Shop Production and Organization
Annotated Instructor's Guide

Module 04401-09

MODULE OVERVIEW

This module explains the organization of the sheet metal shop and the various responsibilities of shop personnel. It describes the planning phases of shop production and the critical path method. Common shop process problems are identified and recommendations for maximum efficiency are provided.

PREREQUISITES

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

OBJECTIVES

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

1. Describe the role of the sheet metal shop in fabricating, assembling, and delivering sheet metal assemblies to the construction job site, ready for installation.
2. Identify and describe the planning phases of shop production.
3. Identify and describe the critical path method (CPM).
4. Describe the various jobs and responsibilities of shop personnel.
5. Identify shop process problems and recommendations for proper job control.

PERFORMANCE TASKS

There are no performance tasks for this module.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Accident reports from OSHA's website
Sample estimating forms
Sample man-hour estimating table
Sample correction factor tables
Bill of materials and associated drawings
Master production schedule
Material requirements plan
Sample labels produced by a computer-aided design software program
Accessible CPM software, or information regarding CPM software
Daily field time sheets
Logs of time
Module Examinations*

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

ADDITIONAL RESOURCES

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

Building Down Barriers: A Guide to Construction Best Practice, 2003. Clive Thomas Cain. London: Taylor and Francis.

Construction Methods and Management, 2003. S. W. Nunnally. Upper Saddle River, NJ: Prentice Hall.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 15 hours are suggested to cover *Shop Production and Organization*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	**Planned Time**
Session I. Introduction; Estimating	
A. Introduction	_____
B. Estimating	_____
Session II. Planning Phases	
A. Materials Management	_____
B. Planning Stages	_____
C. Throughput	_____
D. Critical Path Method (CPM)	_____
Session III. Shop Layout and Operation	
A. Shop Layout and Materials Flow	_____
B. Efficient Shop Operation	_____
Session IV. Work Control; Automated Shop Equipment	
A. Work Control	_____
B. Automated Shop Equipment	_____
Session V. Roles and Relationships	
A. Foreman	_____
B. Detailer	_____
C. Journeyman	_____
D. Apprentice	_____
Session VI. Review and Testing	
A. Review	_____
B. Module Examination	_____

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

Air Testing and Balancing
Annotated Instructor's Guide

Module 04402-09

MODULE OVERVIEW

This module explains the principles of air balancing, and describes accepted air-balancing methods and procedures. Trainees will learn how to identify air-balancing tools and instruments and how to operate and control air-balancing components.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Sheet Metal Level One; Sheet Metal Level Two; Sheet Metal Level Three; and Sheet Metal Level Four*, Module 04401-09.

OBJECTIVES

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

1. Explain the principles of air balance.
2. Define common terms associated with grilles, registers, and diffusers.
3. Describe the more commonly accepted methods of performing air-balancing procedures.
4. Identify the tools and instruments necessary for balancing air distribution systems.
5. Describe the operation and control of air-balancing components.

PERFORMANCE TASKS

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

1. Diagram how to properly set up a duct leakage testing kit.
2. Properly calculate allowable leakage for a given duct section provided by the instructor.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Appropriate personal protective equipment
Copies of your local code
Sample field balancing data sheets
Sample duct design drawings
Sample reporting forms
Variety of air-measuring devices, along with manufacturer's instructions
Calculators
Manometers
Fan curve charts
Manufacturer's instructions for estimating air quantities in conditioning equipment
Thermocouple or thermistor-type thermometers
Module Examinations*
Performance Profile Sheets*

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

SAFETY

Ensure that trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures. Always work in a clean, well-lit, appropriate work area.

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.

Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems, 2005. Gaithersburg, MD: National Environmental Balancing Bureau.

Residential Heating, Ventilating, and Air Conditioning: Design and Application. John E. Traister. Englewood Cliffs, NJ: Prentice Hall.

Testing and Balancing HVAC Air and Water Systems, 2001. Samuel C. Monger. Lilburn, GA: The Fairmont Press, Inc.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover *Air Testing and Balancing.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	**Planned Time**
Session I. Introduction; Air Distribution, Part One	
A. Introduction	_____
B. Air Distribution	_____
C. Determining Actual CFM	_____
Session II. Air Distribution, Part Two	
A. Low-Velocity Systems	_____
B. High-Velocity Systems	_____
C. Variable Air Volume Systems	_____
Session III. Air Distribution System Components	
A. Air Distribution System Components	_____
Session IV. Air-Measuring Devices	
A. Anemometers	_____
B. Balancing Hoods	_____
Session V. Air System Balancing Considerations, Part One	
A. Airflow	_____
B. Air Weight	_____
C. Laboratory	_____
Trainees practice identifying air-measuring devices.	
Session VI. Air System Balancing Considerations, Part Two	
A. Duct Leakage Testing	_____
B. Laboratory	_____
Trainees diagram a duct leakage test setup and calculate allowable duct leakage. This laboratory corresponds to Performance Tasks 1 and 2.	

Session VII. Air System Balancing Procedures, Part One

A. Air System Balancing Procedures _____

B. Prebalance Checks _____

Session VIII. Air System Balancing Procedures, Part Two

A. Duct System Balancing: Mains _____

B. Terminal Balancing _____

Session IX. Air System Balancing Procedures, Part Three

A. Mixed Air System Adjustment _____

B. Measuring Temperature Rise _____

C. Measuring Temperature Drop _____

Session X. Review and Testing

A. Review _____

B. Module Examination _____

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

C. Performance Testing _____

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

Introduction to Welding, Brazing, and Cutting
Annotated Instructor's Guide

Module 04403-09

MODULE OVERVIEW

This module introduces welding, brazing, and cutting techniques. Trainees will learn to properly use protective equipment, to categorize welding electrodes, and to use flame cutting equipment and welding machines. Trainees will practice welds in a variety of positions and perform a basic braze.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Sheet Metal Level One; Sheet Metal Level Two; Sheet Metal Level Three; and Sheet Metal Level Four*, Modules 04401-09 and 04402-09.

OBJECTIVES

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

1. Explain the basic theory of arc welding.
2. Identify the necessary health and safety hazards, requirements, and protective equipment for arc welding, flame cutting, and plasma cutting
3. Explain the characteristics and uses of direct current welding machines, alternating current welding machines, and AC-DC arc-welding machines.
4. Describe the types and uses of welding electrodes and categorize them according to the American Welding Society's (AWS) classification system.
5. Describe the basic setups for gas metal-arc and gas tungsten-arc welding processes.
6. Describe the basic brazing process.
7. Describe the operation and use of a hand plasma cutter.

PERFORMANCE TASKS

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

1. Set up and adjust the power source for arc welding.
2. Weld stringer beads.
3. Identify SMAW electrodes.
4. Perform welds for shielded metal-arc welding (SMAW) in the following positions:
   - Flat
   - Horizontal
   - Vertical uphill
   - Vertical downhill
   - Overhead
5. Perform welds for gas tungsten-arc welding (GTAW) in the following positions:
   - Flat
   - Horizontal
   - Vertical uphill
   - Vertical downhill
   - Overhead
6. Perform welds for gas metal-arc welding (GMAW) in the following positions:
   - Flat
   - Horizontal
   - Vertical uphill
   - Vertical downhill
   - Overhead

7. Perform welds for oxyacetylene brazing in the following positions:
   - Flat
   - Horizontal
   - Vertical uphill
   - Vertical downhill
   - Overhead
8. Set up oxyacetylene flame cutting equipment.
9. Light and extinguish the cutting torch.
10. Make straight cuts on carbon steel plate.
11. Cut a given size opening using a portable plasma cutter.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen

Transparencies

Blank acetate sheets

Transparency pens

Whiteboard/chalkboard

Markers/chalk

Pencils and paper

Copies of your local code

Appropriate personal protective equipment, including:
- Welding caps
- Safety glasses
- Ear plugs
- Gauntlet-type welding gloves
- Head and face protection
- High-top leather boots
- Face shield
- Leather or fire-resistant clothing and covers
- Leather aprons

Copies of the AWS standard

AC arc welding machine

DC arc welding machine

Ground clamps

Base metal

Tools and materials to practice button and bead welds

Tools and materials to perform weaving and padding

Tools and materials to perform welding, including:
- ¼" and 3⁄16" mild-steel plate workpieces
- ⅛" E6013 electrodes
- Carbon electrodes
- Filler rods
- Carbon-arc holders
- Spacer wire
- Wire brush
- Chipping hammer

Tools and materials to braze a joint, including:
- Brazing rod
- Filler rod
- Flux

Fuel gas regulator and oxygen regulator

Portable hand plasma cutter

Flame cutting tools, including:
- Friction lighter
- Multipurpose wrench
- Tip cleaner
- Drill kits

Oxyacetylene flame cutting equipment

Materials to make straight cuts, including:
- 3⁄16" mild-steel plates
- Cutting torch with a Number 1 tip
- Spark lighter
- Pliers

Module Examinations*

Performance Profile Sheets*

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

SAFETY

Ensure trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures when working with welding equipment. Always work in a clean, well-lit, appropriate work area.

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.

Brazing (VHS Video/Slides/Book). Syracuse, NY: Carrier Corporation, Literature Services.

Modern Welding Technology. Howard B. Cary. Englewood Cliffs, NJ: Prentice Hall, Inc.

The Procedure Handbook of Welding. Cleveland, OH: The Lincoln Electrical Company.

Standards and Codes. Miami, FL: American Welding Society (AWS).

Welding Skills. Joseph W. Giachino, W.R. Weeks, and G.S. Johnson. Homewood, IL: American Technical Publishers, Inc.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover *Introduction to Welding, Brazing, and Cutting.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of the trainees may be noted during these exercises for Performance Testing purposes.

Topic	**Planned Time**
Session I. Introduction; Welding Basics, Part One	
A. Welding Basics	_____
B. Safety Precautions	_____
C. Power Sources	_____
D. Laboratory	_____
Have trainees practice setting up and adjusting the power source for arc welding. This laboratory corresponds to Performance Task 1.	
Session II. Welding Basics, Part Two	
A. Welding Equipment	_____
B. Electrodes	_____
C. Laboratory	_____
Have trainees practice identifying SMAW electrodes. This laboratory corresponds to Performance Task 3.	
D. Striking the Arc	_____
E. Electrode Angles	_____
Session III. Shielded Metal-Arc Welding (SMAW), Part One	
A. Before You Begin Welding	_____
B. Button Weld Practice	_____
C. Bead Weld Practice	_____
D. Laboratory	_____
Have trainees practice welding stringer beads. This laboratory corresponds to Performance Task 2.	
E. Weaving and Padding	_____

Session IV. Shielded Metal-Arc Welding (SMAW), Part Two

A. Joint Welds _____
B. Arc Welding Positions _____
C. Laboratory _____

Have trainees practice SMAW in multiple positions. This laboratory corresponds to Performance Task 4.

Session V. Carbon-Arc Welding

A. Equipment and Procedures _____
B. Welding Aluminum Alloys _____
C. Welding Brass and Copper Alloys _____
D. Soldering _____
E. Welding Galvanized Steel _____

Session VI. Other Welding Processes

A. Gas Tungsten-Arc Welding _____
B. Laboratory _____

Have trainees practice GTAW in multiple positions. This laboratory corresponds to Performance Task 5.

C. Gas Metal-Arc Welding _____
D. Laboratory _____

Have trainees practice GMAW in multiple positions. This laboratory corresponds to Performance Task 6.

E. Spot Welding _____

Session VII. Brazing

A. Safety Precautions _____
B. Carbon-Arc Brazing _____
C. Laboratory _____

Have trainees practice brazing in multiple positions. This laboratory corresponds to Performance Task 7.

Session VIII. Introduction to Flame Cutting, Part One

A. Flame Cutting Equipment _____
B. Manual (Hand) Plasma Cutting _____
C. Laboratory _____

Have trainees practice cutting an opening using a portable plasma cutter. This laboratory corresponds to Performance Task 11.

Session IX. Introduction to Flame Cutting, Part Two

A. General Flame Cutting Safety _____
B. Equipment Setup and Operation _____
C. Laboratory _____

Have trainees practice setting up flame cutting equipment and lighting and extinguishing a cutting torch. This laboratory corresponds to Performance Tasks 8 and 9.

D. Making Straight Cuts _____
E. Laboratory _____

Have trainees practice making straight cuts. This laboratory corresponds to Performance Task 10.

Session X. Review and Testing

A. Review _____

B. Module Examination _____

1. Trainees must score 70 percent 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 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.

Fume and Exhaust System Design
Annotated Instructor's Guide

Module 04404-09

MODULE OVERVIEW

This module reviews the codes and specifications that pertain to fume and exhaust system design. Trainees will learn to select the appropriate materials for fume or exhaust system components and to identify the different types of hoods and applications for each.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Sheet Metal Level One; Sheet Metal Level Two; Sheet Metal Level Three; and Sheet Metal Level Four*, Modules 04401-09 through 04403-09.

OBJECTIVES

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

1. Interpret codes and specifications pertaining to selected fume or exhaust systems.
2. Select appropriate materials for fabrication of identified exhaust or fume systems or components.
3. Identify different types of hoods and their operating principles, and identify specific applications for each.

PERFORMANCE TASKS

There are no performance tasks for this module.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Calculators
Computers with Internet access
Appropriate personal protective equipment
Copies of your local code
Sample regulations from several national safety organizations, including:
- The American Society of Heating, Refrigerating, and Air-Conditioning Engineers
- The National Fire Protection Association
- The American Conference of Governmental Industrial Hygienists

Copies of the wet collector (*Figure 21*) with the symbol key covered
Module Examinations*

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

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.

Industrial Ventilation: A Manual of Recommended Practice, 2004. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems, 2009. Quincy, MA: National Fire Protection Association.

NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, 2008. Quincy, MA: National Fire Protection Association.

Ventilation for Acceptable Indoor Air Quality, 2004. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 25 hours are suggested to cover *Fume and Exhaust System Design.* You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	**Planned Time**
Session I. Introduction; Codes and Standards	
A. Introduction	_____
B. Codes and Standards	_____
Session II. Particulates and Respiratory Hazards	
A. Particulates and Respiratory Hazards	_____
1. Appendix A (Teaching Tip)	_____
Sessions III-V. Ventilation Air Requirements	
A. Exhaust Hoods	_____
1. Appendix B (Teaching Tip)	_____
B. Grease Filters	_____
C. Ventilation for Spray Painting	_____
1. Appendix C (Teaching Tip)	_____
D. Ventilating for Welding, Cutting, and Brazing	_____
Sessions VI-VII. Dust Collection Equipment	
A. Dust Collection Equipment Overview	_____
B. Electrostatic Precipitators	_____
C. Fabric Collectors	_____
D. Wet Collectors	_____
E. Dry Centrifugal Collectors	_____
Sessions VIII-IX. Exhaust Duct Materials	
A. Duct Materials Overview	_____
B. Materials Selection	_____
C. Joints and Fittings	_____
Session X. Review and Testing	
A. Review	_____
B. Module Examination	_____
1. Trainees must score 70 percent or higher to receive recognition from NCCER.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

Fabrication Four – Comprehensive Review
Annotated Instructor's Guide

Module 04405-09

MODULE OVERVIEW

This module provides a comprehensive review of the three development methods for laying out sheet metal patterns. Trainees will practice laying out and fabricating selected sheet metal fittings using parallel line development, radial line development, and triangulation.

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Sheet Metal Level One; Sheet Metal Level Two; Sheet Metal Level Three; and Sheet Metal Level Four*, Modules 04401-09 through 04404-09.

OBJECTIVES

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

1. Explain the principles of parallel line development, radial line development, and triangulation.
2. Given a fitting to be fabricated, select the best layout method for that fitting.

PERFORMANCE TASKS

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

1. Select, lay out, and fabricate at least one fitting using each of the following methods:
   - Parallel line development
   - Radial line development
   - Triangulation

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Copies of your local code
Appropriate personal protective equipment
Tools and equipment needed to perform layout and fabrication tasks
Sheet metal
Paper for drawing patterns
Module Examinations*
Performance Profile Sheets*

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

SAFETY

Ensure trainees are equipped with appropriate personal protective equipment. Emphasize the importance of following all safety precautions and procedures for all fabrication tools and equipment. Always work in a clean, well-lit, appropriate work area.

ADDITIONAL RESOURCES

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

Advanced Sheet Metal Fabrication, 2003. Timothy Remus. Stillwater, MN: Wolfgang Publications.

Sheet Metal Technology. Richard S. Budzik, George Kuprianczyk, George Mata. Chicago: Practical Publications.

Ultimate Sheet Metal Fabrication. Timothy Remus. Stillwater, MN: Wolfgang Publications.

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

Topic	**Planned Time**
Session I. Introduction; Development Methods	
A. Introduction	_____
B. Development Methods	_____
1. Parallel Line Development	_____
2. Radial Line Development	_____
3. Triangulation	_____
Session II. Fabrication Task One	
A. 90° Tee Intersecting a Round Pipe	_____
B. Laboratory	_____
Have trainees practice laying out and fabricating a 90° tee intersecting a round pipe. This laboratory corresponds to Performance Task 1.	
Session III. Fabrication Task Two	
A. Double Offset	_____
B. Laboratory	_____
Have trainees practice laying out and fabricating a double offset. This laboratory corresponds to Performance Task 1.	
Session IV. Fabrication Task Three	
A. Gored Elbow	_____
B. Laboratory	_____
Have trainees practice laying out and fabricating a gored elbow. This laboratory corresponds to Performance Task 1.	
Session V. Fabrication Task Four	
A. Square-to-Round Two-Way Offset	_____
B. Laboratory	_____
Have trainees practice laying out and fabricating a square-to-round two-way offset. This laboratory corresponds to Performance Task 1.	
Session VI. Fabrication Task Five	
A. Tapered Offset Duct	_____
B. Laboratory	_____
Have trainees practice laying out and fabricating a tapered offset duct. This laboratory corresponds to Performance Task 1.	

Session VII. Fabrication Task Six

A. Transition Offset Elbow _____

B. Laboratory _____

Have trainees practice laying out and fabricating a transition offset elbow. This laboratory corresponds to Performance Task 1.

Session VIII. Fabrication Task Seven

A. Round Duct Intersecting Taper _____

B. Laboratory _____

Have trainees practice laying out and fabricating a round duct intersecting taper. This laboratory corresponds to Performance Task 1.

Session IX. Fabrication Task Eight

A. Off-Center Tapered Duct _____

B. Laboratory _____

Have trainees practice laying out and fabricating an off-center tapered duct. This laboratory corresponds to Performance Task 1.

Session X. Fabrication Task Nine

A. 90° Tapered Elbow _____

B. Laboratory _____

Have trainees practice laying out and fabricating a 90° tapered elbow. This laboratory corresponds to Performance Task 1.

Session XI. Fabrication Task Ten

A. 90° Change Elbow _____

B. Laboratory _____

Have trainees practice laying out and fabricating a 90° change elbow. This laboratory corresponds to Performance Task 1.

Session XII. Fabrication Task Eleven

A. Round Tapering Tee Intersecting Round Pipe at 45° Angle _____

B. Laboratory _____

Have trainees practice laying out and fabricating a round tapering tee intersecting round pipe at a 45° angle. This laboratory corresponds to Performance Task 1.

Session XIII. Fabrication Task Twelve

A. Round Tapering Roof Jack _____

B. Laboratory _____

Have trainees practice laying out and fabricating a round tapering roof jack. This laboratory corresponds to Performance Task 1.

Session XIV. Grinding Wheel Hood; Lateral Capturing Hood for Acid Tanks

A. Appendix A _____

B. Appendix B _____

Session XV. Cyclone Dust Collector; Taper Duct System

A. Appendix C _____

B. Appendix D _____

Session XVI. Review and Testing

A. Review _____

B. Module Examination _____

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

C. Performance Testing _____

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

Introductory Supervisory Skills
Annotated Instructor's Guide

Module 04406-09

MODULE OVERVIEW

This module introduces the basic leadership skills a crew leader needs in order to supervise a crew. Trainees will learn about:

- The construction industry today
- Construction organization
- Team building
- Gender and cultural issues
- Communication
- Motivation
- Problem solving
- Decision making
- Safety
- Project control

PREREQUISITES

Prior to training with this module, it is recommended that the trainee shall have successfully completed *Core Curriculum; Sheet Metal Level One; Sheet Metal Level Two; Sheet Metal Level Three; and Sheet Metal Level Four*, Modules 04401-09 through 04405-09.

OBJECTIVES

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

1. Discuss current issues and organizational structure in the construction industry today.
2. Understand and incorporate leadership skills into work habits, including communication, motivation, team building, problem solving, and decision-making skills.
3. Demonstrate an awareness of safety issues, including the cost of accidents and safety regulations.
4. Identify a supervisor's typical safety responsibilities.
5. Show a basic understanding of the planning process, scheduling, and cost and resource control.

PERFORMANCE TASKS

There are no performance tasks for this module.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and paper
Sample job descriptions
Examples of MSDSs
Module Examinations*

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

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.

A Guide to the Project Management Body of Knowledge, 2004. PMI Standards Committee. Newtown Square, PA: PMI Publications.

Project Management, 2008. NCCER. Upper Saddle River, NJ: Pearson.

NOTE TO INSTRUCTORS

If you are teaching this class under an Accredited NCCER Sponsor, note that your trainees may be eligible for dual credentials for successful completion of *Introductory Supervisory Skills*. When submitting the Form 200, indicate completion of the two module numbers that apply to *Introductory Skills for the Crew Leader* – MT101 (from NCCER's *Management* series) and 27410-08 (from NCCER's *Carpentry Level Four*) and transcripts will be issued accordingly.

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 *Introductory Supervisory Skills*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources.

Topic	**Planned Time**
Session I. Orientation to the Job	
A. Overview of the Construction Industry	_____
B. The Construction Industry Today	_____
C. Gender and Cultural Issues	_____
D. Construction Projects	_____
E. The Construction Organization	_____
Session II. Leadership Skills, Part One	
A. Introduction to Supervision	_____
B. The Shift in Work Activities	_____
C. Becoming a Leader	_____
D. Communication	_____
E. Motivation	_____
Session III. Leadership Skills, Part Two	
A. Team Building	_____
B. Getting the Job Done	_____
C. Problem Solving and Decision Making	_____
Session IV. Safety	
A. Safety Overview	_____
B. Costs of Accidents	_____
C. Safety Regulations	_____
D. Safety Responsibilities	_____
E. Supervisor Involvement in Safety	_____
F. Promoting Safety	_____

Session V. Project Control, Part One

A. Project Control Overview _____
B. Project Delivery Systems _____
C. An Overview of Planning _____
D. Stages of Planning _____
E. The Planning Process _____

Session VI. Project Control, Part Two

A. Planning Resources _____
B. Ways to Plan _____
C. Estimating _____
D. Scheduling _____

Session VII. Project Control, Part Three

A. Cost Awareness and Control _____
B. Resource Control _____
C. Production and Productivity _____

Session VIII. Review and Testing

A. Review _____
B. Module Examination _____
   1. Trainees must score 70 percent 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.