Lesson Plans for Module 28101-13

Introduction to Masonry

Module One (28101-13) provides information about basic masonry materials, tools, techniques, and safety precautions; explains how to mix mortar by hand and lay masonry units; and describes the skills, attitudes, and abilities of successful masons.

Objectives

Learning Objective 1

- Describe modern masonry materials and techniques.
  a. Explain how concrete masonry units (CMUs or block) are used in construction.
  b. Explain how clay masonry units (brick) are used in construction.
  c. Explain how stone is used in construction.
  d. Describe how mortar and grout are used in masonry construction.
  e. Describe how wall structures are created using masonry units.

Learning Objective 2

- Recognize the basic safety precautions when working with masonry materials.
  a. List basic safety practices.
  b. Describe personal protective equipment used in masonry.

Learning Objective 3

- Explain how to mix mortar and lay masonry units.
  a. Explain how to mix mortar.
  b. Describe how to lay masonry units.

Learning Objective 4

- Describe the skills, attitudes, and abilities needed to be a successful mason.
  a. Identify the skills of a successful mason.
  b. Identify the attitudes of a successful mason.
  c. Identify the abilities of a successful mason.
  d. Explore career ladders and advancement possibilities in masonry.

Learning Objective 5

- Summarize how to be connected to the industry through an organization like SkillsUSA.
  a. Understand the program, curriculum, and SkillsUSA championships.
  b. Understand SkillsUSA membership.
  c. Understand the National Program of Work Standards.

Performance Tasks

Performance Task 1 (Learning Objective 2)

- Put on eye protection and respiratory protection.

Performance Task 2 (Learning Objective 3)

- Properly mix mortar by hand.

Performance Task 3 (Learning Objective 3)

- Properly spread mortar using a trowel.

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.

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 ability to properly mix mortar by hand and lay masonry units. Safety is paramount in the masonry 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
Masonry Level One PowerPoint® Presentation Slides
LCD projector and screen
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing mortar mixing and spreading, and laying masonry units (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

A variety of commonly used sizes, shapes, and weights of concrete masonry units
A variety of concrete brick, a concrete pre-faced and precoated unit, a concrete manhole and catch basin unit, insulated block, and a variety of architectural blocks
A variety of standard brick, hollow masonry units, and architectural units
Photos of buildings constructed of different types of stone and manufactured stone veneer
Copies of *CFR 1926.20, CFR 1926.21,* and *CFR 1926.32*
Several types of eye and face protection
Several types of respiratory protection
Gloves
Hard hats
Eye protection
Hearing protection
Safety shoes
Respiratory protection
Basic brick trowels
Sand
Cement, lime, or masonry cement and recipe
A supply of water
Mortar boxes
Shovels
Wheelbarrows
Mortarboards or mortar pans
Water hose with spray nozzle
Stiff brushes
2 × 4 boards
Cement blocks
Brick
Mason's level

Additional Resources and References

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

Bricklaying: Brick and Block Masonry. Reston, VA: Brick Industry Association.

Building Block Walls: A Basic Guide for Students in Masonry Vocational Training. 1988. Herndon, VA: National Concrete Masonry Association.

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

Concrete Masonry Shapes and Sizes Manual CD-ROM. Herndon, VA: National Concrete Masonry Association.

Hot & Cold Weather Masonry Construction Manual. 1999. Herndon, VA: National Concrete Masonry Association.

Installation Guide for Adhered Concrete Masonry Veneer, Third Edition. 2012. Washington, DC: Masonry Veneer Manufacturers Association.

SkIlsUSA Professional Development Resources. **http://www.skillsusa.org/store/curricula.html**

There are a number of online resources available for trainees who would like more information on materials, tools, and techniques used by masons, as well as basic safety precautions and the skills, attitudes, and abilities exhibited by successful masons. A search for additional information may be assigned as homework to interested trainees.

Session Outline for 28101-13

Introduction to Masonry

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 modern masonry materials.

1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of different types of concrete masonry units, clay masonry units, and stone.
3. Describe cement-lime mortars, masonry cement, preblended mortars, and grout, as well as their properties, and uses.
4. Discuss the advantages of masonry walls.

Session Two

Session Two introduces basic safety precautions and personal protective equipment used in masonry.

1. Show Session Two PowerPoint® presentation slides.
2. Explain basic safety precautions and PPE needed when working with masonry materials.
3. Set up stations with various types of eye and respiratory protection. Explain the features of each type of eye and respiratory protection and have trainees put on each one. Note the proficiency of each trainee. This laboratory corresponds to Performance Task 1.

Session Three

Session Three introduces the basic elements of bricklaying.

1. Show Session Three PowerPoint® presentation slides.
2. Explain the personal relation between a mason and a masonry unit as being a craft. Describe tools and equipment used to mix and spread mortar, and lay brick.
3. Set up workstations with materials needed to mix mortar by hand. Under your supervision, have trainees mix mortar. Make sure the trainees wear appropriate personal protective equipment. Note the proficiency of each trainee. This laboratory corresponds with Performance Task 2.
4. Under your supervision, have trainees lay masonry units. Make sure the trainees wear appropriate personal protective equipment. Note the proficiency of each trainee. This laboratory corresponds with Performance Task 3.

SESSION FOUR

Session Four introduces trainees to the skills, attitudes, and abilities of a successful mason.

1. Show Session Four PowerPoint® presentation slides.
2. Describe the skills that a successful mason needs.
3. Have trainees discuss the features of a good attitude, including dependability, responsibility, adaptability, pride, and ethics. Also have trainees discuss the personal abilities that a mason must have.
4. Provide a brief overview of the stages of skill recognized by masons' organizations.
5. Explain the SkillsUSA program, curriculum, and championships. Define the National Program of Work Standards and how they assist in carrying out the plan of action for a SkillsUSA chapter.

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 Sponsor.

Lesson Plans for Module 28105-13

Masonry Units and Installation Techniques

Module Six (28105-13) describes characteristics of block and brick; how to set up, lay out, and bond block and brick; how to cut block and brick; how to lay and tool block and brick; and how to clean block and brick once they have been laid. This module also provides information about masonry reinforcements and accessories that masons use on the job to lay block and brick professionally and safely.

Objectives

Learning Objective 1

- Describe how to install concrete masonry units.
  - a. Identify the characteristics of concrete masonry units.
  - b. Explain how to set up, lay out, and bond concrete masonry units.
  - c. Explain how to lay and tool concrete masonry units.
  - d. Explain how to clean concrete masonry units.

Learning Objective 2

- Describe how to install brick.
  - a. Identify the characteristics of brick.
  - b. Explain how to set up, lay out, and bond brick.
  - c. Explain how to lay and tool brick.
  - d. Explain how to clean brick.

Learning Objective 3

- Describe how to cut concrete masonry units and brick.
  - a. Explain how to cut with chisels and hammers.
  - b. Explain how to cut with masonry hammers.
  - c. Explain how to cut with saws and splitters.
  - d. Explain how to check units and cuts.

Learning Objective 4

- Describe how to install masonry reinforcement and accessories.
  - a. Describe how to install masonry reinforcements.
  - b. Describe how to install masonry accessories.

Performance Tasks

Performance Task 1 (Learning Objective 1)

- Lay a dry bond for block.

Performance Task 2 (Learning Objective 1)

- Tool a bed joint for block.

Performance Task 3 (Learning Objective 1)

- Lay block to the line in courses that are true for height, level, plumb, and range.

Performance Task 4 (Learning Objective 1)

- Build a block lead.

Performance Task 5 (Learning Objective 2)

- Lay a dry bond for brick.

Performance Task 6 (Learning Objective 2)

- Tool a bed joint for brick.

Performance Task 7 (Learning Objective 2)

- Lay brick to the line in courses that are true for height, level, plumb, and range.

Performance Task 8 (Learning Objective 2)

- Build a brick lead.

Performance Task 9 (Learning Objective 3)

- Accurately cut block using the following tools:
  - A masonry hammer
  - A brick set
  - A power saw
  - A splitter

Performance Task 10 (Learning Objective 3)

- Accurately cut brick using the following tools:
  - A masonry hammer
  - A brick set
  - A power saw
  - A splitter

Teaching Time: 60 hours

(Twenty-four 2.5-hour classroom sessions)

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

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 ability to install and cut masonry units. Safety is paramount in the masonry 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

Masonry Level One PowerPoint® Presentation Slides

LCD projector and screen

Computer

Copies of the Module Examination and Performance Profile Sheets

Vendor-supplied videos/DVDs showing installation and cutting of masonry units (optional)

TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

"The Basics of Brickwork Details"

A watch with a second hand

Bags of sand or boards

Bits of wood

Brick Industry Association's booklet, *Cleaning Brickwork*

Brick sets

Brick splitters

Bricks

Bucket

Chalklines

Chemical cleaning solution for brick

Chisel

Concrete blocks

Construction drawings for a simple structure

Copies of a set of construction drawings and specifications for a simple brick structure that includes an opening for a door and a window, the schedule, any referenced standards and codes, and an estimation of workers, materials, and equipment needed for the job

Copies of the National Concrete Masonry Association's booklet, *Cleaning Concrete Masonry*

Copies of the safety data sheet and the manufacturer's directions for mixing, using, and storing a chemical cleaning solution for brick

Corner poles

First course of concrete blocks, with a length greater than 4 feet, already in place

Framing squares

Grease pencils

Hammers

Hose

Jointers, including convex sled runners and rakers

Levels

Markers

Masonry hammers

Mason's chisels

Mason's lines

Materials and tools needed for hand-mixing mortar

Medicine droppers

Modular and standard course spacing rules

Mortar boxes

Mortar mixing materials

National Concrete Masonry Association's booklet, *Steel Reinforcement for Concrete Masonry*

Pencils

Personal protective equipment

Plans and specifications for a simple concrete structure that includes an opening for a door and a window

Portable masonry saws with operating instructions

Rules

Sets of drawing plans that include a detailed drawing of an unreinforced outside-corner lead in a half-lap running bond pattern and specifications

Squares

Stiff brush

String

Tables

Tools and equipment needed for hand-mixing mortar

Trowels

Various types of jointers, including runner jointers and rake-out jointers

Various types of line fasteners

Water

Wax markers

Wooden scraper

Additional Resources and References

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

The ABCs of Concrete Masonry Construction. Skokie, IL: Portland Cement Association (Video, 13:34).

ASTM C90, Standard Specification for Loadbearing Concrete Masonry Units. 2012. West Conshohocken, PA: ASTM International.

The Basics of Brickwork Details. 2006. Wyomissing, PA: Glen-Gery Corporation.

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

Building Block Walls: A Basic Guide for Students in Masonry Vocational Training. 1988. Herndon, VA: National Concrete Masonry Association.

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

Good Practice for Cleaning New Brickwork. 2003. Charlotte, NC: Brick SouthEast.

Steel Reinforcement for Concrete Masonry. 2006. Herndon, VA: National Concrete Masonry Association.

Technical Note TN3A, Brick Masonry Material Properties. 1992. Reston, VA: The Brick Industry Association. **www.gobrick.com/Portals/25/docs/Technical%20Notes/TN3A.pdf**

Technical Note TN20, Cleaning Brickwork. 2006. Reston, VA: The Brick Industry Association. **www.gobrick.com/Portals/25/docs/Technical%20Notes/TN20.pdf**

TEK 2-3A, Architectural Concrete Masonry Units. 2001. Herndon, VA: National Concrete Masonry Association. **secure.ncma.org/source/Orders/ProductDetail.cfm?pc=TEK02-03**

TEK 8-4A, Cleaning Concrete Masonry. 2005. Herndon, VA: National Concrete Masonry Association. **www.ncma.org/etek/Pages/Manualviewer.aspx?filename=TEK%2008-04A.pdf**

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

Session Outline for 28105-13

Masonry Units and Installation Techniques

The lesson plan for this module is divided into twenty-one 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

Session One

Session One identifies and explains characteristics of various types, classes, and parts of concrete masonry units.

1. Show Session One PowerPoint® presentation slides.
2. Discuss the six types of concrete masonry units and the four classes of block.
3. Discuss the different parts of CMUs as well as the variety of CMUs that are available.
4. Describe various types of architectural block.

Session Two

Session Two describes the steps of setting up a job and laying out a CMU structure.

1. Show Session Two PowerPoint® presentation slides.
2. Explain that a masonry contractor must prepare a checklist of preliminary procedures for setting up a job before any actual work can begin.
3. Discuss the steps involved in locating where the masonry work will go.
4. Show trainees how to dry-bond the door and window openings with block. Use a square and grease pencil to mark the exact location and angle of the corners. Under your supervision, have trainees practice dry bonding the first course of the structure based on the plans and specifications that you provide. This laboratory corresponds with Performance Task 1.

Session Three

Session Three provides information about buttering block, the types of bed joints that a block can take, and common bond patterns for block walls.

1. Show Session Three PowerPoint® presentation slides.
2. Explain the process of buttering block.
3. Discuss the three types of bed joints that a block can take, depending on its purpose.
4. Discuss common bond patterns and variations in block walls.

Session Four

Session Four describes the steps for planning to lay masonry units, explains how to lay block, and explains how to place and adjust block.

1. Show Session Four PowerPoint® presentation slides.
2. Review the multistage process that precedes laying masonry units: reading the specifications, planning the layout of the job, locating and laying out walls, dry bonding, calculating the number of units to cut, and cutting them.
3. Introduce the process of laying out concrete masonry units by discussing with trainees the many creative aspects of masonry. Have trainees note such variations as color, size, texture, and positioning that can be used to create interesting visual effects.
4. Explain the procedures for laying block.
5. Demonstrate the procedures for placing blocks and adjusting them when necessary. Under your supervision, have trainees place and align blocks.
6. Demonstrate how to lay block to the line. This laboratory corresponds with Performance Task 3.

Session Five

Session Five describes how to set up a mason's line using corner poles and various types of fasteners.

1. Show Session Five PowerPoint® presentation slides.
2. Explain that a line needs to be tied tautly with fasteners at a height that can be measured precisely.
3. Demonstrate how to securely brace corner poles and attach a line to them using hitch or half-hitch knots. Under your supervision, have trainees secure corner poles, attach a line to the poles, lay a course of block, and use a rule to check the line height. This laboratory corresponds with Performance Task 3.
4. Explain how to set up a line using line blocks, line pins, and trigs.

Session Six

Session Six explains how to build a block lead and how to check its diagonal after it has been completed.

1. Show Session Six PowerPoint® presentation slides.
2. Explain that leads set the position, alignment, and elevation of walls by serving as guides for the courses that fill the spaces between them.
3. Discuss the importance of accurate leveling and plumbing to make sure that corners are true.
4. Demonstrate how to lay a block outside-corner lead. Emphasize the proper mortar-spreading technique. Under your supervision, have trainees lay a block outside-corner lead. This laboratory corresponds with Performance Task 5.

Session Seven

Session Seven explains tooling and finishing mortar.

1. Show Session Seven PowerPoint® presentation slides.
2. Review the use of jointers as tools designed to finish the surface of mortar joints.
3. Have trainees mix mortar and lay several courses of block. Have trainees periodically check the mortar throughout this session until the mortar is at the proper consistency to be tooled.
4. Discuss tooling and finishing mortar as the last step in making a mortar joint. This laboratory fulfills Performance Task 2.
5. Explain why mortar must be tested before joints are tooled. Point out that the best time for tooling joints varies, depending on weather.

Session Eight

Session Eight describes how to use various types of jointers to tool mortar.

1. Show Session Eight PowerPoint® presentation slides.
2. Explain that tooling is begun after the mortar has been tested and found to be ready to take impressions.
3. Discuss the proper technique for using a jointer.
4. Demonstrate and describe how to use the proper jointers for tooling various types of joints, including raked joints, troweled joints, and flush joints. Under your supervision, have trainees tool the types of joints that you demonstrated.

SESSION NINE

Session Nine describes how to clean dried mortar, provides information about chemical cleaning solutions, and explains the process of washing block using high-pressure water.

1. Show Session Nine PowerPoint® presentation slides.
2. Point out that the hardest material to clean off masonry units is dried, smeared mortar that has worked its way into the surfaces of masonry units.
3. Discuss the importance of checking the manufacturer's safety data sheets for mixing, using, and storing recommended chemical cleaners, and explain cleaning procedures when further cleaning is needed for masonry.
4. Discuss the process of washing block with high-pressure water.

SESSION TEN

Session Ten provides information about the characteristics of various types of brick.

1. Show Session Ten PowerPoint® presentation slides.
2. Discuss the functions of the three general types of brick masonry units: cored and tile, uncored, and architectural terra-cotta.
3. Describe how the percentage of water present in brick the effects the hardening of the mortar around the brick.
4. Have trainees perform the test used to measure the absorption rate of brick.
5. Review the most common structural bond patterns of brick.

SESSION ELEVEN

Session Eleven describes the preliminary steps for setting up a brick project and explains the procedures for laying a dry bond.

1. Show Session Eleven PowerPoint® presentation slides.
2. Explain that the procedures for setting up, laying out, and bonding brick are similar in most ways to the procedures for block.
3. Review the steps to follow when setting up a brick masonry project, with and without the use of a scaffold.
4. Demonstrate how to establish bond with bricks. Discuss the importance of dry-bonding brick across openings. Under your supervision, have trainees practice dry-bonding brick. This laboratory corresponds with Performance Task 1.

SESSION TWELVE

Session Twelve covers simple bonds, pattern bonds, structural bonds, and structural pattern bonds for brick, and explains how and why bricks are placed in different bond patterns.

1. Show Session Twelve PowerPoint® presentation slides.
2. Review the four types of bonds: simple bonds, pattern bonds, structural bonds, and structural pattern bonds.
3. Discuss the primary uses of stretchers, headers, soldiers, rowlocks, rowlock stretchers, and sailors.
4. Discuss other commonly used brick bonds.

SESSION THIRTEEN

Session Thirteen explains the steps performed when laying brick, adjusting brick, and checking the height, plumb, level, and range of a course of brick.

1. Show Session Thirteen PowerPoint® presentation slides.
2. Explain the most efficient way to handle brick when laying it.
3. Demonstrate how to lay several courses of brick, and how to adjust units that have been placed. Under your supervision, have trainees place several courses of brick.
4. Discuss the steps to follow when measuring the height of a course and when checking for plumb and range.
5. Under your supervision, have trainees check the plumb, level, and range of bricks.

SESSION FOURTEEN

Session Fourteen explains the processes of laying the brick closure unit.

1. Show Session Fourteen PowerPoint® presentation slides.
2. Explain that the closure unit, being the last brick to be laid, must fit in the gap between the bricks that have already been laid.

SESSION FIFTEEN

Session Fifteen explains the processes of laying brick to the line.

1. Show Session Fifteen PowerPoint® presentation slides.
2. Discuss how to lay brick to the line, and explain why it is important not to disturb the line while doing so.
3. Demonstrate the proper way to hold the brick to avoid disturbing the line. Under your supervision, have trainees lay brick to the line. This laboratory corresponds with Performance Task 4.

SESSION SIXTEEN

Session Sixteen explains how to build a brick corner lead, and explains the importance of the lead in establishing the position, alignment, and elevation of the wall to be built.

1. Show Session Sixteen PowerPoint® presentation slides.
2. Explain that corner leads set the position, alignment, and elevation of walls by serving as guides for the courses that fill the spaces between them.
3. Discuss the purposes and methods of checking the level on the diagonal and using a framing square.
4. Demonstrate and describe each step in the process of building an unreinforced outside-corner lead in a half-lap running bond pattern. Under your supervision, have trainees build an unreinforced outside-corner lead in a half-lap running bond pattern. This laboratory corresponds with Performance Task 6.

SESSION SEVENTEEN

Session Seventeen describes the processes of cleaning brick by hand with a chemical solution and by using high-pressure water equipment.

1. Show Session Seventeen PowerPoint® presentation slides.
2. Discuss the importance of consulting the brick manufacturer's SDS for recommended chemical cleaning solutions. Review the SDS and manufacturer's instructions for mixing, using, and storing a chemical cleaning solution.
3. Arrange to visit a job site where brick walls have been constructed and the mortar has had time to cure and set. Demonstrate and describe how to dry-scrub a wall, mix the solution, and wash the wall by hand.
4. Discuss the necessity of consulting a brick manufacturer's guidelines to ensure that pressurized water cleaning is suitable for the type of brick being used.

SESSION EIGHTEEN

Session Eighteen explains the procedure for smoothly cutting masonry units with a mason's chisel and a hammer, and the procedure for making clean cuts in brick with a brick set.

1. Show Session Eighteen PowerPoint® presentation slides.
2. Discuss situations when a mason needs to cut masonry units to fit a specific space.
3. Explain the standard ways of cutting block and the four types of cuts that are made in two-cell block.
4. Using a mason's chisel and a hammer, demonstrate and explain the steps to follow to smoothly cut a block. Also demonstrate how to use a brick set to make a clean cut in a brick. Under your supervision, have trainees choose the proper tools and follow the procedures to make smooth cuts in block and brick. This laboratory corresponds with Performance Task 9.
5. Demonstrate and describe how to cut brick with the chisel end of a masonry hammer, and how to use the striking end of the hammer to dress out any small, rough edges left by the cut. Under your supervision, have trainees use a masonry hammer to cut a brick. This laboratory corresponds with Performance Task 10.

SESSION NINETEEN

Session Nineteen describes the steps to follow to accurately cut block and brick with a power saw, as well as how to cut brick with a splitter.

1. Show Session Nineteen PowerPoint® presentation slides.
2. Discuss the uses and features of power masonry saws and brick splitters. Note the importance of being familiar with the operating instructions of these tools.
3. Demonstrate and describe how to use a masonry saw to cut a masonry unit. Also demonstrate how to cut a brick with a brick splitter. Under your supervision, have trainees use a masonry saw to cut a masonry unit and use a brick splitter to cut a brick. This laboratory corresponds with Performance Task 7.
4. Discuss the items that must be checked on masonry units after equipment, safety procedures, and operating procedures have been checked.

SESSION TWENTY

Session Twenty explains the requirements and uses of installing accessories when building masonry structures.

1. Show Session Twenty PowerPoint® presentation slides.
2. Explain that reinforcements make walls stronger, hold them in place, or handle moisture.
3. Discuss the features, uses, and placement of anchors and metal and veneer ties.

SESSION TWENTY-ONE

Session Twenty-One explains the requirements and uses of reinforcement for masonry structures.

1. Show Session Twenty-One PowerPoint® presentation slides.
3. Discuss the features, uses, and placement of reinforcement bars and joint reinforcement ties.

SESSION TWENTY-TWO

Session Twenty-Two covers the installation of accessories commonly used in masonry, including flashing.

1. Show Session Twenty-Two PowerPoint® presentation slides.
2. Emphasize that the manufacturer's instructions must always be followed when installing accessories.
3. Discuss the applications of flashing, as well as the various materials that flashing can be made from.

SESSION TWENTY-THREE

Session Twenty-Three covers the installation of accessories commonly used in masonry, including joint fillers.

1. Show Session Twenty-Three PowerPoint® presentation slides.
2. Emphasize that the manufacturer's instructions must always be followed when installing accessories.
3. Explain how to control shrinkage by using reinforcement in combination with contraction or control joints.

SESSION TWENTY-FOUR

Session Twenty-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 Twenty-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.

Lesson Plans for Module 27105-13
Floor Systems

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.

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
- 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)
- 100' measuring tape
- Framing square
- Transit or builder's level
- 2 x 4 or 2 x 6 sill plates
- Anchor bolts
- Sill sealer
- Termite shield
- Column posts
- 2 x 8 or 2 x 10 girder stock
- Pneumatic, ring shank, and screw nails
- Etched galvanized staples
- Construction adhesive
- 8' carpenter's level
- Measuring tape
- Square
- Hammer
- Nails
- Manufacturers' instructions for installing metal cross-bridging
- Measuring tape
- Calculator
- Photos of alternative floor systems

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.

Session Outline for 27105-13

Floor Systems

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

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.
6. Trainees practice and/or complete the requirements of Performance Task 1.

SESSION SEVEN

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.
5. Trainees practice and/or complete the requirements of Performance Task 1.

SESSION EIGHT

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.
8. Trainees practice and/or complete the requirements of Performance Task 2.

SESSION NINE

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

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 the Registration of Training Modules form, and submit the report to your Training Program Sponsor.

Materials Checklist for Module 27105-13, Floor Systems

Equipment and Materials					
Personal protective equipment:		Foundation plans		Joist span tables	
Hard hat		Joist hangers		Local building codes	
Safety glasses		2 x 8 or 2 x 10 floor joists		Wood I-joists	
Gloves		Floor trusses		Wood cross-bridging	
Hearing protection		Solid bridging		Metal cross-bridging	
Whiteboard/Chalkboard		100' measuring tape		Framing square	
Markers/Chalk		2 x 4 or 2 x 6 sill plates		Transit or builder's level	
Pencils and paper		Sill sealer		Anchor bolts	
Carpentry Level One PowerPoint® Presentation Slides		Photos of different types of girders		Sets of construction drawings	
Computer		Termite shield		Column posts	
Copies of the Module Examination and Performance Profile Sheets		Manufactured panels (OSB, waferboard, composite board, structural particleboard)		8' carpenter's level	
Vendor-supplied videos/ DVDs showing floor systems (optional)		*International Residential Code*®		Pneumatic, ring shank, and screw nails	
TV/DVD player		2 x 8 or 2 x 10 girder stock		Manufacturers' instructions for installing metal cross-bridging	
Photographs of wood-framed buildings		Construction adhesive		Photos of alternative floor system	
Square		Calculator		Nails	
Etched galvanized staples		Hammer		Measuring tape	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27112-13

Ceiling and Roof Framing

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.

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 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

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 × 4, 2 × 6, or 2 × 8 framing lumber

Carpenter's pencil

Measuring tape

4' level

Plywood

1× lumber

Circular saw

Compound miter saw

2 × 6 strongback or 1 × 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

Handsaw

Sawhorses

Scrap lumber (1 × 2 or 1 × 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:

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

American Wood Council. A trade association that develops design tools and guidelines for wood construction, **http://www.awc.org**

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

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**

Framing Roofs. Newtown, CT: Taunton Press.

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

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

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

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

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

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

Wood Frame Construction Manual. Washington, DC: American Wood Council.

Wood I-Joist Manufacturers Association (WIJMA). An organization representing manufacturers of prefabricated wood I-joist and structural composite lumber, **http://www.i-joist.org**

Wood Truss Council of America. An international trade association representing structural wood component manufacturers, **http://www.sbcindustry.com**

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.

Session Outline for 27112-13

Ceiling Joist and Roof Framing

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.
6. Trainees practice and/or complete the requirements of Performance Task 1.

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.
5. Trainees practice and/or complete the requirements of Performance Tasks 2 and 3.

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.
4. Trainees practice and/or complete the requirements of Performance Task 4.

Session Outline for 27112-13

Ceiling Joist and Roof Framing

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™.
7. Trainees practice and/or complete the requirements of Performance Task 5.

Session Eight

Session Eight introduces installing rafters for a gable roof.

1. Show Session Eight PowerPoint® presentation slides.
2. Explain the procedure for installing rafters in a gable roof.
3. Trainees practice and/or complete the requirements of Performance Task 5.

Session Nine

Session Nine introduces the procedure for framing an opening in a roof.

1. Show Session Nine PowerPoint® presentation slides.
2. Explain the procedure for framing an opening in a roof.
3. Trainees practice and/or complete the requirements of Performance Task 5.

Session Ten

Session Ten introduces double headers and double trimmer rafters.

1. Show Session Ten PowerPoint® presentation slides.
2. Review the purpose and use of temporary bracing.
3. Discuss the use of double headers and double trimmer rafters when framing an opening in a roof.
4. Trainees practice and/or complete the requirements of Performance Task 5.

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.
4. Trainees practice and/or complete the requirements of Performance Task 6.

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.
4. Trainees practice and/or complete the requirements of Performance Task 6.

Ceiling Joist and Roof Framing

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 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.
5. Trainees practice and/or complete the requirements of Performance Task 7.

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.
4. Trainees practice and/or complete the requirements of Performance Task 8.

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.
4. Trainees practice and/or complete the requirements of Performance Task 8.

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.
4. Trainees practice and/or complete the requirements of Performance Task 9.

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 the Registration of Training Modules Form, and submit the report to your Training Program Sponsor.

Materials Checklist for Module 27112-13, Ceiling Joist and Roof Framing

Equipment and Materials					
Personal protective equipment:		Framing hammer		Carpenter's pencil	
Safety glasses		Rafter square		Framing square	
Gloves		Handsaw		Speed Square™	
Hearing protection		1× lumber		4' level	
Hard hats		Measuring tape		Circular saw	
Copies of the Module Examination and Performance Profile Sheets		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	
Carpentry Level One PowerPoint® Presentation Slides, DVD player		Calculator or smartphone calculator app		2 × 6 strongback or 1 × 4 ribband	
Whiteboard/chalkboard		Compound miter saw		Scrap lumber (1 × 2 or 1 × 4)	
Markers/chalk		Sawhorses		Plywood	
Pencils and paper		Extension cord		Skylight or roof window	
Computer		Truss placement diagram		Set of rafters for a small roof	
		8d common nails		16d box nails	
TV/DVD (*optional*)		H-clips		Roof underlayment	
Photographs or drawings that show building construction in various stages of completion		Photos or illustrations of intersecting roofs that include two gable sections and a gable and hip combination		Fall protection equipment such as peak anchors and lifelines, lifts, scaffolds, and ladders	
2 × 4, 2 × 6, or 2 × 8 framing lumber		Pneumatic/cordless framing nailer		Framing square or Speed Square™	
Temporary roof braces for trusses		Photographs of different types of roofs		Manufacturer's instructions for the Speed Square™	
Copies of blank job hazard analysis (JHA) forms		Roof sheathing (OSB or plywood panels)		Coated sheets	
Drip edges		Heavy felt		Shims	
Roofing plan for a building					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27202-13

Roofing Applications

Module Five (27202-13) describes how to properly prepare the roof deck and install roofing for residential and commercial buildings.

Objectives

Learning Objective 1

- Explain the safety requirements for roofing projects.
  a. Identify potential hazards when working on roofs.
  b. Discuss the fall protection equipment required when working on roofs.
  c. Identify proper personal protective equipment (PPE) and hazard control devices used when working on roofs.

Learning Objective 2

- Identify the tools and fasteners used in roofing.
  a. Identify the hand tools used when working on roofing projects.
  b. Identify the power tools used when working on roofing projects.
  c. Identify fasteners used on roofing projects.

Learning Objective 3

- Identify the different roofing systems and their associated materials.
  a. Identify composition shingles and their applications.
  b. Identify roll-roofing applications.
  c. Identify wood shakes and shingles and their applications.
  d. Identify tile/slate roofing materials and their applications.
  e. Identify metal roofing and its applications.
  f. Identify built-up roofing and its applications.
  g. Identify single-ply roofing and its applications.
  h. Explain the purpose of underlayment and waterproof membrane.
  i. Discuss the purpose of drip edge, flashing, and roof ventilation.

Learning Objective 4

- Describe the installation techniques for common roofing systems.
  a. Describe how to properly prepare a roof deck.
  b. Explain how to install composition shingles.
  c. Explain how to install metal roofing.
  d. Describe how to install roll roofing.
  e. Discuss roof projections, flashing, and ventilation.

Learning Objective 5

- Describe the estimating procedure for roofing projects.

Performance Tasks

Performance Task 1 (Learning Objective 4)

- Demonstrate how to install composition shingles on a specified roof and valley.

Performance Task 2 (Learning Objective 4)

- Demonstrate the method to properly cut and install the ridge cap using composition shingles.

Performance Task 3 (Learning Objective 4)

- Lay out, cut, and install a cricket or saddle.

Performance Task 4 (Learning Objective 4)

- Demonstrate the techniques for installing other selected types of roofing materials.

Teaching Time: 25 hours

(Ten 2.5-hour classroom sessions)

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

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 perform tasks at elevated surfaces. 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 Two PowerPoint® Presentation Slides

Computer

Copies of the Module Examination and Performance Profile Sheets

Vendor-supplied videos/DVDs showing roofing applications (optional)

TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment (PPE):

- Hard hat
- Eye protection
- Hearing protection
- Fall protection, including body harness and lanyard
- Gloves

Assortment of fasteners used for roofing

Assortment of flashing

Assortment of hand and power roofing tools

Assortment of vents

Aviation snips

Body harness

Calculator

Composition shingles

Extension ladder

Frame scaffold

Framing square

Hammer

Ladder

Measuring tape

Metal roofing

Photographs of various commercial roofs

Photographs of various residential roofing systems

Roll roofing

Roof plan for a hip roof

Roofing brackets

Roofing nails

Samples of built-up roofing

Samples of composition shingles

Samples of drip edges, flashing, and roof vents

Samples of metal roofing

Samples of roll roofing

Samples of tile/slate roofing

Samples of underlayment and waterproof membranes

Samples of wood shakes and shingles

Sets of constructions drawings, including residential and commercial drawings

Tin ships

Utility knife

Additional Resources and References

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

Asphalt Manufacturers Association website. **www.asphaltroofing.org**

National Roofing Contractors Association website. **www.nrca.net**

Roof Coating Manufacturers Association website. **www.roofcoatings.org**

OSHA Safety and Health Standards for the Construction Industry, Part 1926, Subpart M. **www.osha.gov**

OSHA Safety and Health Standards for the Construction Industry, Part 1926, Appendices C and D to Subpart M. **www.osha.gov**

There are a number of online resources available for trainees who would like more information on roofing applications. 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 encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.

Session Outline for 27202-13

Roofing Applications

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 introduces roofing safety.

1. Show Session One PowerPoint® presentation slides.
2. Identify safety hazards associated with roofing projects.
3. Review OSHA regulations regarding working at elevations.
4. Review fall protection and personal fall arrest equipment used for roofing.

Session Two

Session Two introduces roofing tools and fasteners.

1. Show Session Two PowerPoint® presentation slides.
2. Review general safety guidelines and introduce safety guidelines pertaining to roofing projects.
3. Demonstrate the safe use of hand and power tools.

Session Three

Session Three introduces roofing systems and materials.

1. Show Session Three PowerPoint® presentation slides.
2. Discuss the various types of roofing systems and roofing materials that may be used for each.
3. Show trainees different types of roofing materials.

Session Four

Session Four introduces roof deck preparation and installation of composition shingles on gable roofs.

1. Show Session Four PowerPoint® presentation slides.
2. Discuss and demonstrate how to properly prepare a roof deck for various types of roofing materials.
3. Discuss the proper installation of composition shingles on various types of roofs.
4. Demonstrate how composition shingles are installed on various types of roofs. Have trainees properly install composition shingles on gable roofs.

Session Five

Session Five introduces installation of composition shingles on hip roofs.

1. Show Session Five PowerPoint® presentation slides.
2. Discuss the proper installation of composition shingles on hip roofs.
3. Demonstrate how composition shingles are installed on hip roofs. Have trainees properly install composition shingles on hip roofs.

Session Six

Session Six introduces installation of metal roofing.

1. Show Session Six PowerPoint® presentation slides.
2. Discuss the proper installation of metal roofing.
3. Demonstrate how metal roofing is installed. Have trainees properly install metal roofing on gable and hip roofs.

SESSION SEVEN

Session Seven introduces installation of roll roofing.

1. Show Session Seven PowerPoint® presentation slides.
2. Discuss the proper installation of roll roofing.
3. Demonstrate how roll roofing is installed. Have trainees properly install roll roofing on gable and hip roofs.

SESSION EIGHT

Session Eight introduces roofing projections, ridge rows, flashing, and ventilation.

1. Show Session Eight PowerPoint® presentation slides.
2. Discuss chimney projections through roofs, and demonstrate how to properly install saddles (crickets) for a chimney projection. Have trainees properly install saddles.
3. Discuss and demonstrate how to properly install ridge rows on gable and hip roofs.
4. Explain the importance of properly flashing a roof.
5. Discuss and demonstrate how to properly install box and ridge vents. Have trainees demonstrate the proper method of installing box and ridge vents.

SESSION NINE

Session Nine introduces trainees to estimating roofing materials.

1. Show Session Nine PowerPoint® presentation slides.
2. Demonstrate how to calculate the roof area.
3. Demonstrate how to calculate the roofing material required for a given roof. Have trainees estimate the amount of roofing material required for a simple gable roof.

SESSION TEN

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.

Materials Checklist for Module 27202-13, Roofing Applications

Equipment and Materials					
Personal protective equipment:		Assortment of flashing		Samples of metal roofing	
Hard hat		Frame scaffold		Metal roofing	
Eye protection		Assortment of vents		Roll roofing	
Hearing protection		Aviation snips		Roof plan for a hip roof	
Fall protection, including body harness and lanyard		Calculator		Roofing brackets	
Gloves		Composition shingles		Roofing nails	
Whiteboard/chalkboard		Extension ladder		Samples of built-up roofing	
Markers/chalk		Samples of drip edges, flashing, and roof vents		Tin ships	
Pencils and paper		Framing square		Utility knife	
Carpentry Level Two PowerPoint® Presentation Slides		Hammer		Sets of constructions drawings, including residential and commercial drawings	
Computer		Assortment of hand and power roofing tools		Samples of roll roofing	
Copies of the Module Examination and Performance Profile Sheets		Photographs of various residential roofing systems		Samples of tile/slate roofing	
Vendor-supplied videos/DVDs showing roofing applications (optional)		Measuring tape		Samples of underlayment and waterproof membranes	
TV/DVD player		Samples of composition shingles		Samples of wood shakes and shingles	
		Photographs of various commercial roofs		Ladder	
				Assortment of fasteners used for roofing	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27111-13

Wall Systems

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.

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.

Teaching Time: 10 hours

(Four 2.5-Hour Classroom Sessions)

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

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
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
¼" 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:

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

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

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

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

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

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.

International Code Council. A membership organization dedicated to building safety and fire prevention through development of building codes, **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**

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.

Session Outline for 27111-13

Wall Systems

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.
5. Trainees practice and/or complete the requirements of Performance Task 1.

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.
7. Trainees practice and/or complete the requirements of Performance Tasks 2 and 3.

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.
5. Trainees practice and/or complete the requirements of Performance Task 4.

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 the Registration of Training Modules Form, and submit the report to your Training Program Supervisor.

Materials Checklist for Module 27111-13, Wall Systems,

Equipment and Materials					
Personal protective equipment:		4' level		½" CD plywood	
Hard hats		25' tape measure		Stock for blocking	
Safety glasses		Carpenter's pencil		8d common nails	
Gloves		Chalkline		Circular saw	
Hearing protection		Framing hammer		Compound miter saw	
Respiratory protection		Extension cord		16d box nails	
Whiteboard/Chalkboard		Banding or cleats		Metal brace material	
LCD projector and screen		Sheathing material		2 × 12 header material	
Copies of the Module Examination and Performance Profile Sheets		Photographs or drawings that show specific types of building construction in various stages of completion		Illustration of a wall cutaway or wall section from a set of construction drawings	
Carpentry Level One PowerPoint® Presentation Slides		Photographs of corner construction		Set of prints with information pertinent to wall framing	
Computer		Pneumatic/cordless framing nailer		Framing square or Speed Square™	
Pencils and paper		¼" CD plywood for header spacers		Calculator or smartphone calculator app	
Vendor-supplied videos/DVDs showing wall framing systems (optional)		Copies of blank job hazard analysis (JHA) forms		Residential construction drawings	
Markers/Chalk		6' stepladder		2 × 4 or 2 × 6 framing lumber for studs and joists	
TV/DVD player					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27204-13

Exterior Finishing

Module Three (27204-13) covers the various types of exterior finish materials and their installation procedures, including wood, metal, vinyl, and fiber-cement siding.

Objectives

Learning Objective 1

- Describe the safety hazards when working with exterior finish materials.
  a. Identify safety hazards that are present when working at elevations.
  b. Describe safety hazards when working with hand and power tools, equipment, and exterior finish materials.

Learning Objective 2

- Describe the various types and applications of exterior finish materials.
  a. Identify the types of wood siding.
  b. Identify vinyl and metal siding materials and components.
  c. List applications for fiber-cement siding.
  d. Discuss the types of veneer finishes.
  e. List specialty exterior finishes.
  f. Explain the purpose of flashing.

Learning Objective 3

- Explain how to install exterior finish materials.
  a. Describe surface preparation that must be performed prior to installing exterior finish materials.
  b. Discuss the types of furring and insulation that might be applied to exterior walls.
  c. Explain how to establish a straight reference line.
  d. Describe how to install wood siding.
  e. Describe how to install vinyl and metal siding.
  f. Describe how to install fiber-cement siding.
  g. Explain how to install cornices.

Learning Objective 4

- Describe the estimating procedure for exterior finish projects.
  a. Explain how to perform a takeoff on panel and board siding.

Performance Tasks

Performance Task 1 (Learning Objective 3)

- Install three of the most common siding types in your area.

Performance Task 2 (Learning Objective 4)

- Estimate the amount of lap or panel siding required for a structure.

Teaching Time: 35 hours

(Fourteen 2.5-hour classroom sessions)

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

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 work at elevated locations, work with hand and power tools, and work around fiber-cement siding. 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 Two PowerPoint® Presentation Slides

Computer

Copies of the Module Examination and Performance Profile Sheets

Vendor-supplied videos/DVDs showing exterior finishing materials and installations (optional)

TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment (PPE):

- Hard hat
- Eye protection
- Fall protection, including body harness and lanyard
- Gloves
- Hearing protection
- Respiratory protection

⅜"- or ½"-thick hardwood stock

Aerial lift

Assortment of vinyl and metal siding components

Aviation snips

Calculator

Caulking gun

Chalk box and chalkline

Circular saw

Duckbill snips

Hacksaw

Hammer

Handsaw

Ladder

Lanyard

Laser level

Photographs of residential structures finished with wood siding

Photographs of veneer finishes

Portable brake

Power nailer

Power shears

Rubber mallet

Safety data sheets (SDSs) for fiber-cement siding

Samples of fiber-cement siding

Samples of flashing

Samples of furring strips

Samples of inside and outside corners of wood siding

Samples of underlayment

Samples of various types of wood siding

Scaffold

Screwdriver

Set of residential construction drawings

Shingle hatchet

Siding installation tools

Snaplock punch

Table saw

Tape measure

Tin snips

Utility knife

Water level

Additional Resources and References

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

Vinyl Siding Institute website. **www.vinylsiding.org**

Cedar Shake & Shingle Bureau website. **www.cedarbureau.org**

There are a number of online resources available for trainees who would like more information on exterior finishing. 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 encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.

Session Outline for 27204-13

Exterior Finishing

The lesson plan for this module is divided into fourteen 2.5-hour sessions.
Each session includes 10 minutes for administrative tasks and one 10-minute break.

Session One

Session One introduces exterior finishing safety.

1. Show Session One PowerPoint® presentation slides.
2. Identify safety hazards that are present when working at elevations, and review the use of personal fall arrest equipment.
3. Describe safety hazards when working with hand and power tools, equipment, and exterior finishing materials. Review the use of safety data sheets (SDSs).

Session Two

Session Two introduces types of wood siding.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss the use of beveled, board-and-batten, reverse batten, board-on-board, tongue-and-groove, shiplap, shingle, shake, and plywood siding.

Session Three

Session Three introduces types of siding other than wood, including vinyl and metal siding, fiber-cement siding, veneer finishes, and specialty finishes.

1. Show Session Three PowerPoint® presentation slides.
2. Discuss the use of types of siding other than wood, including vinyl and metal siding, fiber-cement siding, veneer finishes, and specialty finishes.
3. Discuss the use of flashing for vertical surfaces.

Session Four

Session Four introduces surface preparation and furring and insulation techniques.

1. Show Session Four PowerPoint® presentation slides.
2. Identify items to consider when preparing a surface for exterior finishing materials.
3. Discuss the purpose of furring strips for exterior finish and the importance of properly installing furring members and insulation.

Session Five

Session Five introduces establishing a straight reference line and installing beveled siding.

1. Show Session Five PowerPoint® presentation slides.
2. Discuss the importance of establishing a straight reference line.
3. Show how beveled siding is installed and have trainees do it.

Session Six

Session Six introduces installing board-and-batten siding, tongue-and-groove siding, shiplap siding, shakes and shingles, and plywood siding.

1. Show Session Six PowerPoint® presentation slides.
2. Discuss the proper procedure for installing board-and-batten siding, tongue-and-groove siding, shiplap siding, shakes, shingles, and plywood siding.
3. Have trainees properly install board-and-batten siding, tongue-and-groove siding, shiplap siding, shakes, shingles, and plywood siding are installed.

SESSION SEVEN

Session Seven introduces installing vinyl and metal siding components.

1. Show Session Seven PowerPoint® presentation slides.
2. Review tools and equipment needed when installing vinyl and metal siding.
3. Discuss and show the installation of corner posts and starter strips.

SESSION EIGHT

Session Eight introduces trimming out gable ends and around doors and windows, and cutting vinyl and metal siding.

1. Show Session Eight PowerPoint® presentation slides.
2. Discuss and show how gable ends and doors and windows are trimmed out prior to installing siding.
3. Discuss and show how to cut vinyl and metal siding.

SESSION NINE

Session Nine introduces installing vinyl and metal siding.

1. Show Session Nine PowerPoint® presentation slides.
2. Discuss and show how to install vinyl and metal siding.
3. Demonstrate how to install siding around windows and doors.
4. Have trainees properly install vinyl and metal siding.

SESSION TEN

Session Ten introduces installing vinyl and metal siding at gable ends and under the eaves. The session concludes with caulking and cleanup.

1. Show Session Ten PowerPoint® presentation slides.
2. Discuss and show how vinyl and metal siding are installed at gable ends and under the eaves.
3. Discuss the proper procedure for caulking and cleaning up vinyl and metal siding.

SESSION ELEVEN

Session Eleven introduces installing fiber-cement siding.

1. Show Session Eleven PowerPoint® presentation slides.
2. Discuss PPE that should be worn when working with fiber-cement siding.
3. Discuss and show the proper method for cutting and installing fiber-cement siding.
4. Have trainees properly install fiber-cement siding.

SESSION TWELVE

Session Twelve introduces installing cornices, fascia, and soffits.

1. Show Session Twelve PowerPoint® presentation slides.
2. Discuss the types of cornices.
3. Explain how the fascia and soffits are installed.
4. Discuss and show how to construct a box cornice.

SESSION THIRTEEN

Session Thirteen introduces estimating exterior finish materials.

1. Show Session Thirteen PowerPoint® presentation slides.
2. Review the formulas for calculating area.
3. Discuss and show how to determine the amount of siding required for a building.
4. Have trainees determine the amount of siding required for a residential structure.

SESSION FOURTEEN

Session Fourteen 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 Thirteen.) 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.

Materials Checklist for Module 27204-13, Exterior Finishing

Equipment and Materials					
Personal protective equipment:		⅜"- or ½"-thick hardwood stock		Chalk box and chalkline	
Hard hat		Aerial lift		Circular saw	
Eye protection		Samples of flashing		Duckbill snips	
Fall protection, including body harness and lanyard		Aviation snips		Hacksaw	
Gloves		Water level		Hammer	
Hearing protection		Calculator		Handsaw	
Respiratory protection		Caulking gun		Ladder	
Whiteboard/chalkboard		Scaffold		Lanyard	
Markers/chalk		Photographs of veneer finishes		Laser level	
Pencils and paper		Portable brake		Samples of fiber-cement siding	
Carpentry Level Two PowerPoint® Presentation Slides		Set of residential construction drawings		Assortment of vinyl and metal siding components	
TV/DVD player		Power shears		Samples of furring strips	
Computer		Rubber mallet		Tape measure	
Copies of the Module Examination and Performance Profile Sheets		Safety data sheets (SDSs) for fiber-cement siding		Samples of inside and outside corners of wood siding	
Vendor-supplied videos/DVDs showing exterior finishing materials and installations (optional)		Photographs of residential structures finished with wood siding		Samples of various types of wood siding	
		Screwdriver		Siding installation tools	
		Shingle hatchet		Snaplock punch	
		Tin snips		Table saw	
		Utility knife		Samples of underlayment	
		Power nailer			

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27110-13

Basic Stair Layout

Module Nine (27110-13) introduces the various types of stairs and the common building code requirements related to stairs. The module focuses on the techniques for measuring and calculating rise, run, and stairwell openings; laying out stringers; and fabricating basic stairways.

Objectives

Learning Objective 1

- Identify the types of stairways.
  a. Identify how residential and commercial stairways differ.

Learning Objective 2

- Identify the various components associated with stairs.

Learning Objective 3

- Identify terms associated with stair framing.
  a. Define *headroom*.
  b. Define *stringer* and explain when more than two stringers are used.
  c. Define *treads* and *risers* and explain the importance of uniform tread depths and riser heights.
  d. List the minimum stairway width requirements for residential and commercial structures.
  e. Describe the difference between handrails and guards.
  f. Identify situations that carpenters may be confronted with when framing stairwells.

Learning Objective 4

- Describe the procedure used to determine the total rise, number and size of risers, and number and size of treads required for a stairway.
  a. Explain how to calculate the riser height, tread depth, and total run for a stairway.
  b. Describe how to calculate stairwell opening sizes.

Learning Objective 5

- Describe the procedure to lay out and cut stringers, risers, and treads.
  a. Explain how to lay out and cut a stringer.
  b. Describe how to properly reinforce a stringer.
  c. Summarize how concrete stairways are formed.

Performance Tasks

Performance Task 1 (Learning Objective 4)

- Calculate the total rise, number and size of risers, and number and size of treads required for a stairway.

Performance Task 2 (Learning Objective 5)

- Lay out and cut a stringer.

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.

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 stairways. 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 basic stair framing (optional)
TV/DVD player(optional)

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment (PPE):
- Hard hat
- Safety glasses
- Gloves
- Hearing protection
- Fall protection, If required

Photographs of ancient Mayan structures and stairways
Photographs of traditional and ornate stairways
International Building Code®
International Residential Code®
Tape measure
Objects of varying heights
Residential prints showing stairways
Calculator
Large strips of cardboard
Blank job hazard analysis (JHA) forms
Pitch board
Framing square
Stair gauges
Carpenter's pencil
2 × 12s for stringers
2 × 12s for treads
1 × 8s for risers
Handrail and brackets
8d box nails
16d box nails
16d casing nails
Nails for pneumatic/cordless nailer
Stair plans
Pneumatic/cordless nailer
Sawhorses or work table
Circular saw
Handsaw
Level
Lumber for pitchboard construction
Hammer

Additional Resources

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

A Simplified Guide to Custom Stairbuilding and Tangent Handrailing. Fresno, CA: Linden Publishing.

Arcways, Inc. Builders of custom stairways, **http://www.arcways.com**

Basic Stairbuilding, Newtown, CT: Taunton Press, Inc. (Book with companion video or DVD.)

Constructing Staircases, Balustrades & Landings. New York: Sterling Publishing Co., Inc.

For Pros By Pros: Building Stairs. Newtown, CT: Taunton Press, Inc.

Framing Floors and Stairs. Berkeley, CA: Publishers Group West. (Book with companion video or DVD.)

L.J. Smith Stair Systems. Manufacturer of stair products, **http://www.ljsmith.net**

Staircases. New York: Watson-Guptill Publications.

Stairs: Design and Construction. New York: Birkhauser.

WM Coffman Resources, LLC. Hardwood stair parts manufacturer, **http://www.wm-coffman.com**

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

Session Outline for 27110-13

Basic Stair Layout

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 stairways and stair components.

1. Show Session One PowerPoint® presentation slides.
2. Provide an overview of the module.
3. Identify types of stairways and their components.
4. Locate sections in the *International Building Code*® and *International Residential Code*® that pertain to stairs.

Session Two

Session Two introduces stair framing terminology.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss stair framing requirements for residential structures. Contrast the requirements to those for commercial construction.

Session Three

Session Three introduces stair calculations.

1. Show Session Three PowerPoint® presentation slides.
2. Explain the mathematical relationship between the riser and tread dimensions. Discuss how a change in one of the dimensions will likely impact the other dimension.
3. Discuss how to determine riser height.
4. Discuss tread depth and total stair run and how these dimensions are determined.
5. Discuss preframed stairwells and explain how to determine their unit rise and run.
6. Trainees practice and/or complete the requirements of Performance Task 1.

Session Four

Session Four introduces stair construction.

1. Show Session Four PowerPoint® presentation slides.
2. Discuss the importance of safety when constructing stairs. Craftworkers must work from heights, which introduces another safety hazard. Emphasize fall protection equipment that may be used when constructing stairs.
3. Explain how to lay out and cut a cutout stringer.
4. Trainees practice and/or complete the requirements of Performance Task 2.

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 the Registration of Training Modules Form, and submit the report to your Training Program Supervisor.

Materials Checklist for Module 27110-13, Basic Stair Layout

Equipment and Materials					
Personal protective equipment:		Calculator		Large strips of cardboard	
Hard hat		Pitch board		Framing square	
Safety glasses		Handrail and brackets		Stair gauges	
Gloves		16d casing nails		Carpenter's pencil	
Hearing protection		8d box nails		2 × 12s for stringers	
Respiratory protection		16d box nails		2 × 12s for treads	
Whiteboard/Chalkboard		Stair plans		1 × 8s for risers	
Markers/Chalk		Circular saw		Handsaw	
Pencils and paper		*International Building Code*®		Pneumatic/cordless nailer	
Carpentry Level One PowerPoint® Presentation Slides		Nails for pneumatic/cordless nailer		Photographs of ancient Mayan structures and stairways	
Computer		Tape measure		Level	
		Objects of varying heights		Hammer	
Copies of the Module Examination and Performance Profile Sheets		Residential prints showing stairways		Blank job hazard analysis (JHA) forms	
Vendor-supplied videos/DVDs showing various hand and power tools (optional)		Photographs of traditional and ornate stairways		Lumber for pitchboard construction	
TV/DVD player		*International Residential Code*®		Sawhorses or work table	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Electrical Safety
Annotated Instructor's Guide

Module 26102-14

Module Overview

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

Objectives

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

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

Performance Tasks

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

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

Materials and Equipment

Multimedia projector and screen
Electrical Level One PowerPoint® Presentation Slides
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Copy of the latest edition of the *National Electrical Code®*
OSHA Electrical Safety Guidelines (pocket guide)
NFPA 70E®
Company safety manual
Solvent MSDS
Access to eye wash station
Various types of personal protective and safety equipment, including:
  Rubber gloves
  Insulating blankets
  Hot sticks
  Fuse pullers
  Shorting probes
  Safety glasses
  Face shields
  Hard hats
GFCI device
Company lockout/tagout procedures
Lockout/tagout devices and labels
Stepladders
Straight ladders

(*continued*)

Fall arrest system
Safety harnesses
TV/DVD/VCR player (*optional*)
Safety videos (*optional*)
Module Examination*
Performance Profile Sheet*

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

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with ladders. Make sure that all trainees are briefed on appropriate safety procedures. Emphasize electrical safety.

Additional Resources

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

29 CFR Parts 1900–1910, Standards for General Industry. Occupational Safety and Health Administration, U.S. Department of Labor.
29 CFR Part 1926, Standards for the Construction Industry. Occupational Safety and Health Administration, U.S. Department of Labor.
National Electrical Code® Handbook, Latest Edition. Quincy, MA: National Fire Protection Association.
Standards for Electrical Safety in the Workplace, Latest Edition. Quincy, MA: National Fire Protection Association.
Managing Electrical Hazards, © 2009, NCCER/Pearson Education.

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Electrical Safety.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	**Planned Time**
Session I. Introduction; Electrical Hazards	
A. Introduction	_____
B. Electrical Shock	_____
C. Protective Equipment	_____
D. OSHA	_____
E. *NFPA 70E®*	_____
Session II. Ladders, Lifts, and Lifting	
A. Ladders and Scaffolds	_____
B. PT/Laboratory Have trainees practice visually inspecting ladders. This laboratory corresponds to Performance Task 1.	_____
C. PT/Laboratory Have trainees practice setting up a ladder. This laboratory corresponds to Performance Task 2.	_____
D. Lifts, Hoists, and Cranes	_____
E. Lifting	_____
F. Basic Tool Safety	_____

Session III. General Construction Safety Topics

A. Confined Space Entry Procedures _____
B. First Aid _____
C. Solvents and Toxic Vapors _____
D. Asbestos, Batteries, PCBs, and Vapor Lamps _____
E. Lead Safety _____

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

A. Fall Protection _____
B. PT/Laboratory _____

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

C. Hazard Assessment _____
D. PT/Laboratory _____

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

E. Review _____
F. 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.

G. Performance Testing _____

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

Residential Electrical Services
Annotated Instructor's Guide

Module 26111-14

Module Overview

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

Objectives

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

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

Performance Tasks

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

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

Materials and Equipment

Multimedia projector and screen
Electrical Level One PowerPoint® Presentation Slides
Computer
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copy of the latest edition of the *National Electrical Code®*
Calculator
Residential floor plan
Blank worksheet for general lighting loads
Various types of GFCIs
Panelboard

(continued)

Examples of cable, including:
- Type NM
- Type AC
- Type UF
- Type SE/USE

Examples of raceways, including:
- Rigid
- IMC
- EMT
- Flexible
- PVC

Various grounding devices
Examples of made-type grounding electrodes
Assortment of metallic and plastic outlet boxes
Assorted types of electrical receptacles
Assortment of switches, including:
- Single-pole
- Three-way
- Four-way
- Photoelectric switches
- Dimmer

Relays
Module Examination*
Performance Profile Sheet*

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

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit job sites. Make sure that all trainees are briefed on site safety procedures.

Additional Resources

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

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

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Residential Electrical Services.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	Planned Time
Sessions I and II. Introduction; Sizing Electrical Service	
A. Introduction	_____
B. Sizing Electrical Service	_____
C. Sizing Residential Neutral Conductors	_____
D. Sizing the Load Center	_____
E. PT/Laboratory	_____
Have trainees practice computing various branch loads. This laboratory corresponds to Performance Task 1.	
Session III. Grounding	
A. Grounding Electrical Services	_____
B. Main Bonding Jumper	_____
C. PT/Laboratory	_____
Have trainees practice identifying the components of a panelboard. This laboratory corresponds to Performance Task 2.	

Topic	Planned Time
Session IV. Installation, Part One	
A. Installing the Service Entrance	_____
B. Panelboard Location	_____
C. Wiring Methods	_____
D. Equipment Grounding System	_____
E. Branch Circuit Layout for Power	_____
Session V. Installation, Part Two	
A. Branch Circuit Layout for Lighting	_____
B. Outlet Boxes	_____
C. PT/Laboratory	_____
Have trainees practice selecting the proper type and size outlet box needed for a given set of wiring conditions. This laboratory corresponds to Performance Task 3.	
D. Wiring Devices	_____
E. Lighting Control	_____
Session VI. Electric Heating; Pools; Review and Testing	
A. Electric Heating	_____
B. Residential Swimming Pools, Spas, and Hot Tubs	_____
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.	

Lesson Plans for 03101-13
Introduction to HVAC

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

Module One (03101-13) provides a broad introduction to the world of the HVAC technician. The most basic operating principles of HVAC systems are presented along with a review of technician licensing and trade-governing regulations. The final portion of the module describes potential career paths for the well-trained HVAC technician.

Objectives

Learning Objective 1

- Explain the basic principles of heating, ventilation, air conditioning, and refrigeration.
  - a. Explain the principles of heating.
  - b. Explain the principles of ventilation.
  - c. Explain the principles of air conditioning.
  - d. Explain the principles of refrigeration.

Learning Objective 2

- Describe the principles that guide HVAC/R installation and service techniques.
  - a. Identify common safety principles and organizations.
  - b. Describe the importance of LEED construction and energy management.
  - c. Describe trade licensing and certification requirements.
  - d. Identify important codes and permits.

Learning Objective 3

- Identify career paths available in the HVAC/R trade.
  - a. Identify the responsibilities and characteristics needed to be a successful HVAC/R technician.
  - b. Identify residential, commercial, and industrial career opportunities.
  - c. Describe opportunities provided by equipment manufacturers.

Performance Tasks

This is a knowledge-based module; there are no performance tasks.

Teaching Time: 7.5 hours

(Three 2.5-Hour Sessions)

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

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 written examinations and performance profile sheets from **www.nccerirc.com**. The passing score for submission into NCCER's Registry is 70% or above for the written examination; performance testing is graded pass or fail.

Safety Considerations

This is a knowledge-based module and no performance tasks are required. However, instructors may choose to expose trainees to the HVAC shop environment or an active job site. Ensure that trainees possess and use the required PPE during any exposure to these types of settings.

Classroom Equipment and Materials

Whiteboard/chalkboard
Markers/chalk
Pencils and paper
HVAC Level One PowerPoint® Presentation Slides
DVD player
LCD projector and screen
Computer
Copies of the Module Examination

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment (if the HVAC shop area or a job site is visited):

- Standard eye protection
- Gloves
- Proper footwear as designated by the instructor or training facility provider
- Hearing protection as designated by the instructor or training facility provider
- Hard hats

Additional Resources

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

ABC's of Air Conditioning. Syracuse, NY: Carrier Corporation.

Refrigeration and Air Conditioning: An Introduction to HVAC/R. Larry Jeffus and David Fearnow. Upper Saddle River, NJ: Pearson Prentice Hall.

Fundamentals of HVAC/R. Carter Stanfield and David Skaves. Upper Saddle River, NJ: Pearson Prentice Hall.

Your Role in the Green Environment. Alachua, FL: NCCER.

Tools for Success. Alachua, FL: NCCER.

There are a number of online resources available for trainees who would like more information on HVAC/R systems and their application. 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 issues.

Instructors are also encouraged to locate additional audiovisual aids available through the internet, make personal videos, and take still pictures related to the HVAC/R trade and add them to the PowerPoint® presentations throughout the program.

Session Outline for 03101-13
Introduction to HVAC

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 introduces trainees to the basic principles of HVAC/R systems and some of the guiding principles of trade safety, LEED construction, and energy management.

1. Show Session One PowerPoint® slides.
2. Use the Kickoff Activity to get trainees engaged and introduce them to the subject matter.
3. Use both lecturing and visual aids to present the topics of the session.
4. Emphasize the important role of the HVAC technician in maintaining indoor air quality and energy efficiency.

Session Two

Session Two covers HVAC trade licensing and certification, as well as an introduction to building codes and permits. The potential career paths for the well-trained technician are also explored.

1. Show Session Two PowerPoint® slides.
2. Explain licensure requirements for technicians and contractors.
3. Present information regarding refrigerants and the environment.
4. Talk about building codes and permits.
5. Present trainees with a variety of HVAC career options and review USDOL statistics on the trade.

Session Three

Session Three 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 Two.) Go over the Module Review Questions in class and answer any questions that the trainees may have.

1. Have trainees complete the written examination.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.

Materials Checklist for Module 03101-13, *Introduction to HVAC*

Equipment and Materials		Equipment		Tools	
Personal protective equipment:					
Standard eye protection					
Gloves					
Proper footwear as designated by the instructor or training facility provider					
Hearing protection as designated by the instructor or training facility provider					
Hard hats					
Whiteboard/chalkboard					
Markers/chalk					
Pencils and paper					
HVAC Level One PowerPoint® Presentation Slides					
DVD player					
LCD projector and screen					
Computer					
Copies of the Module Examination					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Introduction to Drain, Waste, and Vent (DWV) Systems
Annotated Instructor's Guide

Module 02111-12

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 Slides (ISBN 978-0-13-292164-0)
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.

Plumbing Systems: Analysis, Design and Construction, 1996. Tim Wentz. Upper Saddle River, NJ: Prentice Hall.

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Introduction to Drain, Waste, and Vent (DWV) Systems.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	**Planned Time**
Session I. DWV Systems, Fixtures, Drains, and Traps	
A. DWV Systems	_____
B. Fixture Drains	_____
C. Types of Traps	_____
D. Parts of Traps	_____
Session II. Installation Requirements	
A. Trap Installation Requirements	_____
B. Why a Trap Loses Its Seal	_____
Session III. Vents, Drains, and Fittings	
A. Vents	_____
B. Sizing Drains and Vents	_____
C. Fittings and Their Applications	_____
Session IV. DWV System Design; Review and Testing	
A. Grade	_____
B. Building Drain	_____
C. Building Sewer	_____
D. Sewer Main	_____
E. Waste Treatment	_____
F. Code and Health Issues	_____
G. PT/Laboratory	_____
Have trainees sketch an isometric drawing of a simple DWV system and label its components. This laboratory corresponds to Performance Task 1.	
H. Review	_____
I. 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.	
J. 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.	

Plastic Pipe and Fittings
Annotated Instructor's Guide

Module 02106-12

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
Plumbing Level One PowerPoint® Presentation Slides (ISBN 978-0-13-292164-0)
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.

Pipefitting Level Two, Latest Edition. NCCER. Upper Saddle River, NJ: Prentice Hall.

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

Teaching Time for This Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 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.

Topic	**Planned Time**
Session I. Introduction to Plastic Pipe	
A. Advantages and Disadvantages	_____
B. Properties	_____
C. Sizing	_____
D. Labeling	_____
E. Manufacturers	_____
Sessions II-III. Plastic Pipe and Fittings	
A. Types of Plastic Pipe	_____
B. PT/Laboratory Have trainees practice identifying types of plastic pipes. This laboratory corresponds to Performance Task 1.	
C. Material Storage and Handling	_____
D. Water Supply Fittings	_____
E. DWV Fittings	_____
F. PT/Laboratory Have trainees practice identifying fittings and valves and their uses. This laboratory corresponds to Performance Task 2.	_____

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.

Copper Tube and Fittings
Annotated Instructor's Guide

Module 02107-12

Module Overview

This module discusses the materials, schedules, and properties of copper tube, fittings, and valves. Trainees will learn how to measure, ream, cut, join, and groove copper tube, as well as how to hang and support copper tube.

Objectives

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

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

Performance Tasks

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

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

Materials and Equipment

Computer
Plumbing Level One PowerPoint® Presentation Slides (ISBN 978-0-13-292164-0)
Markers/chalk
Pencils and paper
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your local code
Access to a fire extinguisher
Sections of copper tube
Tee-pulling tool
Fittings and valves, including:
- Water supply fittings
- Water supply valves
- DWV fittings
- Alternative fittings

Tools for measuring copper tube
Copper cutter
Handheld tube cutter
Internal tube cutter
Sizing tool
Tools to form sweat joints, compression joints, and flare joints
Variety of soldering tools, including an acetylene torch
Tools to roll groove and cut groove copper tube
Tube attachments for wood-frame construction
National Fire Protection Association (NFPA) Chapter 13
Manufacturers Standardization Society MSS40 hanger standards
Pressure gauge
Test plug
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. Emphasize safety precautions specific to tube-cutting operations. Stress the importance of following manufacturers' recommendations when cutting or sawing tube or when using any flame, heat, or power tools. Remind trainees of the environmental and physical hazards related to soldering work.

Additional Resources

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

The Copper Tube Handbook, 2006. New York: Copper Development Association.

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

"Throw Away Your Torches," Julius Ballanco, P.E. *Plumbing and Mechanical*, 2000.

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

Topic	**Planned Time**
Session I. Introduction to Copper Tube	
A. Types	_____
B. Sizing	_____
C. Labeling	_____
D. Applications	_____
E. Material Storage and Handling	_____
F. PT/Laboratory Have trainees select correct types of materials for copper tube systems. This laboratory corresponds to Performance Task 1.	_____
Session II. Fittings and Valves	
A. Water Supply Fittings	_____
B. Water Supply Valves	_____
C. DWV Fittings	_____
D. Alternative Fittings	_____
E. PT/Laboratory Have trainees identify types of fittings and valves and their uses. This laboratory corresponds to Performance Task 2.	_____

Sessions III-IV. Measuring, Cutting, Bending, Joining, and Grooving

A. Measuring _____
B. Cutting _____
C. Bending _____
D. Joining _____
E. Grooving _____
F. PT/Laboratory _____
Have the trainees select the appropriate personal protective equipment for working with copper tube and have them correctly measure, cut, ream, and join copper tube. This laboratory corresponds to Performance Tasks 3 and 4.

Session V. Installing, Insulating, and Pressure Testing; Review and Testing

A. Types of Tube Hangers and Supports _____
B. PT/Laboratory _____
Have trainees select the correct support and spacing for a given application. This laboratory corresponds to Performance Task 5.
C. Insulating Tubes _____
D. Pressure Testing _____
E. Review _____
F. Module Examination _____
1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

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

Lesson Plans for Module 27501-15

CABINETMAKING

Module 27501-15 introduces advanced trainees and experienced carpenters to the construction of high-quality finished products such as cabinets and furniture. Many companies build and install custom cabinets designed to fit into a specific area or serve a particular need. Custom cabinets are common in both residential and commercial construction. Custom entertainment centers, bookcases, and kitchen cabinets are all examples of work done by cabinetmakers. Like trim carpentry, this craft requires great precision, attention to detail, an eye for design, and the ability to use a variety of specialized tools that are unique to cabinet fabrication and construction.

Objectives

Learning Objective 1

- Identify and describe the types of wood commonly used to construct cabinets.
  a. Identify and describe solid woods.
  b. Identify and describe various types of plywood.
  c. Identify and describe particleboard.

Learning Objective 2

- Identify and describe the safe use of various cabinetmaking power tools.
  a. Identify and describe the safe use of various types of saws.
  b. Identify and describe the safe use of jointers, planers, shapers, and routers.
  c. Identify and describe the safe use of sanders, drill presses, and brad guns.

Learning Objective 3

- Identify and describe joints and other construction features of cabinet components and their related hardware and fasteners.
  a. Identify and describe the common wood joints used in cabinetmaking.
  b. Identify and describe the construction features of cabinet doors, drawers, and shelves.
  c. Identify and describe various types of cabinet hardware and fasteners.

Learning Objective 4

- Describe how to assemble, sand, and finish cabinets.
  a. Describe the process of cabinet assembly.
  b. Describe how to properly sand cabinets.
  c. Describe how to apply sealers, wood fillers, and stains.

Learning Objective 5

- Describe how to prepare and apply laminate to a countertop.
  a. Identify basic considerations for laminate installation.
  b. Describe how to lay out and cut laminates.
  c. Describe how to apply laminate to a countertop.

Performance Tasks

Performance Task 1

(Learning Objectives 2 and 3)

- Use power tools to make joints commonly used by cabinetmakers.

Performance Task 2

(Learning Objectives 2, 3, and 4)

- Build a cabinet from a set of drawings.

Performance Task 3

(Learning Objective 5)

- Install plastic laminate on a countertop core.

Teaching Time: 35 Hours

(Fourteen 2.5-hour Classroom Sessions)

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

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the accompanying 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 written examinations and Performance Profile sheets from **www.nccerirc.com**. The passing score for submission into NCCER's Registry is 70% or above for the written examination; all Performance Tasks are graded pass or fail.

Safety Considerations

This module requires that trainees work with and around numerous power tools and equipment capable of causing serious personal injury. Safety must be emphasized at all times. Trainees should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to power tools and the cabinet-shop environment. Any deficiencies must be corrected to ensure the future safety of all trainees. All practice sessions and Performance Tasks must be completed under your direct supervision.

Classroom Equipment and Materials

- Whiteboard
- Dry-erase markers
  - (a variety of standard marker sizes)
- Pencils and paper
- Poster board
- Flip chart
- LCD projector and screen
- Computer (Internet access optional)
- Samples of various hardwoods
- Samples of plywood with different core types
- Samples of particleboard, MDF, and melamine
- A variety of sandpapers with different abrasives and grit values
- Module Review answer key
- Copies of the Module Examination and answer key
- Performance Profile sheets
- The following tools are optional for classroom sessions:
  - Table saw
  - Radial arm saw
  - Compound miter saw
  - Jointer
  - Planer
  - Shaper
  - Router and router table
  - Drum sander
  - Belt-disc sander
  - Belt and pad sanders
  - Drill press
  - Brad gun
  - Biscuit joiner and biscuits

Laboratory Equipment and Materials

- Minimum Safety Equipment:
  - Safety glasses
  - Face shields
  - Work gloves
  - The following items as directed by the instructor or training facility provider:
    - Respiratory protection
    - Proper footwear
    - Hearing protection
    - Hard hat
- Table saw with both cutting and dado blade sets
- Radial arm saw
- Compound miter saw
- Scroll or band saw
- Jointer-planer
- Thickness planer
- Shaper with assorted cutting blades
- Router with assorted bits
- Router table
- Laminate trimmer (or appropriate router bit)
- Drum sander
- Disc sander
- Belt sander
- Random-orbit sander
- Appropriate abrasives and sandpaper for all sanding equipment
- Drill press and assorted bits
- Brad gun and brads
- Biscuit joiner
- Biscuits and dowels
- Squares
- Level
- Block plane
- Assortment of clamps
- Wood files and/or rasps
- Tape measures and steel rulers
- J-rollers
- Paint rollers and/or brushes for applying contact cement
- Contact cement
- Wood glue
- Wood sealers
- Wood filler
- Various wood stains
- Finish coat products, such as varnish or polyurethane
- Brushes and rags for applying finishes
- Assortment screws and similar assembly hardware
- Appropriate scrap lumber for joint-fabrication demonstration and trainee practice
- Countertop base and backsplash
- Sufficient laminate material to cover the countertop base

Additional Resources

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

Wood Handbook: Wood as an Engineering Material. General Technical Report FPL-GTR-190. Madison, WI: Forest Products Laboratory, United States Department of Agriculture.

Building Kitchen Cabinets. 2003. Udo Schmidt. Newton, CT: Taunton Press.

The Complete Kitchen Cabinetmaker. 2014. Robert W. Lang. East Petersburg, PA: Fox Chapel Publishing.

Understanding Wood Finishing: How to Select and Apply the Right Finish. 2010. Bob Flexner. East Petersburg, PA: Fox Chapel Publishing.

American Plywood Association. **www.apawood.org**. Last accessed June 24, 2015.

Hardwood Plywood and Veneer Association. **www.hpva.org**. Last accessed June 24, 2015.

The Wood Database. **www.wood-database.com**. Last accessed June 24, 2015.

Jet Power Tools. **www.jettools.com**. Last accessed June 27, 2015.

Porter Cable. **www.portercable.com**. Last accessed June 27, 2015.

CPO Powermatic. **www.cpopowermatic.com**. Last accessed June 27, 2015.

SawStop™ Table Saws. **www.sawstop.com**. Last accessed June 27, 2015.

Rockler Woodworking and Hardware. **www.rockler.com**. Last accessed June 28, 2015.

Kreg Enterprises, Inc. **www.kregtool.com**. Last accessed June 28, 2015.

General Finishes. **www.generalfinishes.com**. Last accessed September 2, 2015.

Wilsonart LLC. **www.wilsonart.com**. Last accessed June 28, 2015.

There are a number of online resources available for trainees who would like more information on cabinetmaking and related finish carpentry skills. 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.

Numerous videos related to the topic are available on the Internet. These can be located by searching “custom cabinets”, “cabinetmaking”, or similar terms and using the Video tab on the results page of your preferred search engine.

Instructors are 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 presentations throughout the program.

Session Outline for 27501-15

Cabinetmaking

The lesson plan for this module is divided into fourteen 2.5-hour sessions.
Each session includes 10 minutes for administrative tasks and one 10-minute break.

Session One

Session One introduces trainees to a wide variety of cabinet woods. The session concludes with an introduction to shop saws. This session covers Sections 1.0.0 through 2.1.3.

1. Open the Session One presentation.
2. Use the Kickoff Activity to encourage discussion and learn more about the trainees.
3. Introduce hardwoods and softwoods used in cabinetmaking.
4. Review plywood construction and the use of particleboard.
5. Open the topic of shop power tools with an introduction to shop saws.
6. Use the Section Review questions to review the topics of this session.

Session Two

Session Two presents the remaining power tools to be covered in this module and introduces trainees to common wood joints used in cabinetmaking. This session covers Sections 2.2.0 through 3.1.11.

1. Open the Session Two presentation.
2. Use the Kickoff Activity to introduce trainees to the jointer and its proper adjustment.
3. Identify and describe jointer-planers, thickness planers, shapers, and routers.
4. Identify and describe sanders, drill presses, and brad guns.
5. Introduce a variety of wood joints used in cabinetmaking.
6. Use the Section Review questions to review the topics of this session.

Session Three

Session Three presents the components of cabinets as well as the necessary hardware. The session concludes with a discussion of cabinet assembly and finishing processes. This session covers Sections 3.2.0 through 4.3.3.

1. Open the Session Three presentation.
2. Use the Kickoff Activity to introduce trainees to the extensive variety of cabinet pulls, knobs, and related hardware available on the market.
3. Review the construction details of cabinet doors, drawers, and shelves.
4. Identify and describe different types of hinges, catches, knobs, pulls, and fasteners.
5. Review the steps in cabinet assembly.
6. Discuss the application of sealers, wood fillers, stains, and finish coatings.
7. Use the Section Review questions to review the topics of this session.

Session Four

Session Four reviews the process of installing countertop laminates. In addition, this session includes a review of the complete module and the module exam is administered. This session covers Sections 5.0.0. through 5.3.2.

1. Open the Session Four presentation.
2. Use the Kickoff Activity to introduce the installation of laminates through a video presentation.
3. Review the process of cutting and applying laminates.
4. Use the Section Review questions to review the topics of this session.
5. Go over the Module Review to prepare trainees for the module exam.
6. Administer the module exam. Record the testing results on the Registration of Training Modules form and submit the form to your Training Program Sponsor.

SESSIONS FIVE THROUGH FOURTEEN

Sessions Five through Fourteen are laboratory sessions that provide an opportunity for trainees to practice and complete the Performance Tasks associated with this module.

1. Note that no slide presentation is associated with these laboratory sessions.
2. Demonstrate how to use a variety of power tools.
3. Demonstrate how to create common wood joints using power tools.
4. Provide trainees with a set of plans to build a cabinet and review the details of its construction.
5. Under your supervision, have trainees practice and complete the requirements of Performance Tasks 1 and 2.
6. Coach trainees through the installation of a laminate on a countertop base.
7. Under your supervision, have trainees practice and complete the requirements of Performance Task 3.
8. Document successful Performance Task completions for each trainee on the Performance Profile sheet and submit the results to the Training Program Sponsor.

Materials Checklist for Module 27501-15, Cabinetmaking

Equipment and Materials					
Personal protective equipment:		Table saw with both cutting and dado blade sets		J-rollers	
Safety glasses		Radial arm saw		Paint rollers and/or brushes for applying contact cement	
Face shields		Compound miter saw		Contact cement	
Work gloves		Scroll or band saw		Wood glue	
The following items as directed by the instructor or training facility provider:		Jointer-planer		Wood sealers	
Respiratory protection		Thickness planer		Wood filler	
Proper footwear		Shaper with assorted cutting blades		Various wood stains	
Hearing protection		Router with assorted bits		Finish coat products, such as varnish or polyurethane	
Hard hat		Router table		Brushes and rags for applying finishes	
Whiteboard		Laminate trimmer (or appropriate router bit)		Assortment screws and similar assembly hardware	
Dry-erase markers		Drum sander		Appropriate scrap lumber for joint-fabrication demonstration and trainee practice	
Pencils and paper		Disc sander		Countertop base and backsplash	
Poster board		Belt sander		Sufficient laminate material to cover the countertop base	
Flip chart		Random-orbit sander		Tools for classroom sessions (*optional*):	
LCD projector and screen		Appropriate abrasives and sandpaper for all sanding equipment		Table saw	
Cabinetmaking PowerPoint® Presentation Slides		Drill press and assorted bits		Radial arm saw	
Computer (Internet access optional)		Brad gun and brads		Compound miter saw	
Module Review answer key		Biscuit joiner		Jointer, planer, shaper	
Copies of the Module Examination and answer key		Biscuits and dowels		Router and router table	
Performance Profile sheets		Squares		Drum sander	
Samples of various hardwoods		Level		Belt-disc sander	
Samples of plywood with different core types		Block plane		Belt and pad sanders	
Samples of particleboard, MDF, and melamine		Assortment of clamps		Drill press	
Variety of sandpapers with different abrasives and grit values		Wood files and/or rasps		Brad gun	
		Tape measures and steel rulers		Biscuit joiner and biscuits	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for Module 27211-13

Cabinet Installation

Module Eleven (27211-13) provides detailed instructions for the selection and installation of base and wall cabinets and countertops.

Objectives

Learning Objective 1

- Describe the safety hazards when installing cabinets.
  a. Identify tool and material hazards that may be present when installing cabinets.
  b. Explain how to prevent back injuries through proper ergonomics.

Learning Objective 2

- Identify the different types of cabinets.
  a. Identify wall cabinets.
  b. Identify base cabinets.
  c. Describe the purpose of a countertop.

Learning Objective 3

- Identify cabinet components and hardware and describe their purpose.
  a. Identify cabinet components.
  b. Describe various types of hardware used on cabinets.

Learning Objective 4

- Explain how to lay out and install a basic set of cabinets.
  a. Describe the surface preparation needed before cabinet installation.
  b. Explain how to install wall cabinets.
  c. Explain how to install base cabinets and countertops.

Performance Tasks

Performance Task 1 (Learning Objective 4)

- Lay out and identify various types of base and wall units following a specified layout scheme.

Teaching Time: 10 hours

(Four 2.5-hour classroom sessions)

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

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 lift cabinets, which may be heavy. 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 Two PowerPoint®
Presentation Slides
Computer
Copies of the Module Examination and Performance Profile Sheets
Vendor-supplied videos/DVDs showing cabinet installation (optional)
TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment (PPE):
- Hard hat
- Eye protection

4' level
Bar clamps
Base cabinets
Belt sander
Broom and dustpan
Cabinet manufacturers' catalogs
Chalk box and chalkline
Chisel
Compass or dividers
Countertop
Drill and drill bits
Framing square
Laser level
Photographs of base cabinets
Photographs of countertops
Photographs of wall cabinets
Plumb bob
Power planer
Power screwdriver
Samples of cabinet doors
Samples of cabinet drawers
Samples of drawer guides
Samples of hinges, catches, knobs, and pulls
Screws
Set of construction drawings
Shims
Spring-loaded clamps
Story pole
Straightedge
Tape measure
T-braces
Utility knife
Wall cabinets
Water level

Additional Resources and References

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

Cabinet Makers Association website. **www.cabinetmakers.org**

Kitchen Cabinet Makers Association website. **www.kcma.org**

Mill's Pride Cabinetry website. **www.millspridekitchens.com**

There are a number of online resources available for trainees who would like more information on cabinet installation. 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 encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take photos related to the subject matter and add them to the PowerPoint® presentations throughout the program.

Session Outline for 27211-13

Cabinet Installation

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 the types of cabinets and installation safety.

1. Show Session One PowerPoint® presentation slides.
2. Review general tool and equipment safety.
3. Discuss the types of base and wall cabinets that are available and applications for each.
4. Discuss countertops and the types of materials used in their manufacture.

Session Two

Session Two introduces cabinet components and hardware.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss two types of cabinet construction.
3. Discuss cabinet components, including doors, drawers, and hardware.

Session Three

Session Three introduces cabinet installation.

1. Show Session Three PowerPoint® presentation slides.
2. Discuss surface preparation that is needed prior to cabinet installation.
3. Discuss and demonstrate the procedure for laying out and installing wall cabinets.
4. Discuss and demonstrate the procedure for laying out and installing base cabinets.
5. Demonstrate the proper method for scribing adjoining pieces.

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.

Materials Checklist for Module 27211-13, Cabinet Installation

Equipment and Materials					
Personal protective equipment:		4' level		Plumb bob	
Eye protection		Bar clamps		Power planer	
Hard hat		Base cabinets		Power screwdriver	
Whiteboard/chalkboard		Belt sander		Samples of cabinet doors	
Markers/chalk		Broom and dustpan		Samples of cabinet drawers	
Pencils and paper		Cabinet manufacturers' catalogs		Samples of drawer guides	
Carpentry Level Two PowerPoint® Presentation Slides		Chalk box and chalkline		Samples of hinges, catches, knobs, and pulls	
TV/DVD player		Chisel		Screws	
Computer		Compass or dividers		Set of construction drawings	
Copies of the Module Examination and Performance Profile Sheets		Countertop		Shims	
Vendor-supplied videos/DVDs showing cabinet installation (optional)		Drill and drill bits		Spring-loaded clamps	
		Framing square		Story pole	
		Laser level		Straightedge	
		Photographs of base cabinets		Tape measure	
		Photographs of countertops		T-braces	
		Photographs of wall cabinets		Utility knife	
				Wall cabinets	
				Water level	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.

Lesson Plans for 27406-14

Introduction to Construction Equipment

Module 27406-14 describes various pieces of equipment commonly used at a construction site, including the aerial lift, skid-steer loader, electric power generator, compressor, compactor, forklift, and backhoe. The module provides an overview of general safety, operation, and maintenance procedures for each type of equipment.

Objectives

Learning Objective 1

1. State the safety precautions associated with construction equipment.
   a. Identify safety precautions when transporting construction equipment.
   b. Identify safety precautions related to interlocking and hydraulic systems.
   c. Identify safety precautions to observe when fueling construction equipment.
   d. Identify safety precautions related to batteries of construction equipment.

Learning Objective 2

2. Identify and explain the safe operation and use of various pieces of construction equipment.
   a. Explain the safe operation of aerial lifts.
   b. Explain the safe operation of skid-steer loaders.
   c. Explain the safe operation of generators.
   d. Explain the safe operation of compressors.
   e. Explain the safe operation of compactors.
   f. Explain the safe operation of forklifts.
   g. Explain the safe operation of backhoes.

Performance Tasks

This is a knowledge-based module; there no required performance tasks.

Teaching Time: 7.5 hours

(Three 2.5-hour Classroom sessions)

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

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 from **www.nccerirc.com**. The passing score for submission into NCCER's Registry is 70 percent or above for the Module Examination.

Important Note: The Core Curriculum *Basic Safety* module and the Safety Review Questions at the back of the Trainee Guide must be successfully completed before a trainee can operate any type of construction equipment.

Instructors may wish to establish a relationship with a local equipment rental facility that will allow the class to visit and observe demonstrations of the equipment covered in this module.

Safety Considerations

This module requires that trainees work in and around construction equipment. 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 Four PowerPoint® Presentation Slides

Computer

Copies of the Module Examination

Vendor-supplied videos/DVDs showing construction equipment (*optional*)

TV/DVD player

Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment:

- Hard hat
- Safety glasses
- Safety shoes
- Personal fall arrest system

Aerial lift

Air compressor

Backhoe

Blank copies of the following forms:

- Forklift operator's daily checklist
- Generator preventive maintenance schedule
- Aerial lift maintenance and inspection schedule
- Skid-steer loader service schedule

Cam-operated twist locks

Copy of Subpart O (*Motor Vehicles, Mechanized Equipment, and Marine Operations*) of OSHA construction regulations

Flat-plate compactor

Forklift

Generator

Operator's manual for aerial lift or skid-steer loader

Photographs of the following types of construction eqipment:

- Aerial lift
- Air compressor
- Backhoe
- Compactor
- Forklift
- Generator
- Skid-steer loader

Set of construction drawings for a small commercial building

Skid-steer loader

Whip checks

Additional Resources and References

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

Construction Equipment Guide. New York: John Wiley & Sons.

Heavy Equipment Operations Levels 1, 2, and 3. Latest Edition. NCCER. Upper Saddle River, NJ: Pearson.

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

Session Outline for 27406-14

Introduction to Construction Equipment

The lesson plan for this module is divided into three 2.5-hour sessions.
Each session includes 10 minutes for administrative tasks and one 10-minute break.

Session One

Session One introduces general construction equipment safety and describes the use of aerial lifts and skid-steer loaders.

1. Show Session One PowerPoint® presentation slides.
2. Identify general safety precautions associated with construction equipment.
3. Discuss how to safely operate an aerial lift.
4. Discuss how to safely operate a skid-steer loader.

Session Two

Session Two introduces generators, air compressors, compactors, forklifts, and backhoes.

1. Show Session Two PowerPoint® presentation slides.
2. Discuss how to safely operate a generator.
3. Discuss how to safely operate a compressor.
4. Discuss how to safely operate a compactor.
5. Discuss how to safely operate a forklift.
6. Discuss how to safely operate a backhoe.

Session Three

Session Three 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 Two.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.

Materials Checklist for Module 27406-14, Introduction to Construction Equipment

Equipment and Materials					
Personal protective equipment:		Aerial lift		Air compressor	
Hard hat		Backhoe		Blank copy of a forklift operator's daily checklist	
Safety glasses		Blank copy of a generator preventive maintenance schedule		Blank copy of aerial lift maintenance and inspection schedule	
Safety shoes		Forklift		Generator	
Personal fall arrest system		Blank copy of skid-steer loader service schedule		Cam-operated twist locks	
Whiteboard/chalkboard		Copy of Subpart O (*Motor Vehicles, Mechanized Equipment, and Marine Operations*) of OSHA construction regulations		Photograph of air compressor	
Markers/chalk		Set of construction drawings for small commercial building		Photograph of compactor	
Pencils and paper		Operator's manual for aerial lift or skid-steer loader		Photograph of generator	
Carpentry Level Four PowerPoint® Presentation Slides		Flat-plate compactor		Photograph of aerial lift	
TV/DVD player		Skid-steer loader		Photograph of backhoe	
Computer		Whip checks		Photograph of forklift	
Copies of the Module Examination				Photograph of skid-steer loader	

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.