MODULE OVERVIEW
This module describes the general construction industry concepts of craftsmanship, safety, and apprenticeship training. It details the history and current opportunities of the sheet metal trade, and describes sheet metal types, their various qualities and applications, and the use of a sheet metal measuring gauge.

PREREQUISITES
Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum.

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

1. Describe what is meant by pride of craftsmanship in the sheet metal trade.
2. Name the general applications of sheet metal construction.
3. List the basic tools and equipment used in the sheet metal trade.
4. Summarize the history and development of the sheet metal trade.
5. Identify shop and field safety considerations specific to the sheet metal trade.
6. Identify types of metal.
7. Identify common fittings.
8. Describe what is involved in being part of a sheet metal training program.
9. Describe how to use a sheet metal gauge.

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

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

MATERIALS AND EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead projector and screen</td>
<td>Sheet metal gauge and wire gauge</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>Examples of sheet metal pieces, including:</td>
</tr>
<tr>
<td>Transparencies</td>
<td>Austenitic steel</td>
</tr>
<tr>
<td>Markers/chalk</td>
<td>Ferritic steel</td>
</tr>
<tr>
<td>Blank acetate sheets</td>
<td>Martensitic steel</td>
</tr>
<tr>
<td>Transparency pens</td>
<td>Magnets and heat sources (torch, burner, heater, etc.)</td>
</tr>
<tr>
<td>Pencils and scratch paper</td>
<td>Material Safety Data Sheets (MSDS)</td>
</tr>
<tr>
<td>Appropriate personal protective equipment</td>
<td>Module Examinations*</td>
</tr>
<tr>
<td>Examples of fiberglass and plastic</td>
<td>Performance Profile Sheets*</td>
</tr>
</tbody>
</table>

*Located in the Test Booklet.

SAFETY CONSIDERATIONS
Ensure that the trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with power tools.
### ADDITIONAL RESOURCES

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


*Sheet Metal Handbook: How to Form and Shape Sheet Metal for Competition and Restoration Use*, HP Books.

*Sheet Metal Worker’s Pocket Manual*. Z/S Pocket Manuals, P.O. Box 872, Evergreen Park, IL 60642.


### 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 5 hours are suggested to cover *Introduction to the Sheet Metal Trade*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session I. Introduction to the Sheet Metal Trade</strong></td>
<td></td>
</tr>
<tr>
<td>A. Pride of Craftsmanship</td>
<td></td>
</tr>
<tr>
<td>B. The History of Sheet Metal</td>
<td></td>
</tr>
<tr>
<td>C. The History of Apprenticeship</td>
<td></td>
</tr>
<tr>
<td>D. Safety</td>
<td></td>
</tr>
<tr>
<td>E. Steel and Other Metals</td>
<td></td>
</tr>
<tr>
<td>F. Types of Sheet Metal</td>
<td></td>
</tr>
<tr>
<td>G. Laboratory</td>
<td></td>
</tr>
<tr>
<td>Trainees practice identifying types of metal from samples provided. This laboratory corresponds to Performance Task 1.</td>
<td></td>
</tr>
<tr>
<td>H. Measuring Sheet Metal</td>
<td></td>
</tr>
<tr>
<td>I. Laboratory</td>
<td></td>
</tr>
<tr>
<td>Trainees practice measuring different gauges of sheet metal using a sheet metal gauge. This laboratory corresponds to Performance Task 3.</td>
<td></td>
</tr>
<tr>
<td><strong>Session II. Sheet Metal Trade Work; Review and Testing</strong></td>
<td></td>
</tr>
<tr>
<td>A. Work in the Sheet Metal Trade</td>
<td></td>
</tr>
<tr>
<td>B. Laboratory</td>
<td></td>
</tr>
<tr>
<td>Trainees practice identifying common sheet metal fittings. This laboratory corresponds to Performance Task 2.</td>
<td></td>
</tr>
<tr>
<td>E. Review</td>
<td></td>
</tr>
<tr>
<td>F. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from the NCCER.</td>
<td></td>
</tr>
<tr>
<td>2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.</td>
<td></td>
</tr>
<tr>
<td>G. Performance Testing</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.</td>
<td></td>
</tr>
<tr>
<td>2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.</td>
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</tr>
</tbody>
</table>
MODULE OVERVIEW
This module describes hand and power tools used in the sheet metal trade. Common fabricating machines are also discussed, as well as measuring, layout, and drafting tools. Trainees will learn which tool to select for a particular job, how to use it safely, and how to keep it in good condition.

PREREQUISITES
Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Module 04101-08

OBJECTIVES
Upon completion of this module, the trainee will be able to do the following:
1. Identify and describe the proper use of tools commonly used in the sheet metal trade.
2. State general rules for safety when using tools.
3. Describe proper maintenance procedures for tools.
4. Demonstrate how to properly use sheet metal tools.

PERFORMANCE TASKS
Under the supervision of the instructor, the trainee should be able to do the following:
1. Identify a given hand tool, state its application, and describe its safe use and maintenance.
2. Demonstrate the use of a given hand tool, according to standards as given by your instructor.
3. Identify a given power tool, state its application, and describe its safe use and maintenance.
4. Demonstrate the use of a given power tool, according to standards as given by your instructor.
5. Identify a given shop machine, state its application, and describe its safe use and maintenance.
6. Demonstrate the use of a shop machine, according to standards as given by your instructor.
7. Select the most suitable tool or machine for a given application.
8. Demonstrate the use of the selected tool, according to standards as given by your instructor.

MATERIALS AND EQUIPMENT LIST
- Overhead projector and screen
- Transparencies
- Blank acetate sheets
- Transparency pens
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and scratch paper
- Appropriate personal protective equipment
- Two sections of duct
- Samples of sheet metal
- Duct stretcher
- Duct tongs
- Duct holder
- A tool belt with various hand tools:
  - Hand crimper
  - Hand seamer
  - Snips (insulated and non-insulated, aviation, and left- and right-handed)
  - Sheet metal hammer
  - Utility knife
  - Tape measure
  - Screwdriver
  - Torpedo level
  - Grip pliers
  - Linesman pliers
  - Mallets
  - Cold chisels
  - Punches
  - Folding tool

(continued)
Various types of stakes, including:
- Blowhorn stake
- Beakhorn stake
- Candlemold stake
- Needlecase stake
- Hollow mandrel stake
- Double-seaming stake
- Hatchet stake

Measuring tools, including:
- Steel rule
- Circumference rule
- Steel square
- Combination square
- Protractor
- Feeler gauge
- Sheet metal gauge

Layout tools, including:
- Straightedge
- Scratch awl
- Scriber
- Trammel
- Groover
- Crimper
- Snap lock punch

Various types of drills and drill bits

Drafting tools, including:
- Drawing board
- T-square
- Dividers
- Compass
- Squaring shear
- Notchers
- Ring and circle shear
- Nibbler
- Uni-shear
- Saws, including:
  - Hacksaw
  - Reciprocating saw
  - Portable, horizontal, and vertical band saw
  - Saber saw
- Bar folder
- Brakes
- Slip-roll forming machine
- Turning machines
- Module Examinations*
- Performance Profile Sheets*

*Located in the Test Booklet.

**SAFETY CONSIDERATIONS**

Ensure that the trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with power tools.

**ADDITIONAL RESOURCES**

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


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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session I. Tools of the Trade, Part One</strong></td>
<td></td>
</tr>
<tr>
<td>A. Hammers and Mallets</td>
<td></td>
</tr>
<tr>
<td>B. Cold Chisels</td>
<td></td>
</tr>
<tr>
<td>C. Punches</td>
<td></td>
</tr>
<tr>
<td>D. Hand-Cutting Tools</td>
<td></td>
</tr>
<tr>
<td>E. Laboratory</td>
<td>Trainees practice using various hand tools. This laboratory corresponds to Performance Tasks 1 and 2.</td>
</tr>
<tr>
<td>F. Cutting Machines</td>
<td></td>
</tr>
<tr>
<td>G. Sawing Tools</td>
<td></td>
</tr>
<tr>
<td>H. Drills and Drill Presses</td>
<td></td>
</tr>
<tr>
<td>I. Laboratory</td>
<td>Trainees practice using various power tools. This laboratory corresponds to Performance Tasks 3 and 4.</td>
</tr>
<tr>
<td>J. Forming Machines</td>
<td></td>
</tr>
<tr>
<td><strong>Session II. Tools of the Trade, Part Two; Review and Testing</strong></td>
<td></td>
</tr>
<tr>
<td>A. Roll-Forming Machines</td>
<td></td>
</tr>
<tr>
<td>B. Laboratory</td>
<td>Trainees practice using shop machines. This laboratory corresponds to Performance Tasks 5 and 6.</td>
</tr>
<tr>
<td>C. Hand-Forming Tools and Hand Tools</td>
<td></td>
</tr>
<tr>
<td>D. Welding Tools</td>
<td></td>
</tr>
<tr>
<td>E. Production and Computer-Aided Machines</td>
<td></td>
</tr>
<tr>
<td>F. Laboratory</td>
<td>Trainees practice fabricating duct and fittings. This laboratory corresponds to Performance Tasks 7 and 8.</td>
</tr>
<tr>
<td>G. Measuring Tools</td>
<td></td>
</tr>
<tr>
<td>H. Layout Tools</td>
<td></td>
</tr>
<tr>
<td>I. Drafting Tools</td>
<td></td>
</tr>
<tr>
<td>J. Review</td>
<td></td>
</tr>
<tr>
<td>K. Module Examination</td>
<td>1. Trainees must score 70% or higher to receive recognition from the NCCER.</td>
</tr>
<tr>
<td></td>
<td>2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.</td>
</tr>
<tr>
<td>L. Performance Testing</td>
<td>1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.</td>
</tr>
<tr>
<td></td>
<td>2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.</td>
</tr>
</tbody>
</table>
MODULE OVERVIEW

This module describes the processes of drawing, transferring patterns, cutting, forming, and assembling sheet metal parts. The terminology, rules, and three basic methods of layout development are discussed. The trainee will learn how to select and use the proper layout, hand, and machine tools for producing sheet metal fittings.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 and 04102-08.

OBJECTIVES

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

1. Define basic layout terminology.
2. Explain how to select and use layout and marking tools.
3. Identify and explain the three development methods for laying out sheet metal patterns.
4. Demonstrate how to select and use hand snips, hacksaws, and squaring shears for cutting out sheet metal parts and patterns.
5. Demonstrate how to select and use forming tools.
6. Demonstrate how to construct seams, edges, and duct connectors.

PERFORMANCE TASKS

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

1. Transfer a sheet metal pattern to a piece of sheet metal to given standards.
2. Use hand snips to make the following cuts to given standards on 24-gauge or lighter sheet metal: straight cuts, outside curved cuts, and internal cuts.
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.
5. Use stakes to form a cone for a weather cap to given standards.
6. Use stakes to form a 90-degree bend to given standards.
7. Use a slip-roll forming machine to make two sections of round pipe with grooved seams to given standards.
8. Use a box and pan brake to make right angle bends to given standards on light-gauge stock.
9. Use a bar folder to make a hem bend to given standards.
10. Use a hand brake to make a Pittsburgh seam to given standards.
11. Make a crimped edge on round pipe to given standards.
12. Join two sections of round pipe by crimping and beading to given standards.

MATERIALS AND EQUIPMENT LIST

<table>
<thead>
<tr>
<th>Overhead projector and screen</th>
<th>Markers/chalk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparencies</td>
<td>Pencils and scratch paper</td>
</tr>
<tr>
<td>Blank acetate sheets</td>
<td>Appropriate personal protective equipment</td>
</tr>
<tr>
<td>Transparency pens</td>
<td>Assorted samples of sheet metal, including</td>
</tr>
<tr>
<td>Whiteboard/chalkboard</td>
<td>24-gauge or lighter</td>
</tr>
</tbody>
</table>

continued
SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with power tools.

ADDITIONAL RESOURCES

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


TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2.5 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7.5 hours are suggested to cover Introduction to Sheet Metal Layout and Processes. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session I. Sheet Metal Pattern Layout</td>
<td></td>
</tr>
<tr>
<td>A. Layout Terminology</td>
<td></td>
</tr>
</tbody>
</table>
Session II. Cutting and Punching Holes in Sheet Metal Patterns; Forming

A. Cutting with Hand Snips
   B. Laboratory
   Trainees practice making cuts with snips. This laboratory corresponds to Performance Task 2.

C. Cutting with Squaring Shears
   D. Laboratory
   Trainees practice cutting with a squaring shear. This laboratory corresponds to Performance Task 4.

E. Punching Holes
   F. Forming
   G. Laboratory
   Trainees practice using stakes to form sheet metal. This laboratory corresponds to Performance Tasks 5 and 6.

H. Laboratory
   Trainees practice using a slip-roll forming machine. This laboratory corresponds to Performance Task 7.

Session III. Edges, Seams, and Connectors; Review and Testing

A. Edges
   B. Seams
   C. Laboratory
   Trainees practice using a hand brake. This laboratory corresponds to Performance Task 10.

D. Connectors
   E. Review
   F. Module Examination
   1. Trainees must score 70% or higher to receive recognition from the NCCER.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.

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

This module explains how to use various units of measure to satisfy job requirements. The trainee will learn about measurement conversion for both the English and metric systems. The module also covers basic geometric concepts and terminology.

**PREREQUISITES**

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: *Core Curriculum; Sheet Metal Level One*, Modules 04101-08 through 04103-08.

**OBJECTIVES**

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

1. Convert denominate numbers and solve problems using them.
2. Calculate using rules.
3. Calculate using linear, square, volume, and weight measures.
4. Calculate the stretchouts for selected fittings.
5. Construct simple geometric figures.
6. Calculate the offset using field mitering and the OWL methods.

**PERFORMANCE TASK**

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

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

**MATERIALS AND EQUIPMENT LIST**

- Overhead projector and screen
- Transparencies
- Blank acetate sheets
- Transparency pens
- Whiteboard/chalkboard
- Markers/chalk
- Appropriate personal protective equipment
- Assorted examples of paper stretchouts
- Sample sheet metal pieces
- Sheet metal scriber
- Metal straightedge
- Empty milk jugs, pitchers, other liquid containers
- Assorted lengths of string
- Calculators
- Protractors, compasses, and dividers to perform the geometry exercises
- Various types of flexible, bench, and tape rules, marked with English and metric measures
- Assorted measuring cups marked with English and metric measures
- Weights and scale
- Assorted rules marked with English and metric measures
- Module Examinations*
- Performance Profile Sheets*

*Located in the Test Booklet.

**SAFETY CONSIDERATIONS**

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

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

www.math.com/tables/geometry

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 20 hours are suggested to cover *Trade Math One*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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</thead>
<tbody>
<tr>
<td><strong>Session I. Denominate Numbers</strong></td>
<td></td>
</tr>
<tr>
<td>A. Adding Denominate Numbers</td>
<td></td>
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<tr>
<td>B. Subtracting Denominate Numbers</td>
<td></td>
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<tr>
<td>C. Multiplying Denominate Numbers</td>
<td></td>
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<tr>
<td>D. Dividing Denominate Numbers</td>
<td></td>
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<tr>
<td><strong>Session II. Rules; Metric System</strong></td>
<td></td>
</tr>
<tr>
<td>A. Rules</td>
<td></td>
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<tr>
<td>B. The Metric System</td>
<td></td>
</tr>
<tr>
<td><strong>Session III. Measurement Systems, Part One</strong></td>
<td></td>
</tr>
<tr>
<td>A. Linear Measure</td>
<td></td>
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<tr>
<td>B. Square Measure</td>
<td></td>
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<tr>
<td>C. Area of a Circle</td>
<td></td>
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<tr>
<td><strong>Session IV. Measurement Systems, Part Two</strong></td>
<td></td>
</tr>
<tr>
<td>A. Area Measure</td>
<td></td>
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<tr>
<td>B. Volume Measure</td>
<td></td>
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<tr>
<td>C. Weight Measure</td>
<td></td>
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<tr>
<td><strong>Session V. Calculating Stretchouts; Geometry, Part One</strong></td>
<td></td>
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<tr>
<td>A. Rectangular Fittings</td>
<td></td>
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<tr>
<td>B. Box Fittings</td>
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<tr>
<td>C. Circular Fittings</td>
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<tr>
<td>D. The Point</td>
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<tr>
<td>E. The Line</td>
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<tr>
<td>F. The Circle</td>
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<tr>
<td><strong>Session VI. Geometry, Part Two</strong></td>
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</tr>
<tr>
<td>A. Angles</td>
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<tr>
<td>B. Polygons</td>
<td></td>
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<tr>
<td>C. Ellipses</td>
<td></td>
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<tr>
<td>D. Geometry Exercises One through Three</td>
<td></td>
</tr>
</tbody>
</table>
Session VII. Geometry, Part Three; Mitering Duct

A. Geometry Exercises Four through Ten
B. Field Mitering
C. OWL Method
D. Laboratory
   Trainees practice calculating an offset using the OWL method. This laboratory corresponds to Performance Task 1.

Session VIII. Review and Testing

A. Review
B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from the NCCER.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.
C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.
MODULE OVERVIEW
This module describes layout and fabrication of ductrun assemblies. Through a series of practice exercises, trainees use the parallel line development method to prepare a pattern on metal to the correct measurements, use the proper tools to cut the fitting, and fabricate it.

PREREQUISITES
Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 through 04104-08.

OBJECTIVES
Upon completion of this module, the trainee will be able to do the following:
1. Explain procedures for parallel line development.
2. Lay out and fabricate selected ductrun fittings.

PERFORMANCE TASKS
Under the supervision of the instructor, the trainee should be able to do the following:
1. Lay out and fabricate seven fittings from among the following:
   - Grooved lock seam
   - Flexible connection
   - Pittsburgh seam
   - Mitered fitting
   - Square elbow
   - 90-degree elbow
   - 90-degree change elbow
   - 45-degree elbow
   - Rectangular Y-branch
   - 90-degree double Y-branch
   - 90-degree clinch tee
   - Three-piece round offset
   - Transition with three straight sides
   - Transition with two straight sides
   - Double offset
   - Ogee offset
   - Rectangular roof flange
   - Smokestack
   - Gored elbow
   - Ogee gutter
   - Belt guard
   - 90-degree tee (Layout only)
   - 45-degree tee (Layout only)
   - Type-A ventilator

MATERIALS AND EQUIPMENT LIST
Overhead projector and screen
Transparencies
Whiteboard/chalkboard
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Drafting pencils
Ledger (11” x 17”) paper

Appropriate personal protective equipment
26-gauge, galvanized iron sheet metal pieces for patterns, according to specifications for each fitting
Materials for fittings, including:
Prefabricated flexible connection material (NFPA Standard 90A)
Fabric-to-fabric connection sealant (NFPA approved)
A completed Type-A ventilator

(continued)
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 hand and power tools. Ensure that they are briefed on shop safety procedures.

ADDITIONAL RESOURCES

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


TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 ½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 22 ½ hours are suggested to cover Fabrication One – Parallel Line Development. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to performance tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>Session I. Parallel Line Development, Part One</td>
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</tr>
<tr>
<td>A. Introduction</td>
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<tr>
<td>B. Pattern Development</td>
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<tr>
<td>C. Grooved Lock Seam</td>
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<tr>
<td>D. Laboratory</td>
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<tr>
<td>Trainees practice laying out and fabricating a grooved lock seam. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>E. Flexible Connection</td>
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<tr>
<td>F. Laboratory</td>
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<tr>
<td>Trainees practice laying out and fabricating a flexible connection. This laboratory corresponds to Performance Task 1.</td>
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</tr>
</tbody>
</table>

Hand tools for cutting, forming, and finishing fittings, including:
- Groover
- Notcher
- Seamer
- Sheet metal hammer
- Snips
- Heavy-duty staple gun and staples

Soldering equipment
Welding equipment

Machines for forming and finishing fittings, including:
- Bar folder
- Brake
- Squaring shear
- Slip-roll
- Pittsburgh roll-forming
- Easy edger

Layout tools, including:
- Straightedge
- Flexible steel rule
- Combination square
- Scratch awl
- Scriber
- Prick punch
- Framing square
- Mallet
- Felt-tipped marker
- Wing dividers
- 45-degree triangle

Module Examinations*
Performance Profile Sheets*
Session II. Parallel Line Development, Part Two
A. Rectangular Pittsburgh Seam
   B. Laboratory
   Trainees practice laying out and fabricating a rectangular Pittsburgh lock duct. This laboratory corresponds to Performance Task 1.
C. Mitered Fitting
   D. Laboratory
   Trainees practice laying out and fabricating a mitered fitting. This laboratory corresponds to Performance Task 1.
E. Square Elbow
   F. Laboratory
   Trainees practice laying out and fabricating a square elbow. This laboratory corresponds to Performance Task 1.

Session III. Parallel Line Development, Part Three
A. 90-Degree Elbow
   B. Laboratory
   Trainees practice laying out and fabricating a 90-degree elbow. This laboratory corresponds to Performance Task 1.
C. 90-Degree Change Elbow
   D. Laboratory
   Trainees practice laying out and fabricating a 90-degree change elbow. This laboratory corresponds to Performance Task 1.
E. 45-Degree Change Elbow
   F. Laboratory
   Trainees practice laying out and fabricating a 45-degree change elbow. This laboratory corresponds to Performance Task 1.

Session IV. Parallel Line Development, Part Four
A. Rectangular Y-Branch
   B. Laboratory
   Trainees practice laying out and fabricating a rectangular Y-branch. This laboratory corresponds to Performance Task 1.
C. 90-Degree Double-Y Branch
   D. Laboratory
   Trainees practice laying out and fabricating a 90-degree double-Y branch. This laboratory corresponds to Performance Task 1.
E. 90-Degree Clinch Tee
   F. Laboratory
   Trainees practice laying out and fabricating a 90-degree clinch tee. This laboratory corresponds to Performance Task 1.
Session V. Parallel Line Development, Part Five
A. Three-Piece Round Offset
B. Laboratory
   Trainees practice laying out and fabricating a three-piece round offset. This laboratory corresponds to Performance Task 1.
C. Transition with Three Straight Sides
D. Laboratory
   Trainees practice laying out and fabricating a transition with three straight sides. This laboratory corresponds to Performance Task 1.
E. Transition with Two Straight Sides
F. Laboratory
   Trainees practice laying out and fabricating a transition with two straight sides. This laboratory corresponds to Performance Task 1.

Session VI. Parallel Line Development, Part Six
A. Double Offset
B. Laboratory
   Trainees practice laying out and fabricating a double offset. This laboratory corresponds to Performance Task 1.
C. Ogee Offset
D. Laboratory
   Trainees practice laying out and fabricating an ogee offset. This laboratory corresponds to Performance Task 1.
E. Rectangular Roof Flange
F. Laboratory
   Trainees practice laying out and fabricating a rectangular roof flange. This laboratory corresponds to Performance Task 1.

Session VII. Parallel Line Development, Part Seven
A. Smokestack
B. Laboratory
   Trainees practice laying out and fabricating a smokestack. This laboratory corresponds to Performance Task 1.
C. Gored Elbow
D. Laboratory
   Trainees practice laying out and fabricating a gored elbow. This laboratory corresponds to Performance Task 1.
E. Ogee Gutter
F. Laboratory
   Trainees practice laying out and fabricating an ogee gutter. This laboratory corresponds to Performance Task 1.
Session VIII. Parallel Line Development, Part Eight

A. Belt Guard
B. Laboratory
   Trainees practice laying out and fabricating a belt guard. This laboratory corresponds to Performance Task 1.

C. 90-Degree Tee
D. Laboratory
   Trainees practice laying out a 90-degree tee. This laboratory corresponds to Performance Task 1.

E. 45-Degree Tee
F. Laboratory
   Trainees practice laying out a 45-degree tee. This laboratory corresponds to Performance Task 1.

Session IX. Parallel Line Development, Part Nine; Review and Testing

A. Type-A Ventilator
B. Laboratory
   Trainees practice laying out and fabricating a type-A ventilator. This laboratory corresponds to Performance Task 1.

C. Review
D. Module Examination
   1. Trainees must score 70% or higher to receive recognition from the NCCER.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.

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

This module describes how to identify and select fasteners that can withstand loads and stresses within air distribution systems. It explains the proper spacing, load ratings, and installation of the hangers and supports used to hold ductwork, fans, compressors, and diffusers in place. It also covers the elimination or reduction of noise connected with the delivery of heated or cooled air.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 through 04105-08.

OBJECTIVES

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

1. Identify and describe fasteners used in the sheet metal trade.
2. Select and use the right fastener for the task.
3. Describe some of the more common methods of supporting air system components.
4. Install duct fasteners, hangers, and supports.
5. Describe how to connect rectangular, round, and spiral ductwork.
6. Explain how to properly seal ductwork.

PERFORMANCE TASKS

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

1. Identify a given fastener and state its application.
2. Determine the various specifications of given fasteners.
3. Classify hangers by types and applications.
4. Demonstrate the proper method of installing selected duct hangers, supports and reinforcements.
5. Connect and seal rectangular and round duct.

MATERIALS AND EQUIPMENT LIST

- Overhead projector and screen
- Transparencies
- Blank acetate sheets
- Transparency pens
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and scratch paper
- Appropriate personal protective equipment
- Steel rule for measuring sizes of bolts and screws
- Hand-operated blind riveter, blind rivets (domed), and practice workpiece
- Expansion shield
- Thread pitch gauge
- Ruler
- Duct sealant
- Sample duct sections, including:
  - TDC, Ductmate®, or S and drive connected fittings
  - Spiralmate®, Ovalmate®, crimped, collared, or dovetail connected fittings
- Examples of bolts, including:
  - Carriage
  - Machine
  - Stud

(continued)
Examples of screws, including:
- Cap
- Lag
- Self-tapping
- Setscrew
- Wood

Copies of your local code

Examples of nuts and washers, including:
- Interference nut
- Jam nut
- Pal nut
- Castellated nut
- Self-locking nut
- Split-ring washer
- Spring-type washer
- Tooth-type washer
- Prem assembly

Practice assembly boards/sheet metal with predrilled holes suitable for fastening selected screws and bolts in place

Examples of special-purpose fasteners, including:
- Toggle bolts
- Molly bolts
- Threaded anchors

A section of flexible duct

Examples of fasteners for hangers, including:
- #10 plated sheet metal screw
- 2½-inch square washer
- ½-inch bolt

Examples of duct supports (riser supports should have holes for #10 screw), including:
- Channel
- Wall support angle
- Floor support angle iron
- Trapeze assembly with rod and wire alternatives
- Single strap
- Strap for flexible duct

Examples of fasteners for hangers, including:
- #10 plated sheet metal screw
- 2½-inch square washer
- ½-inch bolt

Examples of duct supports (riser supports should have holes for #10 screw), including:
- Channel
- Wall support angle
- Floor support angle iron
- Trapeze assembly with rod and wire alternatives
- Single strap
- Strap for flexible duct

Module Examinations*
Performance Profile Sheets*

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with power tools.

ADDITIONAL RESOURCES

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


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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td><strong>Session I. Assembling Ductwork</strong></td>
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<tr>
<td>A. Sealing and Connecting Ductwork</td>
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<tr>
<td>B. Lifting Ductwork</td>
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<tr>
<td>C. Connecting Ductwork</td>
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<tr>
<td>D. Laboratory</td>
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<tr>
<td>Trainees practice connecting and sealing ductwork. This laboratory corresponds to Performance Task 5.</td>
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<tr>
<td><strong>Session II. Bolts, Screws, and Nuts</strong></td>
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<tr>
<td>A. Bolts and Screws</td>
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<tr>
<td>B. Laboratory</td>
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</tr>
<tr>
<td>Trainees practice fastening bolts and screws to predrilled sheet metal using the appropriate tools.</td>
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<tr>
<td>C. Nuts</td>
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<tr>
<td>D. Laboratory</td>
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<tr>
<td>Trainees practice fastening nuts and bolts.</td>
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<tr>
<td><strong>Session III. Washers; Structural Fasteners; Rivets</strong></td>
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<tr>
<td>A. Lock Washers</td>
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<tr>
<td>B. Structural Fasteners</td>
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<tr>
<td>C. Rivets</td>
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<td>D. Laboratory</td>
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<tr>
<td>Trainees practice using a blind riveter.</td>
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<tr>
<td><strong>Session IV. Fasteners; Hangers and Supports</strong></td>
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<tr>
<td>A. Special Purpose Fasteners</td>
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<tr>
<td>B. Hangers and Supports</td>
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<tr>
<td><strong>Session V. Equipment Noise</strong></td>
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<tr>
<td>A. Air Handling Equipment Noise</td>
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<tr>
<td><strong>Session VI. Review and Testing</strong></td>
<td></td>
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<tr>
<td>A. Review</td>
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<tr>
<td>B. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from the NCCER.</td>
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<tr>
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<td>C. Performance Testing</td>
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</tbody>
</table>
MODULE OVERVIEW

This module reviews air distribution accessories and how they work within a system. It discusses the manufacturer’s installation instructions and local code requirements. The trainee will learn to test the installation of various accessories for correct operation.

PREREQUISITES

Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 through 04106-08.

OBJECTIVES

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

1. Identify and explain the purpose of selected air distribution accessories.
2. Correctly install selected air distribution accessories.

PERFORMANCE TASKS

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

1. Explain the purpose of selected air distribution components.
2. Simulate and/or demonstrate the installation of selected air distribution accessories.
3. Install an opposed-blade balancing damper in a section of lined duct.
4. Install a takeoff in the same section of duct.

MATERIALS AND EQUIPMENT LIST

- Overhead projector and screen
- Transparencies
- Blank acetate sheets
- Transparency pens
- Whiteboard/chalkboard
- Markers/chalk
- Pencils and scratch paper
- Copies of your local code
- Appropriate personal protective equipment
- Assorted air handling and zoning accessories, including those designed for flexible duct attachment
- Flexible duct hangers
- Assorted sections of flexible duct, including duct with vapor barriers and insulation
- A cardboard box and two stiff pieces of cardboard
- Various types of louvers, including one that is in its original packaging
- Manual volume damper (opposed-blade and parallel-blade)
- Fire or fire/smoke damper
- Tools required for flexible duct installation
- Various registers, grilles, and diffusers
- Module Examinations*
- Performance Profile Sheets*

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with power tools.
ADDITIONAL RESOURCES
This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.


TEACHING TIME FOR THIS MODULE
An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2 1/2 hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 5 hours are suggested to cover Installation of Air Distribution Accessories. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td><strong>Session I. Air Distribution Accessories, Part One</strong></td>
<td></td>
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<tr>
<td>A. Introduction to Air Distribution Accessories</td>
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<tr>
<td>B. Louvers</td>
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<tr>
<td>C. Dampers and Access Doors</td>
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<tr>
<td>D. Laboratory</td>
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<tr>
<td>Trainees practice installing an opposed-blade damper. This laboratory corresponds to Performance Task 3.</td>
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<tr>
<td>E. Laboratory</td>
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<tr>
<td>Trainees practice testing dampers.</td>
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<tr>
<td>F. Zoning Accessories and Coils</td>
<td></td>
</tr>
<tr>
<td><strong>Session II. Air Distribution Accessories, Part Two; Review and Testing</strong></td>
<td></td>
</tr>
<tr>
<td>A. Takeoffs</td>
<td></td>
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<tr>
<td>B. Laboratory</td>
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</tr>
<tr>
<td>Trainees practice installing a takeoff. This laboratory corresponds to Performance Task 4.</td>
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<tr>
<td>C. Flexible Duct</td>
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<tr>
<td>D. Registers, Grilles, and Diffusers</td>
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<tr>
<td>E. Review</td>
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<tr>
<td>F. Module Examination</td>
<td></td>
</tr>
<tr>
<td>1. Trainees must score 70% or higher to receive recognition from the NCCER.</td>
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<tr>
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<td>G. Performance Testing</td>
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<td>1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.</td>
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</tbody>
</table>
MODULE OVERVIEW
This module describes different types of thermal and acoustic insulation. It also discusses how to install different types of insulation using sealers, adhesives, and fasteners.

PREREQUISITES
Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 through 04107-08.

Please note that this is an elective module. It is not necessary to complete this module in order to advance to Sheet Metal Level Two.

OBJECTIVES
Upon completion of this module, the trainee will be able to do the following:
1. Explain the principles of thermal insulation.
2. Explain the principles of acoustic insulation.
3. Install liner materials on selected duct sections.
4. Install duct wrap on selected duct sections.

PERFORMANCE TASKS
Under the supervision of the instructor, the trainee should be able to do the following:
1. Measure and cut a specified size of fibrous duct liner from a larger piece, including at least one facing tab, using the appropriate tools.
2. Properly install appropriate insulation around a provided pipe.
3. Properly install a vapor barrier around a provided pipe.
4. Properly seal the seams, joints, or facing tabs on the insulation with tape or adhesive, as the instructor chooses.
5. Install metal nosing.

MATERIALS AND EQUIPMENT LIST
Overhead projector and screen
Transparencies
Transparency pens
Blank acetate sheets
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Tape measures
Straightedges
Assorted pieces of cardboard (18” × 18”)
Installation tools
Insulation tape and adhesives
Staple gun and staples
Scissors
Assorted duct sections, including:
Rectangular duct
Round duct
Oval duct
Assorted flexible and rigid fibrous glass duct liners
Assorted samples of different types of fiberglass duct and blanket insulation
Assorted samples of metal nosing
Brushed-on adhesive strips for blanket insulation
Vapor barrier mastic
Assorted mechanical fasteners
Assorted samples of insulation with factory-applied adhesive

(continued)
Assorted samples of fiberglass pipe insulation, including insulation with the All-Service Jacket (ASJ)
Appropriate personal protective equipment, to include:
Gloves
Safety glasses

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 hand and power tools. Ensure that they are briefed on shop safety procedures.

ADDITIONAL RESOURCES

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


TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 7½ hours are suggested to cover Insulation. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

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<thead>
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<tbody>
<tr>
<td><strong>Session I. Introduction to Insulation</strong></td>
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<tr>
<td>A. Insulation Properties</td>
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<tr>
<td>B. Principles of Thermal Insulation</td>
<td></td>
</tr>
<tr>
<td>C. Principles of Acoustic Insulation</td>
<td></td>
</tr>
<tr>
<td>D. Fibrous Glass Duct Liner</td>
<td></td>
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<tr>
<td>E. Laboratory</td>
<td></td>
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<tr>
<td>Trainees practice cutting fibrous glass duct liner. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>F. Laboratory</td>
<td></td>
</tr>
<tr>
<td>Trainees practice installing metal nosing. This laboratory corresponds to Performance Task 5.</td>
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<tr>
<td><strong>Module Examinations</strong></td>
<td></td>
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<tr>
<td><strong>Performance Profile Sheets</strong></td>
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</tbody>
</table>

*Located in the Test Booklet.
Session II. Fiberglass Blanket and Fiberglass Pipe Insulation

A. Measuring and Cutting
B. Installing Fiberglass Blanket Insulation
C. Sealing
D. Laboratory
   Trainees practice sealing seams on blanket insulation using insulation tape and adhesive. This laboratory corresponds to Performance Task 4.
E. Mechanical Fasteners
F. Factory-Applied Adhesives
G. Field-Applied Adhesives
H. Fiberglass Pipe Insulation
I. Laboratory
   Trainees practice measuring and cutting fiberglass pipe insulation.

Session III. Flexible Foam Insulation; Review and Testing

A. Flexible Foam Insulation
B. Review
C. Module Examination
   1. Trainees must score 70% or higher to receive recognition from the NCCER.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.
D. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from the NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the performance testing requirements.
   2. Record the testing results on Craft Training Report Form 200 and submit the results to the Training Program Sponsor.
MODULE OVERVIEW
This module reviews architectural sheet metal tasks for roofing, gutters, downspouts, and chimneys. Trainees will learn how to lay out and fabricate selected drainage and flashing components.

PREREQUISITES
Please refer to the Course Map in the Trainee Module. Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Sheet Metal Level One, Modules 04101-08 through 04108-08.

Please note that this is an elective module. It is not necessary to complete this module in order to advance to Sheet Metal Level Two.

OBJECTIVES
Upon completion of this module, the trainee will be able to do the following:
1. Describe the parts of a roof drainage system.
2. Describe how flashing is used.
3. Describe how gutters and downspouts are used.
4. Lay out and fabricate selected drainage components.
5. Fabricate selected flashing components.

PERFORMANCE TASKS
Under the supervision of the instructor, the trainee should be able to do the following:
1. Lay out and develop the pattern for a 60-degree two-piece conductor elbow.
2. Fabricate the fitting listed above.
3. Form and solder a lap seam and a butt seam.
4. Lay out and fabricate the following:
   • Rectangular outlet tube
   • Rectangular gutter (two styles)
5. Fabricate flashing for a shingle roof.
6. Lay out and fabricate:
   • Chimney flashing
   • Typical metal coping profile

MATERIALS AND EQUIPMENT LIST
Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Appropriate personal protective equipment
Copies of your local code
Samples of shingles, wood shakes, and slate and tile roofing
Roll roofing (standard, granule, and selvage)

Slate roofing (grades A through C)
Large sheets of heavy, white paper
Scissors
Rulers
26-gauge galvanized sheet metal (12-inch and 10-inch)
Soldering equipment and supplies
Layout and development tools
Aviation snips
Combination square
Flexible steel rule
Circumference rule
(continued)
Steel square  
Hand seamer  
Box or pan brake  
Squaring shear  
Slip-roll forming machine  
Number three hand groover  
Bar folder  
Layout and development tools  
Tools and materials to lay out and fabricate two rectangular gutters  
Tools and materials to lay out and fabricate shingle roof flashing, including:  
  Drawing of a shingle roof flashing (Figure 37)  
Tools and materials to lay out and fabricate chimney flashing, including:  
  Sealant  
  Hammer and galvanized roofing nails  
  Lead wedges  
  Drawing of chimney flashing (Figure 38)  
Tools and materials to lay out and fabricate wall flashing (top surface), including:  
  Drawing of coping profile (Figure 40)  
Real or mockup small residential chimney fabrication  
Model wall, model chimney, and model roofing  
Module Examinations*  
Performance Profile Sheets*  

*Located in the Test Booklet.

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with hand and power tools. Ensure that they are briefed on shop safety procedures.

ADDITIONAL RESOURCES

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


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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tbody>
<tr>
<td>Session I. Roofing Materials; Roof Pitch</td>
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<tr>
<td>A. Introduction</td>
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<tr>
<td>B. Roofing Materials</td>
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<td>C. Roof Pitch</td>
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<tr>
<td>Session II. Flashing and Gutters</td>
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<tr>
<td>A. Roof Flashing</td>
<td></td>
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<tr>
<td>B. Gutters and Downspouts</td>
<td></td>
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</tbody>
</table>
Session III. Chimneys; Practice Tasks, Part One
A. Chimney
B. Conductor Elbow
C. Laboratory
   Trainees practice fabricating a conductor elbow. This laboratory corresponds to Performance Tasks 1 and 2.
D. Rectangular Outlet Tube
E. Laboratory
   Trainees practice fabricating a rectangular outlet tube. This laboratory corresponds to Performance Task 4.

Session IV. Practice Tasks, Part Two
A. Two Rectangular Gutters
B. Laboratory
   Trainees practice fabricating rectangular gutters. This laboratory corresponds to Performance Task 4.
C. Shingle Roof Flashing
D. Laboratory
   Trainees practice fabricating shingle roof flashing. This laboratory corresponds to Performance Task 5.

Session V. Practice Tasks, Part Three
A. Chimney Flashing
B. Laboratory
   Trainees practice fabricating chimney flashing. This laboratory corresponds to Performance Task 6.
C. Wall Flashing
D. Laboratory
   Trainees practice fabricating wall flashing. This laboratory corresponds to Performance Task 6.

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