includes a review of the complete module and the module exam is administered.
1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with navigating the National Electrical Code®.
3. Identify the chapters in the NEC®.
4. Show the trainees how to use the NEC® to find specific installation requirements.
5. Have the trainees find the NEC® information listed in Performance Tasks 1 through 4.
6. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
7. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.
Module Six (26106-17) describes the various types of boxes and explains how to calculate the NEC® fill requirements for outlet and junction boxes under 100 cubic inches (1,650 cubic centimeters). It also covers mounting methods.

**Objectives**

**Learning Objective 1**
- Size and install outlet boxes.
  a. Identify boxes and their applications.
  b. Size outlet boxes.
  c. Install outlet boxes.

**Learning Objective 2**
- Size and install pull and junction boxes.
  a. Size pull and junction boxes.
  b. Install pull and junction boxes.

**Performance Tasks**

**Performance Task 1 (Learning Objective 1)**
- Identify the appropriate box type and size for a given application.

**Performance Task 2 (Learning Objective 2)**
- Select the minimum size pull or junction box for the following applications:
  - Conduit entering and exiting for a straight pull.
  - Conduit entering and exiting at an angle.

**Note**

NFPA 70®, National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Quincy, MA.

**Teaching Time: 10 hours**

(Four 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

*Core Curriculum*

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint Presentations® and Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.
**Safety Considerations**

This module requires trainees to work with various types of boxes. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any safety hazards. Remind trainees that knockouts have sharp edges and gloves/safety goggles must be worn at all times.

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- *Electrical Level One PowerPoint® Presentation Slides*
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Copy of the latest edition of the *National Electrical Code®*
- Module Review answer key
- Module Examinations
- Performance Profile Sheets

**Equipment and Materials for Laboratories and Performance Testing**

- Safety glasses/goggles
- Hard hats
- Work gloves
- Electrician’s hand tools
- Conduit caps
- Examples of different types of metallic and nonmetallic outlet boxes, device covers, and extension rings
- Examples of pull and junction boxes
- Wire nuts
- NM cable

**Additional Resources**

This module presents thorough resources for task training. The following reference material is recommended for further study.


There are a number of online resources available for trainees who would like more information on sizing and installing boxes. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
The Lesson Plan for this module is divided into four 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**
 Session One covers Sections 1.0.0 through 1.1.5, and describes outlet boxes and their applications.
1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with outlet boxes.
3. Explain how to identify various types of boxes and their applications.

**SESSION TWO**
 Session Two covers Sections 1.2.0 through 1.3.2, and covers outlet box sizing and installation.
1. Show the Session Two PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with installing outlet boxes.
3. Explain how to size outlet boxes.
4. Explain how to install outlet boxes.
5. Have the trainees identify the appropriate box type and size for a given application. This laboratory corresponds to Performance Task 1.

**SESSION THREE**
 Session Three covers Sections 2.0.0 through 2.2.0, and describes procedures for pull and junction box sizing and installation.
1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with pull box sizing.
3. Describe how to size pull and junction boxes.
4. Describe how to install pull and junction boxes.

**SESSION FOUR**
 Session Four is reserved for a laboratory and performance testing.
1. Demonstrate how to install pull and junction boxes.
2. Have the trainees select the minimum size pull or junction box for the following applications (this laboratory corresponds to Performance Task 2):
   - Conduit entering and exiting for a straight pull.
   - Conduit entering and exiting at an angle.
3. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
4. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.
Module Nine (26109-17) discusses conductor types, cable markings, color codes, and ampacity derating. It also describes how to install conductors using fish tape and power conduit fishing systems.

### Objectives

#### Learning Objective 1
- Classify conductors by wire size, insulation, and application.
  - a. Identify wire sizes.
  - b. Determine conductor ampacities.
  - c. Identify conductor materials.
  - d. Identify conductor insulation.
  - e. Identify fixture wiring.
  - f. Identify cable types and applications.
  - g. Identify instrumentation control wiring.

#### Learning Objective 2
- Install conductors in a conduit system.
  - a. Install conductors using fish tape.
  - b. Install conductors using pulling equipment.

### Performance Task

#### Performance Task 1 (Learning Objective 2)
- Install conductors in a raceway system.

### Teaching Time: 10 hours
(Four 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

**Core Curriculum**

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint Presentations® and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). For information and updates about accessing the Module Examinations, visit [www.nccer.org/testing](http://www.nccer.org/testing). The passing score for submission into NCCER's Registry is 70% or above for the module examination; performance testing is graded pass or fail.
**Additional Resources**

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


There are a number of online resources available for trainees who would like more information on installing conductors. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.

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**Safety Considerations**

This module requires trainees to work with conductors and pulling equipment. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any safety hazards. Remind trainees that cut conductors have sharp edges and gloves/safety goggles must be worn at all times. Emphasize the safety hazards and precautions required when pulling conductors.
The Lesson Plan for this module is divided into four 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**

Session One covers Sections 1.0.0 through 1.4.5, and describes procedures for classifying conductors.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with conductor markings.
3. Explain how to identify wire sizes.
4. Explain how to determine conductor ampacities.
5. Explain how to identify conductor materials.
6. Explain how to identify conductor insulation.

**SESSION TWO**

Session Two covers Sections 1.5.0 through 1.7.3, and describes specialty conductors.

1. Show the Session Two PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with various types of wires and cables.
3. Explain how to identify fixture wiring.
4. Explain how to determine cable types and applications.
5. Explain how to identify instrumentation control wiring.

**SESSION THREE**

Session Three covers Sections 2.0.0 through 2.2.3, and describes procedures for installing conductors in a conduit system.

1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with fish tape.
3. Describe how to install conductors using fish tape.
4. Describe how to install conductors using pulling equipment.

**SESSION FOUR**

Session Four is reserved for a laboratory and performance testing.

1. Demonstrate how to install conductors in a raceway system.
2. Have the trainees practice installing conductors in a raceway system. This laboratory corresponds to Performance Task 1.
3. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
4. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.
Lesson Plans for Module 26111-17

RESIDENTIAL ELECTRICAL SERVICES

Module Eleven (26111-17) discusses basic load calculations and NEC® requirements for residential electrical systems. It also describes how to lay out branch circuits, install wiring, size outlet boxes, and install wiring devices.

Objectives

Learning Objective 1
• Size the electric service for a dwelling.
  a. Calculate the electric service load.
  b. Apply demand factors.
  c. Calculate appliance loads.
  d. Size the load center.

Learning Objective 2
• Identify the grounding requirements for a residential electrical system.
  a. Size grounding electrodes.
  b. Size the main bonding jumper.
  c. Install the equipment grounding system.

Learning Objective 3
• Install service-entrance equipment.
  a. Identify the service drop location.
  b. Select the panelboard location.

Learning Objective 4
• Identify wiring methods for various types of residences.
  a. Select and install cable systems.
  b. Select and install raceways.

Learning Objective 5
• Lay out branch circuits and size outlet boxes.
  a. Complete the branch circuit layout for power.
  b. Complete the branch circuit layout for lighting.
  c. Install outlet boxes.

Learning Objective 6
• Select and install various wiring devices.
  a. Select and install receptacles.
  b. Select and install switches.
  c. Install devices near residential swimming pools, spas, and hot tubs.

Performance Tasks

Performance Task 1 (Learning Objective 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 conductors, panelboard, and protective devices.

Performance Task 2 (Learning Objective 3)
• Using an unlabeled diagram of a panelboard (Performance Profile Sheet 3), label the lettered components.

Performance Task 3 (Learning Objective 5)
• Select the proper type and size of outlet box needed for a given set of wiring conditions.

Note
NFPA 70®, National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Quincy, MA.

Teaching Time: 15 hours
(Six 2.5-Hour Sessions)
Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Prerequisites
Core Curriculum
Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint Presentations® and Performance Profile Sheets from www.nccerirc.com. For information and updates about accessing the Module Examinations, visit www.nccer.org/testing. The passing score for submission into NCCER’s Registry is 70% or above for the module examination; performance testing is graded pass or fail.

Safety Considerations

This module requires trainees to work with electrical conductors and boxes with sharp edges. Electrical and mechanical safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and remain aware of any safety hazards.

Classroom Equipment and Materials
- Whiteboard and markers
- Pencils and paper
- Electrical Level One PowerPoint® Presentation Slides
- DVD player
- LCD projector and screen
- Computer
- Internet access during class (optional)
- Copy of the latest edition of the National Electrical Code®
- Calculator
- Residential floor plan
- Blank worksheet for general lighting loads
- Module Review answer key
- Module Examinations
- Performance Profile Sheets

Equipment and Materials for Laboratories and Performance Testing
- Appropriate personal protective equipment
- Various types of GFCIs
- Panelboard
- Various grounding devices (clips, screws, clamps, bonding bushings, wedges, etc.)
- Examples of made-type grounding electrodes
- Basic electrician's tools, including various wire cutters and cable strippers
- Examples of cable, including:
  - Type NM
  - Type AC
  - Type UF
  - Type SE/USE
- Examples of raceways, including:
  - Rigid
  - IMC
  - EMT
  - Flexible
  - PVC
- 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

Additional Resources

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


There are a number of online resources available for trainees who would like more information on installing residential electrical services. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
**Session Outline for Module 26111-17**

**RESIDENTIAL ELECTRICAL SERVICES**

The Lesson Plan for this module is divided into six 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

### Sessions One and Two

Sessions One & Two cover Section 1.0.0, and they describe procedures for sizing the electrical service for a dwelling.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with residential load estimating.
3. Demonstrate how to calculate the service load for a sample residence.
4. Explain how to apply demand factors.
5. Explain how to calculate appliance loads.
6. Demonstrate how to size the load center, including GFCIs and AFCIs.
7. Have the trainees practice computing lighting, appliance, and laundry loads; determining the number of branch circuits required to serve these loads; and selecting the service-entrance conductors, panelboard, and protective devices. This laboratory corresponds to Performance Task 1.

### Session Three

Session Three covers Sections 2.0.0 and 3.0.0, and it describes procedures for identifying the grounding requirements for a residential electrical system and installing the service-entrance equipment.

1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with the installation of ground rods.
3. Explain how to size the grounding electrodes for a sample residence.
4. Explain how to size the main bonding jumper for a sample residence.
5. Describe the installation methods for equipment grounding systems.
6. Explain how to identify the service drop location.
7. Describe how to select the panelboard location.
8. Have the trainees label a panelboard diagram. This laboratory corresponds to Performance Task 2.
## Session Outline for Module 26111-17

### Residential Electrical Services

### Session Four
Session Four covers Section 4.0.0, and it describes procedures for identifying wiring methods for various types of residences.

1. Show the Session Four PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with residential wiring.
3. Demonstrate how to select and install cable systems.
4. Demonstrate how to select and install raceways.

### Session Five
Session Five covers Section 5.0.0, and it describes procedures for laying out branch circuits and sizing outlet boxes.

1. Show the Session Five PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with branch circuits and outlet boxes.
3. Explain how to complete the branch circuit layout for power.
4. Explain how to complete the branch circuit layout for lighting.
5. Demonstrate how to select and install outlet boxes.
6. Have the trainees practice selecting the proper type and size of outlet box for a given set of wiring conditions. This laboratory corresponds to Performance Task 3.

### Session Six
Session Six covers Section 6.0.0, and it describes procedures for selecting and installing various wiring devices. In addition, this session includes a review of the complete module and the module exam is administered.

1. Show the Session Six PowerPoint® presentation.
2. Use the Kickoff Activity to review wiring devices.
3. Demonstrate how to select and install receptacles.
4. Demonstrate how to select and install switches.
5. Explain the special installation needs for devices near pools, spas, and hot tubs.
6. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
7. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.
Module Twelve (26112-17) covers the applications of various types of electrical test equipment. It also describes meter safety precautions and category ratings.

**Objectives**

**Learning Objective 1**
- Identify various types of electrical test equipment.
  a. Identify the applications of a voltmeter.
  b. Identify the applications of an ammeter.
  c. Identify the applications of an ohmmeter.
  d. Identify the applications of a multimeter.
  e. Identify the applications of other meters.

**Learning Objective 2**
- Select a meter with the correct category rating for an application.
  a. Identify electrical test equipment safety hazards.

**Performance Tasks**

**Performance Task 1 (Learning Objective 2)**
- Measure the voltage in the classroom from line to neutral and neutral to ground.

**Performance Task 2 (Learning Objective 2)**
- Use an ohmmeter to measure the value of various resistors.

**Note**

NFPA 70®, National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Quincy, MA.

**Teaching Time: 5 hours**

(Two 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

**Prerequisites**

Core Curriculum.

**Before You Begin**

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

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

*ABCs of DMMs, Multimeter Features and Functions Explained.* Everett, WA: Fluke Corporation.

*ABCs of Multimeter Safety.* Everett, WA: Fluke Corporation.

*Clamp Meter ABCs.* Everett, WA: Fluke Corporation.


There are a number of online resources available for trainees who would like more information on electrical test equipment. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
The Lesson Plan for this module is divided into two 2.5-hour sessions. This time includes 10 minutes for administrative tasks and a 10-minute break per session.

**SESSION ONE**

Session One covers Sections 1.0.0 and 2.0.0, and describes various types of electrical test equipment.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to introduce electrical test equipment.
3. Identify various types of electrical test equipment.
4. Select a meter with the correct category rating for an application.

**SESSION TWO**

Session Two is reserved for a laboratory and performance testing. In addition, this session includes a review of the complete module and administering the module exam.

1. Demonstrate how to use various types of electrical test equipment.
2. Have the trainees practice measuring the voltage in the classroom from line to neutral and neutral to ground. This laboratory corresponds to Performance Task 2.
3. Have the trainees practice using an ohmmeter to measure the value of various resistors. This laboratory corresponds to Performance Task 2.
4. Have the trainees complete the module review questions. Go over the review questions in class prior to the exam and answer any questions that the trainees may have.
5. Administer the Module Examination and any outstanding performance testing, and submit the results to your Training Program Sponsor through the Registry System.