Overview

The sheet metal craft plays an important role in industry, with applications in HVACR, building materials, transportation, manufacturing, architecture, and countless consumer products. Sheet metal craftworkers cut, bend, fold, shape, and connect sheets of metal into the structures needed to support all these applications, as well as many others.

Journey-level craftworkers are employed in fabrication shops using a wide variety of specialized tools and equipment, and at job sites installing and putting the finishing touches on the final product. This module provides an introduction to the sheet metal craft and the diversity it offers to those choosing to join thousands of other proud sheet-metal craft professionals.

Learning Objective 1

Successful completion of this module prepares trainees to:
Summarize the history of the sheet metal craft and the opportunities it presents.

a. Explain the meaning of pride in craftsmanship.
b. Summarize the history of the sheet metal craft.
c. Describe sheet metal work and the opportunities it presents.

Learning Objective 2

Successful completion of this module prepares trainees to:
Describe common sheet metal materials and how they are measured.

a. Describe metals commonly used to create sheet metal.
b. Describe common alloys used in sheet metal.
c. Describe common sheet metal coatings.
d. Explain how sheet metal is measured.
Learning Objective 3

Successful completion of this module prepares trainees to:
Describe apprenticeship programs and identify general safety guidelines for construction work.

a. Describe modern apprenticeship training.
b. Identify general safety guidelines for construction work.

Performance Tasks

1. Identify types of metal from a collection of examples.
2. Identify common sheet metal fittings.
3. Use a standard sheet metal gauge to measure various metal thicknesses to given standards.

Recommended Teaching Time: 7.5 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 04101
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

Performance Task 1 Materials

• Examples of a variety of types of metal, each numbered for identification purposes
• “Performance Task One— Metal Sample Identification” sheets
• Writing utensils
• Small magnets
• Performance Profile sheets

Performance Task 2 Materials
• PowerPoint® Presentation for Module 04101, Slide 31 “Performance Task Two—Sheet Metal Fittings Matching”
• Answer Recording Form for “Performance Task Two—Sheet Metal Fittings Matching”
• Performance Profile sheets

Performance Task 3 Materials
• Examples of various metals, including both coated and uncoated metals, each labeled with a number for identification purposes
• Standard sheet metal gauges
• Performance Profile sheets
Sheet Metal Tools and Equipment

Overview
Sheet metal workers must complete a variety of tasks using numerous hand tools, power tools, and stationary equipment. Knowing which tool to choose and how each is used are important skills every craftworker must learn. Equally important is the knowledge of safety and maintenance requirements for each tool. To become a successful craftworker, regardless of the craft, a sheet metal worker must know the tools available and how to safely apply them to the task at hand.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify common tool-related safety precautions.

a. Identify common safety precautions related to hand tools.
b. Identify common safety precautions related to power tools and machinery.

Learning Objective 2

Successful completion of this module prepares trainees to:
Identify and describe the use of measuring, drafting, and layout tools.

a. Identify and describe the use of various measuring tools.
b. Identify and describe the use of drafting and layout tools.

Learning Objective 3

Successful completion of this module prepares trainees to:
Identify and describe the safe use of various hammers, hammered tools, and hand tools.

a. Identify and describe the use of various hammers and mallets.
b. Identify and describe the use of cold chisels and various punches.
c. Identify and describe the use of common sheet-metal hand tools.

**Learning Objective 4**

*Successful completion of this module prepares trainees to:*
Identify and describe the safe use of various cutting, sawing, drilling, and welding tools.

a. Identify and describe the use of hand-operated cutting and sawing tools.
b. Identify and describe the use of various power tools.
c. Identify and describe the use of drills and drill bits.
d. Identify and describe the use of welding equipment.

**Learning Objective 5**

*Successful completion of this module prepares trainees to:*
Identify and describe the safe use of sheet metal shop equipment.

a. Identify and describe the use of shop metal-cutting equipment.
b. Identify and describe plasma-arc cutting equipment and applications.
c. Identify and describe the use of various forming machines.

**Performance Tasks**

1. Identify a given hand tool and demonstrate its safe use and maintenance.
2. Identify a given power tool and demonstrate its safe use and maintenance.
3. Identify a given shop machine and demonstrate its safe use and maintenance.

Recommended Teaching Time: 10 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 04102
- A variety of standard marker sizes
- Poster board
- Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Task 1 Materials**
• Appropriate PPE
• A selection of sheet-metal hand tools
• Various sheet metal materials on which the hand tools can be used
• Performance Profile sheets

**Performance Task 2 Materials**
• Appropriate PPE
• A selection of relevant power tools
• Various sheet metal materials on which the power tools can be used
• Performance Profile sheets

**Performance Task 3 Materials**
• Appropriate PPE
• A selection of relevant sheet-metal shop equipment
• Various sheet metal materials on which the equipment can be used
• Performance Profile sheets
Module Three (29103) introduces the trainees to the methods and procedures related to the plasma arc cutting process. Trainees will learn safety procedures, equipment setup, gas types, flow rates, and techniques.

### Objectives

**Learning Objective 1**
- Explain plasma arc cutting processes and identify related safety precautions.
  a. Describe the plasma arc cutting processes.
  b. Identify safety practices related to plasma arc cutting.

**Learning Objective 2**
- Identify and describe plasma arc cutting equipment.
  a. Identify and describe plasma arc power units.
  b. Identify and describe plasma arc torches and accessories.
  c. Identify and describe plasma arc cutting gases and gas control devices.

**Learning Objective 3**
- Describe how to set up, safely operate, and care for plasma arc cutting equipment.
  a. Describe how to set up plasma arc cutting equipment and the adjacent work area.
  b. Describe how to safely operate plasma arc cutting equipment.
  c. Describe how to care for plasma arc cutting equipment.

### Performance Tasks

**Performance Task 1**
*(Learning Objectives 1, 2, and 3)*
- Set up plasma arc cutting equipment.

**Performance Task 2**
*(Learning Objectives 2 and 3)*
- Set the amperage and gas pressures or flow rates for the type and thickness of metal to be cut using plasma arc equipment.

**Performance Task 3** *(Learning Objective 3)*
- Square-cut metal using plasma arc equipment.

**Performance Task 4** *(Learning Objective 3)*
- Bevel-cut metal using plasma arc equipment.

**Performance Task 5** *(Learning Objective 3)*
- Pierce and cut slots in metal using plasma arc equipment.

**Performance Task 6** *(Learning Objective 3)*
- Dismantle and store the equipment.

### 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.

### Prerequisites

Core Curriculum; Welding Level One, Module 29101.

### 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 module requires that trainees work with equipment that generates high voltages, extremely high temperatures, and intense ultraviolet radiation. 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 hazards related to plasma arc cutting equipment. Any deficiencies must be corrected to ensure future trainee safety. All practice sessions and performance tasks must be completed under the instructor’s direct supervision.

**Classroom Equipment and Materials**
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- *Welding Level One PowerPoint® Presentation*
- DVD player or a computer with a DVD drive
- LCD projector and screen
- Computer with Internet access
- Module Review and Trade Terms Quiz answer keys
- Copies of the Module Examination and Performance Profile Sheets
- An example of the plasma arc cutting unit and torch trainees will operate
- Manufacturer’s documentation for the cutting units to be used (a copy for each trainee is recommended)
- Gas cylinders and regulators (if required)

**Equipment and Materials for Laboratories and Performance Testing**
- Appropriate PPE:
  - Appropriate flame-retardant clothing
  - Eye and face protection, properly tinted
  - Welding or cutting gloves
  - Proper footwear as designated by the instructor or training facility provider
  - Hearing protection as designated by the instructor or training facility provider
  - Hard hat or welding helmet as designated by the instructor or training facility provider
- Plasma arc cutting power units and accessories
- Clean, dry compressed air supply
- Other gases (if required)
- Gas pressure regulators (if required)
- Plasma torch cutting guides
- Sufficient carbon steel plate for all trainees to create the specified workpieces
- Soapstone
- Tape measures or steel rules
- Squares
- Wire brushes

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


There are a number of on-line resources available for trainees who would like more information on plasma arc cutting. 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. The Lincoln Electric web site at [http://newsroom.lincolnelectric.com/Video](http://newsroom.lincolnelectric.com/Video) offers a video entitled “Tech Tips: Plasma Cutting Basics” along with many other welding-related videos. Video length is 5:09.

Instructors are also encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.
Session Outline for 29103

PLASMA ARC CUTTING

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 explains plasma arc cutting (PAC) processes and identifies related safety precautions. The trainees will also be introduced to PAC power units, torches, accessories, gases and gas control devices. This session covers Sections 1.0.0 through 3.3.3.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to get trainees engaged and give them an idea of what they will learn from this module.
3. Describe plasma arc cutting processes and review safety considerations.
4. Introduce plasma arc cutting equipment.
5. Describe how to set up PAC equipment and prepare the adjacent work areas.
6. Describe how to safely operate the PAC equipment.
7. Review common cutting techniques.

**SESSION TWO**

Session Two is a laboratory session that provides an opportunity to practice and/or complete the Performance Tasks required in this module.

1. Note that no PowerPoint® presentation is associated with this laboratory session.
2. Demonstrate equipment setup and plasma arc cutting techniques, including slots and bevels.
3. Trainees practice and/or complete the specific tasks required by Performance Tasks 1 through 6.

**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 the previous session. Go over the Module Review in class prior to the exam and answer any questions that the trainees may have.

1. Have trainees complete the written examination. Any outstanding performance testing must be completed during this session as well.
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 29103, Plasma Arc Cutting

<table>
<thead>
<tr>
<th>Personal protective equipment:</th>
<th>Equipment and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate flame-retardant clothing</td>
<td>Clean, dry compressed air supply</td>
</tr>
<tr>
<td></td>
<td>Other gases (if required)</td>
</tr>
<tr>
<td>Eye and face protection, properly tinted</td>
<td>Sufficient carbon steel plate for all trainees to create the specified workpieces</td>
</tr>
<tr>
<td>Welding or cutting gloves</td>
<td>Plasma arc cutting power units and accessories</td>
</tr>
<tr>
<td>Proper footwear as designated by the instructor or training facility provider</td>
<td>Gas pressure regulators (if required)</td>
</tr>
<tr>
<td>Hearing protection as designated by the instructor or training facility provider</td>
<td>Soapstone</td>
</tr>
</tbody>
</table>

- Whiteboard/chalkboard
- Markers/chalk
- Pencils and paper
- **Welding Level One PowerPoint® Presentation Slides**
- DVD player or a computer with a DVD drive
- Computer with Internet access
- Copies of the Module Examination and Performance Profile Sheets
- Module Review and Trade Terms Quiz answer keys
- An example of the plasma arc cutting unit and torch trainees will operate
- Manufacturer’s documentation for the cutting units to be used (a copy for each trainee is recommended)
- Gas cylinders and regulators (if required)

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.
Sheet Metal Math and Measurement

Overview
Math skills are especially important in the sheet metal craft. Laying out, creating, and assembling the many unique workpieces needed requires good math skills. When sheet metal fabrication and installation processes are attempted without a firm mathematical foundation, they become exercises in trial and error. Good math skills are one of several characteristics that identify sheet metal craft professionals and separate them from others. The best way to advance and hone those skills is through practice.

Learning Objective 1
Successful completion of this module prepares trainees to:
Solve mathematical problems related to fractions, percentages, ratios, and proportions.

a. Add, subtract, multiple, and divide fractions.
b. Solve problems related to percentages.
c. Solve problems related to ratios and proportions.

Learning Objective 2
Successful completion of this module prepares trainees to:
Read and calculate linear measurements and convert measurements to and from the metric system.

a. Read a rule and make linear measurements.
b. Convert linear measurements to and from the metric system.
c. Make mathematical calculations with denominate numbers.

Learning Objective 3
Successful completion of this module prepares trainees to:
Calculate area, volume, and weight values.
a. Define square measurement and calculate the area of squares and rectangles.
b. Calculate the area of various two-dimensional figures.
c. Calculate the volume of various three-dimensional figures.
d. Calculate and convert weight values.

Learning Objective 4

Successful completion of this module prepares trainees to:
Identify basic geometric shapes and construct lines and arcs.

a. Identify points, lines, and circles.
b. Identify angles and their parts.
c. Identify various polygons.
d. Construct various lines and arcs to identify other lines and points.

Learning Objective 5

Successful completion of this module prepares trainees to:
Calculate stretchouts and miters for duct offsets.

a. Calculate stretchouts for sheet metal fittings.
b. Calculate miters for duct offsets.

Performance Tasks

1. Use the OWL method to calculate a specified offset.

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 04104
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

**Performance Task 1 Materials and Equipment**

• A copy of *Figure 95* for each trainee
• Paper and pencil
• Calculators (optional)
• Performance Profile sheets
Course Planning Tools

Module 04103
Overview
Before sheet metal craftworkers can safely and effectively perform all the tasks needed to transform sheets of metal into the array of shapes used in construction, a fundamental understanding of basic sheet metal layout and forming processes must be developed. This module explains some of the general rules that apply to sheet metal layout work, and it describes how to select and use some common layout tools. It also explains the three primary methods used for laying out sheet metal patterns, and describes how to cut, form, and assemble finished objects.

Learning Objective 1
Successful completion of this module prepares trainees to:

Visualize the layout process and state general rules relevant to the layout process.

a. Explain how to best visualize the layout process.
b. State general rules relevant to the layout process.

Learning Objective 2
Successful completion of this module prepares trainees to:

Identify and describe the three primary sheet metal layout methods.

a. Identify and describe parallel line development.
b. Identify and describe radial line development.
c. Identify and describe triangulation.

Learning Objective 3
Successful completion of this module prepares trainees to:

Explain how to follow a layout to cut sheet metal components.

a. Explain how to make cuts with hand snips.
b. Explain how to make cuts with squaring shears.

**Learning Objective 4**

*Successful completion of this module prepares trainees to:*

Explain how to punch holes, form shapes, and finish edges of sheet metal components.

a. Explain how to punch holes in sheet metal.
b. Explain how to form sheet metal using forming machines.

c. Explain how to finish edges.

**Learning Objective 5**

*Successful completion of this module prepares trainees to:*

Identify and describe various sheet metal seams and connectors.

a. Identify and describe various sheet metal seams.
b. Identify and describe various sheet metal connectors.

**Performance Tasks**

1. Transfer a sheet metal pattern to a piece of sheet metal to given standards.
2. Use hand snips to make straight cuts, outside curved cuts, and internal cuts on 24-gauge or lighter sheet metal to given standards.
3. Perform a double cut on light pipe to given standards.
4. Use shears to square a piece of light-gauge sheet metal for ductwork to within 1/16 inch (2 mm).
5. Use a slip-roll forming machine to make two sections of round pipe with grooved seams to given standards.
6. Use a brake to make right-angle bends and Pittsburgh seams, then assemble the pieces to create a section of duct.
7. Use a bar folder to create single and double hems to given standards.
8. Make a crimped edge on round pipe to given standards.
9. Join two sections of round pipe by crimping and beading to given standards.

Recommended Teaching Time: 17.5 hours
Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 04103
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

**Performance Task 1 Materials**
- Appropriate PPE as directed by the instructor or training facility provider
- Prepared sheet metal patterns
- Sufficient sheet metal to accommodate pattern and number of trainees
- Common layout tools, including rules, dividers, scribes, and straightedges

**Performance Tasks 2 and 3 Materials**
- Appropriate PPE as directed by the instructor or training facility provider
- Resulting sheet metal pattern from *Performance Task 1*, or scrap sheet metal
- Round pipe, any size
- Prepared sheet metal patterns
- Aviator snip sets
- Offset snip sets
- Double-cut snips

**Performance Task 4 Materials**
- Appropriate PPE as directed by the instructor or training facility provider
- Light-gauge sheet metal
- Common layout tools, including squares, rules, and scribes
- Squaring shear

**Performance Tasks 5, 8, and 9 Materials**
• Appropriate PPE as directed by the instructor or training facility provider
• Light-gauge sheet metal sufficient for two lengths of round pipe, per trainee (instructor determines diameter and section length)
• Common layout tools, including squares, rules, and scribes
  • Squaring shear
  • Slip roll machine
  • Bar folder and/or brakes
  • Hand crimpers

**Performance Task 6 Materials**
• Appropriate PPE as directed by the instructor or training facility provider
• Light-gauge sheet metal sufficient to create a short section of duct, per trainee (instructor determines duct size and section length)
• Common layout tools, including squares, rules, and scribes
  • Squaring shear
  • Pittsburgh machine
  • Bar folder and/or brakes

**Performance Task 7 Materials**
• Appropriate PPE as directed by the instructor or training facility provider
• Light-gauge sheet metal appropriate for hem fabrication practice
• Common layout tools, including squares, rules, and scribes
  • Bar folder
04105
Parallel Line Development
Sheet Metal

Overview
Of the three methods used for sheet metal layout, parallel line development is the one most frequently used to create sheet metal fittings for air distribution systems. This module examines how to use parallel line development to lay out the patterns to fabricate various fittings commonly used in HVAC systems. Developing layout and fabrication skills is very important to any sheet metal craftworker. If a pattern is laid out incorrectly, the fitting that results will not fit together with other components in the system, and rework becomes necessary.

Learning Objective 1
Successful completion of this module prepares trainees to:
Explain how to use parallel line development to fabricate various sheet metal duct fittings and objects.

  a. Identify the basic steps in pattern development.
  b. Explain how to fabricate a grooved lock seam.
  c. Explain how to fabricate a flexible connection.
  d. Explain how to fabricate a rectangular duct section using a Pittsburgh lock.
  e. Explain how to fabricate a square mitered fitting.
  f. Explain how to fabricate a 90-degree square elbow.
  g. Explain how to fabricate a 90-degree radius elbow.
  h. Explain how to fabricate a transition with three straight sides.
  i. Explain how to fabricate a transition with two straight sides.
  j. Explain how to fabricate a double offset.
  k. Identify complex fittings that use parallel line development.

Performance Tasks

1. Lay out and fabricate an instructor-selected fitting to the specifications provided.

Recommended Teaching Time: 27.5 hours
Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 04105
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1 Materials

- Appropriate PPE
- Sheets of 26- and 28-gauge galvanized sheet metal
- Scratch awls
- Straightedges
- Wing dividers
- Scribers
- Felt-tipped markers
- Framing squares
- Combination squares
- Prick punches
- Mallets
- Sheet metal hammers
- Hand seamers
- Hand groovers
- Snips
- Hand notchers
- Easy Edgers
- Squaring shear
- Bar folder or brake
- Slip-roll machine
- Pittsburgh roll-forming machine
Installation of Ductwork

Course Planning Tools

Module 04106
Overview
To install ductwork, craftsmen must be able to identify and select fasteners, hangers, and supports for the installation of duct and other HVAC system components. To do so, it is important to understand load requirements and the standards related to hangers and supports. The module also presents information regarding the reduction of noise created by air distribution equipment.

Learning Objective 1

Successful completion of this module prepares trainees to:
Describe the process of assembling duct.

a. Describe how to lift duct into position.
b. Describe how duct sections are connected.
c. Describe how duct is sealed.

Learning Objective 2

Successful completion of this module prepares trainees to:
Identify and describe common hardware.

a. Describe identifying characteristics of bolts and screws.
b. Identify and describe types of bolts and screws.
c. Identify and describe types of nuts and washers.
d. Identify and describe types of toggle bolts.
e. Identify and describe rivets.
f. Identify and describe types of concrete anchors.
g. Identify and describe various hangers and supports.
Learning Objective 3

Successful completion of this module prepares trainees to:
Identify and describe the application of hangers and supports.

a. Describe various hanging methods.
b. Identify hanger and support code and specification requirements.

Performance Tasks

1. Connect both rectangular and round sections of duct and seal the joints with mastic.
2. Identify and determine the various specifications of a given fastener.
3. Install one or more instructor-selected concrete anchors.
4. Demonstrate the proper method of installing selected duct hangers and supports.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 04106
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations

Performance Task 1

- Appropriate PPE
- Appropriate hand and power tools
- Sections of duct, prepared for connection to each other
- Mastic and brushes
- Performance Profile sheets
Performance Task 2
- Appropriate PPE
- Instructor selected fasteners; each fastener should be numbered or lettered
- Tape measures or rules
- Thread gauges
- Performance Profile sheets

Performance Task 3
- Appropriate PPE, including breathing protection appropriate for silica dust
- Instructor-selected concrete anchors
- Masonry or hammer drills, with appropriately sized masonry bits
- HEPA vacuums for airborne silica-dust control
- Performance Profile sheets

Performance Task 4
- Appropriate PPE
- Installation hand and power tools, as required
- Instructor-selected duct hangers and supports
- Performance Profile sheets
Installation of Air Distribution Accessories

Overview
Each accessory in an air distribution system performs a specific task. The goal may be to control air volume in various ducts, provide service access for components inside the duct, or safeguard against fire and smoke distribution in the event of a fire. A variety of accessories like these and others are presented in this module, along with their unique installation considerations.

Learning Objective 1
Successful completion of this module prepares trainees to:
Identify and describe how to install various air distribution system components.

  a. Identify and describe the installation of louvers.
  b. Identify and describe the installation of manual and motorized dampers.
  c. Identify and describe the installation of fire and smoke dampers.
  d. Identify and describe the installation of duct access doors.
  e. Identify and describe the installation of VAV boxes and inline fans.

Learning Objective 2
Successful completion of this module prepares trainees to:
Identify and describe how to install flexible duct and air distribution devices.

  a. Identify and describe the installation of various duct takeoffs.
  b. Identify and describe the installation of flexible duct.
  c. Identify and describe the installation of registers, grilles, and diffusers.

Performance Tasks
1. Install a louver, duct access door, or fire/smoke damper.
2. Install an opposed-blade balancing damper in a section of lined duct.
3. Install a flexible-duct branch line from a rectangular duct to a diffuser, register, or grille, including
the takeoff and register boot (if needed).

Recommended Teaching Time: 12.5 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 04107
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations

Performance Task 1 Materials

• Appropriate PPE
• Instructor-selected accessories and materials for installation, relevant to this module
• Common sheet metal hand tools
• Necessary power tools required to install the chosen accessory
• Tape, gasket material, and other consumables needed to install the selected accessory

Performance Task 2 Materials

• Appropriate PPE
• Opposed-blade balancing dampers
• Section of lined duct
• Common sheet metal hand tools
• Power drill with bit set
• Tape, gasket material, and other consumables needed to install the selected accessory
• Mounting hardware

Performance Task 3 Materials

• Appropriate PPE
• Flexible duct of the appropriate size
• Appropriate takeoff for duct type
• Diffusers, register, or grille and a location in which to install it
• Register boot (if installing floor grilles)
• Common sheet metal hand tools
• Fiberglass duct insulation
• Tape, gasket material, hanger strap, and other consumables needed to install the selected accessory