MODULE OVERVIEW

This module introduces chemical, compressed air, fuel oil, steam, and water systems and explains how to identify them by color-code. It also explains thermal expansion of pipes and pipe insulation.

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* and *Pipefitting Level One*.

OBJECTIVES

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

1. Identify and explain the types of piping systems.
2. Identify piping systems according to color-coding.
3. Explain the effects and corrective measures for thermal expansion in piping systems.
4. Explain types and applications of pipe insulation.

PERFORMANCE TASKS

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

1. Identify the type of piping system designated by a red color-code.
2. Identify the type of piping system designated by a yellow color-code
3. Identify the type of piping system designated by a green color-code.
4. Identify the type of piping system designated by a bright blue color-code.

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
MSDSs for commonly used chemicals
Various types of pipe from different piping systems
Sections of color-coded pipe for identification
Samples of various insulation materials
Bimetallic strip
Acetylene torch with rosebud
Calculator
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly.

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.

Audel Mechanical Trades Pocket Manual, 1990. Carl Nelson. New York, NY: Macmillan Publishing Company.

The Pipefitter's Bluebook, 2002. W. V. Graves. Clinton, NC: Construction Trades Press.

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

Topic	**Planned Time**
Session I. Piping Systems	
A. Introduction	_____
B. Types of Piping Systems	_____
C. Identifying Piping Systems	_____
D. Laboratory – Trainees practice identifying piping systems. This laboratory corresponds to Performance Tasks 1 through 4.	_____
Session II. Thermal Expansion, Insulation, Review, and Testing	
A. Thermal Expansion	_____
B. Pipe Insulation	_____
C. Module Review	_____
D. Module Examination	_____
1. Trainees must score 70% 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.	
E. Performance Testing	_____
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.	
2. Record the testing results on Craft Training Report Form 200, and submit the results to the Training Program Sponsor.	

Drawings and Detail Sheets
Annotated Instructor's Guide

Module 08202-06

MODULE OVERVIEW

This module introduces the trainee to plot plans, structural drawings, elevation drawings, as-built drawings, equipment arrangement drawings, P&IDs, isometric drawings, spool sheets, and detail sheets.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Module 08201-06.

OBJECTIVES

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

1. Identify parts of drawings.
2. Identify types of drawings.
3. Make field sketches.
4. Interpret drawing indexes and line lists.

PERFORMANCE TASKS

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

1. Identify parts of a drawing:
   - Title block
   - Scales and measurements
   - Symbols and abbreviations
   - Notes
   - Revision blocks
   - Coordinates
2. Interpret the following:
   - Drawing indexes
   - Line lists
3. Identify the following types of drawings:
   - Plot plans
   - Structural drawings
   - Elevation and section drawings
   - Equipment arrangement drawings
   - P&IDs
   - Isometric drawings
   - Spool drawings
   - Pipe support drawings and detail sheets
   - Orthographic drawings
4. Make field sketches:
   - Orthographic
   - Isometric

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
Set of blueprints
Plot plan
Structural drawings
Elevation and section drawings
As-built drawings
Equipment arrangement drawings
P&IDs
Isometric drawings
Spool drawings
Equipment drawings
Pipe support drawings
Orthographic drawings
Standard set of sketching tools
  Pencils
  Sketch pad
  Rulers
  Templates or protectors
Calculators
Several sets of piping drawings
Commercial prints or public works drawings
Small object such as a pipe fitting, valve, or coffee mug for sketching
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit construction sites or utility areas. Ensure that they are briefed on site safety procedures.

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.

Process Piping Drafting, 1986. Rip Weaver. Houston, TX: Gulf Publishing Company.

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

Topic	**Planned Time**
Sessions I and II. Identifying and Interpreting Drawings	
A. Introduction	_____
B. Identifying Parts of Drawings	_____
C. Laboratory – Trainees practice identifying parts of drawings. This laboratory corresponds to Performance Task 1.	_____
D. Drawing Indexes and Line Lists	_____

E. Laboratory – Trainees practice interpreting drawing indexes and line lists. This laboratory corresponds to Performance Task 2. _____

Session II. Identifying Different Types of Drawings

A. Plot Plans _____
B. Structural Drawings _____
C. Elevation and Section Drawings _____
D. Equipment Arrangement Drawings _____
E. P&IDs _____
F. Isometric Drawings _____
G. Spool Drawings _____
H. Pipe Support Drawings and Detail Sheets _____
I. Orthographic Drawings _____
J. Laboratory – Trainees practice identifying different types of drawings. This laboratory corresponds to Performance Task 3. _____

Sessions IV and V. Field Sketches

A. Orthographic _____
B. Isometric _____
C. Laboratory – Trainees practice making field sketches. This laboratory corresponds to Performance Task 4. _____

Session VI. Review and Testing

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

MODULE OVERVIEW

This module identifies and provides installation methods for different types of valves. It also covers valve storage and handling.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 and 08202-06.

OBJECTIVES

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

1. Identify types of valves that start and stop flow.
2. Identify types of valves that regulate flow.
3. Identify valves that relieve pressure.
4. Identify valves that regulate the direction of flow.
5. Identify types of valve actuators.
6. Explain how to properly store and handle valves.
7. Explain valve locations and positions.
8. Explain the factors that influence valve selection.
9. Interpret valve markings and nameplate information.

PERFORMANCE TASKS

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

1. Identify valves that start and stop flow.
2. Identify valves that regulate flow.
3. Identify valves that relieve pressure.
4. Identify valves that regulate the direction of flow.
5. Identify valve actuators.
6. Given a select number of valves, match each valve to its given application.
7. Interpret valve markings and nameplate information.

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
Gate valves with various types of bonnets and stems
Knife gate valve
Ball valves
Venturi-type and top-entry ball valves
Various types of plug valves
Globe valves
Angle valves
Y-type valves
Butterfly valves
Diaphragm valves
Needle valves
Control valves
Safety valves

continued

Pressure-relief valves
Various types of check valves
Swing check valves
Lift check valves
Ball check valves
Butterfly check valves
Foot valves
Gear operators
Chain operators
Electric motor-driven actuators
Pneumatic and hydraulic actuators
Photograph or picture of valve boxes
Manufacturers' literature on pressure-relief valves
Backflow preventer
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit construction sites or utility areas. Ensure that they are briefed on site 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.

Choosing the Right Valve. New York, NY: Crane Company.

Piping Pointers; Application and Maintenance of Valves and Piping Equipment. New York, NY: Crane Company.

The Piping Guide, 1980. San Francisco, CA: Syentek Books Company, Ltd.

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

Topic	**Planned Time**
Sessions I and II. Valves That Start and Stop Flow	
A. Introduction	_____
B. Gate Valves	_____
C. Knife Gate Valves	_____
D. Ball Valves	_____
E. Plug Valves	_____
F. Three-Way Valves	_____
G. Laboratory – Trainees practice identifying valves that start and stop flow. This laboratory corresponds to Performance Task 1.	_____
Session III. Valves that Regulate Flow and Pressure	
A. Globe Valves	_____
B. Y-Type Valves	_____

C. Butterfly Valves _____
D. Diaphragm Valves _____
E. Needle Valves _____
F. Control Valves _____
G. Laboratory – Trainees practice identifying valves that regulate flow. This laboratory corresponds to Performance Task 2. _____

Session IV. Valves That Relieve Pressure

A. Safety Valves _____
B. Pressure-Relief Valves _____
C. Laboratory – Trainees practice identifying valves that relieve pressure. This laboratory corresponds to Performance Task 3. _____

Session V. Valves That Regulate the Direction of Flow

A. Swing Check Valves _____
B. Lift Check Valves _____
C. Ball Check Valves _____
D. Butterfly Check Valves _____
E. Foot Valves _____
F. Laboratory – Trainees practice identifying valves that regulate the direction of flow. This laboratory corresponds to Performance Task 4. _____

Session VI. Actuators

A. Gear Operators _____
B. Chain Operators _____
C. Pneumatic and Hydraulic Actuators _____
D. Electric or Air Motor-Driven Actuators _____
E. Laboratory – Trainees practice identifying valve actuators. This laboratory corresponds to Performance Task 5. _____

Session VII. Installation and Applications

A. Storing and Handling Valves _____
B. Installing Valves _____
C. Valve Selection, Types, and Applications _____
D. Laboratory – Trainees practice matching a valve to the given application. This laboratory corresponds to Performance Task 6. _____
E. Valve Markings _____
F. Laboratory – Trainees practice interpreting valve markings. This laboratory corresponds to Performance Task 7. _____

Session VIII. Review and Testing

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

Pipefitting Trade Math
Annotated Instructor's Guide

Module 08204-06

MODULE OVERVIEW

This module explains how to use ratios and proportions, solve basic algebra, area, volume, and circumference problems, and solve for right triangles using the Pythagorean theorem.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08203-06.

OBJECTIVES

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

1. Identify and explain the use of special measuring devices.
2. Use tables of weights and measurements.
3. Use formulas to solve basic problems.
4. Solve area problems.
5. Solve volume problems
6. Solve circumference problems.
7. Solve right triangle problems using the Pythagorean theorem.

PERFORMANCE TASKS

This is a knowledge-based module; there are no Performance Tasks.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen
Transparencies
Blank acetate sheets
Transparency pens
Whiteboard/chalkboard
Markers/chalk
Pencils and scratch paper
Architect's scale
Engineer's scale
Copies of the Quick Quiz*
Module Examinations**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module may require trainees to visit construction sites or utility areas. Ensure that they are briefed on site 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.

Pipe Fitter's Math Guide, 1989. Johnny Hamilton. Clinton, NC: Construction Trade Press.

The Pipefitters' Blue Book. W. V. Graves. Webster, TX: Graves Publisher.

The Pipe Fitter's and Pipe Welder's Handbook. Thomas W. Frankland. Milwaukee, WI: The Bruce Publishing Company.

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

Topic	**Planned Time**
Sessions I and II. Measuring and Using Tables and Formulas	
A. Introduction	_____
B. Special Measuring Devices	_____
C. Using Tables	_____
D. Using Formulas	_____
E. Laboratory – Trainees practice using formulas to solve problems.	_____
Session III. Solving Area Problems	
A. Rectangles	_____
B. Triangles	_____
C. Circles	_____
D. Laboratory – Trainees practice solving area problems.	_____
Session IV. Solving Volume Problems	
A. Rectangular Solids	_____
B. Cylinders	_____
C. Spheres	_____
D. Pyramids	_____
E. Cones	_____
F. Laboratory – Trainees practice solving volume problems.	_____
Session V. Solving Circumference Problems and Right Triangles	
A. Solving Circumference Problems	_____
B. Laboratory – Trainees practice solving circumference problems.	_____
C. Pythagorean Theorem	_____
D. Laboratory – Trainees practice solving right triangles using the Pythagorean theorem.	_____
Session VI. Review and Testing	
A. Module Review	_____
B. Module Examination	_____
1. Trainees must score 70% 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.	

Threaded Pipe Fabrication
Annotated Instructor's Guide

Module 08205-06

MODULE OVERVIEW

This module describes the materials used in threaded piping systems. It explains how to determine pipe lengths between threaded pipe fittings, prepare the pipe and fittings for fit-up, and assemble the piping system.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08204-06.

OBJECTIVES

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

1. Identify and explain the materials used in threaded piping systems.
2. Identify and explain pipe fittings.
3. Read and interpret screwed fitting joint drawings.
4. Identify and explain types of threads.
5. Determine pipe lengths between joints.
6. Thread and assemble piping and valves.
7. Calculate offsets.

PERFORMANCE TASKS

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

1. Read and interpret screwed fitting joint drawings.
2. Determine pipe lengths between fittings, using the center-to-center method.
3. Determine pipe lengths between fittings, using the center-to-face method.
4. Determine pipe lengths between fittings, using the face-to-face method.
5. Given the length of travel of a 45-degree piping offset, calculate the length of the set.
6. Given the length of the set and the degree of the fittings, use the table of elbow constants to figure the travel and the run.
7. Calculate offsets, using the table of multipliers used to calculate offsets.
8. Calculate the travel of a rolling offset.
9. Thread pipe, using manual threaders.
10. Thread pipe, using a threading machine.
11. Apply pipe joint compound to the male threads of the pipe.
12. Make up the pipe and fittings.
13. Install a screwed valve.

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
Various types of pipe
Various sizes of pipe
Assorted elbows
Return bends
Branch connections
Caps and plugs
Line connections
Nipples
Flanges
Examples of various pipe threads
Fitting manufacturer's makeup chart
Thread gauge
Pipe drawings
Manual pipe threader
Powered pipe threader
Cutting oil
Pipe stand
Vises
Reamers
⅜-inch to ¾-inch sets of open-end wrenches
Adjustable wrenches
Channel-lock pliers
Drift pins
Framing squares
Measuring tape
Soapstones
Torque wrenches
Liquid Teflon®
Teflon® tape
Pipe dope
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to work with hand 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.

Audel Mechanical Trades Pocket Manual. Thomas B. Davis, Carl Nelson. New York, NY: Macmillan Company.

IPT's Pipe Trades Handbook. Robert A. Lee. Clinton, NC: Construction Trades Press.

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 *Threaded Pipe Fabrication*. 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. Threaded Piping Systems and Fittings	
A. Introduction	_____
B. Materials Used in Threaded Piping Systems	_____
C. Pipe Fittings	_____
Session II. Screwed Fitting Joint Drawings and Threads	
A. Screwed Fitting Joint Drawings	_____
B. Laboratory – Trainees practice reading and interpreting screwed fitting joint drawings. This laboratory corresponds to Performance Task 1.	_____
C. Threads	_____
Session III. Determining Pipe Lengths Between Fittings	
A. Center-to-Center Method	_____
B. Laboratory – Trainees practice determining pipe length using the center-to-center method. This laboratory corresponds to Performance Task 2.	_____
C. Center-to-Face Method	_____
D. Laboratory – Trainees practice determining pipe length using the center-to-face method. This laboratory corresponds to Performance Task 3.	_____
E. Face-to-Face Method	_____
F. Laboratory – Trainees practice determining pipe length using the face-to-face method. This laboratory corresponds to Performance Task 4.	_____
Session IV. Calculating Offsets	
A. Calculating Offsets	_____
B. 45-Degree Offsets	_____
C. Laboratory – Trainees practice determining pipe length for a 45-degree piping offset. This laboratory corresponds to Performance Task 5.	_____
D. Elbow Constants	_____
E. Laboratory – Trainees practice determining pipe length using elbow constants. This laboratory corresponds to Performance Task 6.	_____
F. Multipliers	_____
G. Laboratory – Trainees practice determining pipe length using multipliers. This laboratory corresponds to Performance Task 7.	_____
H. Rolling Offsets	_____
I. Laboratory – Trainees practice determining pipe length for a rolling offset. This laboratory corresponds to Performance Task 8.	_____

Session V. Assembly Techniques

A. Threading Pipe Using a Manual Threader _____

B. Laboratory – Trainees practice threading pipe using a manual threader. This laboratory corresponds to Performance Task 9. _____

C. Threading Pipe Using a Threading Machine _____

D. Laboratory – Trainees practice threading pipe using a threading machine. This laboratory corresponds to Performance Task 10. _____

E. Pipe Joint Compound _____

F. Laboratory – Trainees practice applying pipe joint compound. This laboratory corresponds to Performance Task 11. _____

G. Fitting Screwed Pipe and Fittings _____

H. Laboratory – Trainees practice making up the pipe and fitting. This laboratory corresponds to Performance Task 12. _____

I. Installing Threaded Valves _____

J. Laboratory – Trainees practice installing a screwed valve. This laboratory corresponds to Performance Task 13. _____

Session VI. Review and Testing

A. Module Review _____

B. Module Examination _____

1. Trainees must score 70% 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.

Socket Weld Pipe Fabrication
Annotated Instructor's Guide

Module 08206-06

MODULE OVERVIEW

This module describes the materials used in socket weld piping systems. It explains how to determine pipe lengths between socket weld fittings, prepare the pipe and fittings for fit-up, and fabricate socket weld 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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08205-06.

OBJECTIVES

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

1. Identify and explain types of socket weld piping materials.
2. Identify and explain socket weld fittings.
3. Read and interpret socket weld piping drawings.
4. Determine pipe lengths between socket weld fittings.
5. Fabricate socket weld fitting to pipe.

PERFORMANCE TASKS

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

1. Identify various socket weld fittings.
2. Interpret socket weld drawings.
3. Calculate pipe lengths from line drawings, using the center-to-center method.
4. Calculate pipe lengths from line drawings, using the center-to-face method.
5. Calculate pipe lengths from line drawings, using the face-to-face method.
6. Align a 90-degree elbow to the end of a pipe.
7. Square a pipe into a 90-degree elbow.
8. Align a flange to the end of a pipe.
9. Align a 45-degree elbow to the end of a pipe.
10. Align pipes joined by a coupling.
11. Install a valve.

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
Socket weld fittings
Tape measures
Various types, sizes, and schedules of pipe
Carbon steel pipe
Stainless steel pipe
Various socket weld piping drawings
Specification books
Two-hole flange pins
Calculator
Socket weld flanges
Spring ring inserts or Gap-A-Lets
Squares
Torpedo levels
Spirit levels
Tripod vises

continued

Jack stands
Ridgid® 300 power drive with pipe cutter
Soapstones
Wraparounds
Socket weld valves
Access to qualified welder with all of the tools and materials to perform tack welding
Calipers
Micrometers
Small objects for shimming
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

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

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.

The Pipe Fitters Blue Book. W. V. Graves. Webster, TX: W.V. Graves Publishing Company.

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 *Socket Weld Pipe Fabrication*. 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. Socket Weld Fittings and Materials	
A. Introduction	_____
B. Socket Weld Pipe	_____
C. Socket Weld Pipe Fittings	_____
D. Socket Weld Flanges	_____
E. Laboratory – Trainees practice identifying socket weld fittings. This laboratory corresponds to Performance Task 1.	_____
Session II. Socket Weld Drawings	
A. Double- and Single-Line Drawings	_____
B. Isometric Drawings	_____
C. Piping Symbols	_____
D. Line Numbers and Specifications Book	_____
E. Laboratory – Trainees practice reading and interpreting socket weld drawings. This laboratory corresponds to Performance Task 2.	_____

Sessions III and IV. Determining Pipe Lengths Between Fittings

A. Center-to-Center Method _____

B. Laboratory – Trainees practice determining pipe length using the center-to-center method. This laboratory corresponds to Performance Task 3. _____

C. Center-to-Face Method _____

D. Laboratory – Trainees practice determining pipe length using the center-to-face method. This laboratory corresponds to Performance Task 4. _____

E. Face-to-Face Method _____

F. Laboratory – Trainees practice determining pipe length using the face-to-face method. This laboratory corresponds to Performance Task 5. _____

Sessions V and VI. Fabricating Socket Weld Fittings To Pipe I

A. Preparing Pipe For Alignment _____

B. Aligning 90-Degree Elbow to Pipe _____

C. Laboratory – Trainees practice aligning a 90-degree elbow to pipe. This laboratory corresponds to Performance Task 6. _____

D. Squaring Pipe into a 90-Degree Elbow _____

E. Laboratory – Trainees practice squaring pipe into a 90-degree elbow. This laboratory corresponds to Performance Task 7. _____

Sessions VII and VIII. Fabricating Socket Weld Fittings To Pipe II

A. Aligning Flange to Pipe _____

B. Laboratory – Trainees practice aligning a flange to the end of a pipe. This laboratory corresponds to Performance Task 8. _____

C. Aligning 45-Degree Elbow to Pipe Using Levels _____

D. Aligning 45-Degree Elbow to Pipe Using Squares _____

E. Laboratory – Trainees practice aligning a 45-degree elbow to the end of a pipe. This laboratory corresponds to Performance Task 9. _____

F. Aligning Pipe Joined By Couplings _____

G. Laboratory – Trainees practice aligning pipe joined by couplings. This laboratory corresponds to Performance Task 10. _____

Session IX. Valves

A. Installing Welded Valves _____

B. Laboratory – Trainees practice installing a valve. This laboratory corresponds to Performance Task 11. _____

Session X. Review and Testing

A. Module Review _____

B. Module Examination _____

1. Trainees must score 70% 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.

Butt Weld Pipe Fabrication
Annotated Instructor's Guide

Module 08207-06

MODULE OVERVIEW

This module describes the materials used in butt weld piping systems. It explains how to determine pipe lengths between butt weld fittings, prepare the pipe and fittings for fit-up, and fabricate butt weld fittings. It also describes how to select and install backing rings, fabricate channel iron welding jigs, and use and care for welding clamps.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08206-06.

OBJECTIVES

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

1. Identify butt weld piping materials and fittings.
2. Read and interpret butt weld piping drawings.
3. Prepare pipe ends for fit-up.
4. Determine pipe lengths between fittings.
5. Select and install backing rings.
6. Perform alignment procedures for various types of fittings.

PERFORMANCE TASKS

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

1. Identify various butt weld fittings.
2. Interpret a butt weld drawing.
3. Clean a beveled pipe end, using a portable grinder.
4. Calculate pipe lengths from line drawings, using the center-to-center method.
5. Calculate pipe lengths from line drawings, using the center-to-face method.
6. Calculate pipe lengths from line drawings, using the face-to-face method.
7. Align straight pipe.
8. Align a pipe to a 45-degree elbow.
9. Align a pipe to a 90-degree elbow.
10. Square a pipe into a 90-degree elbow.
11. Align a pipe to a flange.
12. Align a pipe to a tee.
13. Install a valve.

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
Various sizes of carbon steel pipe
Butt weld fittings
Butt weld flanges
Piping drawings
Portable grinders
Pipe beveller (optional)
Oxyacetylene pipe-beveling machine (optional)
Pipefitting guidebooks
Specification book
Fitting manufacturer's literature on takeout
Calculators
Carbon steel pipe
Stainless steel pipe
Various backing rings
Scrap angle iron
Scrap channel iron
Steel plate
Hacksaws
Torch
Acetylene cylinder
Oxygen cylinder
Bottle cart
Hose sets
Regulators
Strikers
Cutting goggles
Full-face shields
Tape measures
Soapstones
Lever-type clamps
Hydraulic clamps
Chain-type clamps
Alignment dogs
Hi-Lo gauge
Center finder
Straight pipe welding clamps
Framing squares
Hammers
Jack stands
Wraparounds
Wrenches
Pipe vises
Spirit levels
Torpedo levels
Tripod vises
Two-hole flange pins
Flange welding clamps
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use grinders and other power tools. Ensure all trainees are briefed on power tool safety and shop safety procedures. This module requires trainees to use an oxyacetylene torch. Ensure all trainees are briefed on safety equipment and fire safety.

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.

The Pipe Fitters Blue Book. W. V. Graves. Webster, TX: W.V. Graves Publishing Company.

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 37.5 hours are suggested to cover *Butt Weld Pipe Fabrication*. 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. Butt Weld Fittings and Materials	
A. Introduction	_____
B. Butt Weld Pipe	_____
C. Butt Weld Pipe Fittings	_____
D. Butt Weld Flanges	_____
E. Laboratory – Trainees practice identifying butt weld fittings. This laboratory corresponds to Performance Task 1.	_____
Session II. Butt Weld Drawings	
A. Double- and Single-Line Drawings	_____
B. Isometric Drawings	_____
C. Piping Symbols	_____
D. Line Numbers and Specifications Book	_____
E. Laboratory – Trainees practice reading and interpreting butt weld drawings. This laboratory corresponds to Performance Task 2.	_____
Sessions III and IV. Preparing Pipe	
A. Beveling Using Grinders	_____
B. Beveling Using Pipe Bevelers	_____
C. Laboratory – Trainees practice beveling pipe using a pipe beveler.	_____
D. Thermal Beveling	_____
E. Cleaning and Inspecting Pipe	_____
F. Laboratory – Trainees practice cleaning a beveled pipe end using a grinder. This laboratory corresponds to Performance Task 3.	_____
Sessions V and VI. Determining Pipe Lengths Between Fittings	
A. Calculating Takeout	_____
B. Obtaining Proper Spacing	_____
C. Center-to-Center Method	_____
D. Laboratory – Trainees practice determining pipe length using the center-to-center method. This laboratory corresponds to Performance Task 4.	_____
E. Center-to-Face Method	_____
F. Laboratory – Trainees practice determining pipe length using the center-to-face method. This laboratory corresponds to Performance Task 5.	_____
G. Face-to-Face Method	_____
H. Laboratory – Trainees practice determining pipe length using the face-to-face method. This laboratory corresponds to Performance Task 6.	_____

Sessions VII and VIII. Alignment Procedures I

A. Selecting and Installing Backing Rings _____
B. Laboratory – Trainees practice installing backing rings. _____
C. Using and Caring For Alignment Tools _____
D. Alignment Procedures _____
E. Aligning Straight Pipe _____
F. Laboratory – Trainees practice aligning straight pipe. This laboratory corresponds to Performance Task 7. _____

Sessions IX and X. Alignment Procedures II

A. Aligning Pipe to a 45-Degree Elbow _____
B. Laboratory – Trainees practice aligning pipe to a 45-degree elbow. This laboratory corresponds to Performance Task 8. _____
C. Aligning Pipe to a 90-Degree Elbow _____
D. Laboratory – Trainees practice aligning pipe to a 90-degree elbow. This laboratory corresponds to Performance Task 9. _____
E. Squaring Pipe to a 90-Degree Elbow _____
F. Laboratory – Trainees practice squaring pipe to a 90-degree elbow. This laboratory corresponds to Performance Task 10. _____

Sessions XI and XII. Alignment Procedures III

A. Aligning Pipe to Flange _____
B. Laboratory – Trainees practice aligning a pipe to a flange. This laboratory corresponds to Performance Task 11. _____
C. Aligning Pipe to A Tee _____
D. Laboratory – Trainees practice aligning a pipe to a tee. This laboratory corresponds to Performance Task 12. _____

Sessions XIII and XIV. Valves

A. Fitting Butt Weld Valves _____
B. Laboratory – Trainees practice installing a valve. This laboratory corresponds to Performance Task 13. _____

Session XV. Review and Testing

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

MODULE OVERVIEW

This module explains the use of shoring materials per OSHA standards and covers shoring systems, installing a hydraulic vertical shore, determining the overall fall of a sewer line, setting the grade and elevation of a trench, and backfilling.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08207-06.

OBJECTIVES

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

1. Identify and explain the use of shoring materials.
2. Identify and explain the use of premanufactured support systems.
3. Install a vertical shore to be used for shoring.
4. Determine the overall fall of a sewer line.
5. Determine and set the grade and elevation of a trench.
6. Explain backfilling procedures.

PERFORMANCE TASKS

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

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
Samples of soils
Manufacturer's literature on shoring systems
Various types of grade stakes
Laser level, transmitter and receiver
Boxes
Soils and sand
Small digging tools
Scale
DVD/VCR and monitor (optional)
Safety video (optional)
String line
Stakes
Copies of the Quick Quiz*
Module Examinations**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

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

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.

Excavators Handbook Advanced Techniques for Operators, 1999. Reinar Christian. Addison, IL: The Aberdeen Group, A division of Hanley-Wood, Inc.

Basic Equipment Operator, 1994 Edition. John T. Morris (preparer), NAVEDTRA 14081, Naval Education and Training Professional Development and Technology Center.

TEACHING TIME FOR THIS MODULE

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 10 hours are suggested to cover *Excavations*. 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. Trenching Hazards	
A. Introduction	_____
B. Soil Hazards	_____
C. Guidelines for Working In and Near a Trench	_____
D. Indications of an Unstable Trench	_____
E. Trench Failure	_____
Session II. Trench Safety	
A. Shoring Systems	_____
B. Shielding Systems	_____
C. Sloping Systems	_____
D. Combined Systems	_____
Session III. Determining Grade and Backfilling	
A. Setting Grade Using String Line	_____
B. Setting Grade Using Laser Level	_____
C. Initial Backfill	_____
D. Final Backfill	_____
Session IV. Review and Testing	
A. Module Review	_____
B. Module Examination	_____
1. Trainees must score 70% 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.	

Underground Pipe Installation
Annotated Instructor's Guide

Module 08209-06

MODULE OVERVIEW

This module explains pipe installation procedures and guidelines, including the procedures for cast iron, ductile iron, concrete, carbon steel, fiberglass, and thermoplastic pipe. It includes an introduction to horizontal directional drilling for pipe installation.

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; Pipefitting Level One;* and *Pipefitting Level Two,* Modules 08201-06 through 08208-06.

OBJECTIVES

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

1. Identify and explain the types of underground piping materials.
2. Identify the size classifications of underground pipe.
3. Identify and explain the use of underground pipe fittings.
4. Explain the joining methods for underground pipe.
5. Explain the storage and handling methods of underground pipe.
6. Identify and explain underground pipe installation guidelines.
7. Join CPVC and PVC.
8. Join ductile iron.

PERFORMANCE TASKS

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

1. Join CPVC and PVC.
2. Join ductile iron.

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
DVD/VCR and monitor (optional)
Safety video (optional)
Various types of lifting devices
Cast iron bell-and-spigot pipe fittings
Cast iron hubless pipe fittings
Soil pipe cutter
Manufacturer's recommendations for installing cast iron pipe
Lever tool
Hammers
Hacksaws
Demolition or cut-off saw
Pry bar
Assembly tools
Tape measures
Inside caulking irons
Outside caulking irons
Chisels
Soapstones
Wraparounds
Compression gaskets
Mechanical joint
No-hub joints
Flange gaskets
Gasket lubricant

continued

Lubricant
Ductile iron flanged pipe and fittings
Torque nut drivers
Torque wrenches
Dresser couplings
Iron alloy pipe and fittings
Vitrified clay bell-and-spigot pipe
Vitrified clay plain-end pipe
Acetone primer and MSDS
Fiberglass pipe adhesive kits
MSDS for fiberglass adhesives
Fiberglass bell-and-spigot pipe
Fiberglass Redi-Thread pipe
Fiberglass threaded-and-bonded pipe
Samples of different types of plastic pipe
ABS and PVC pipe and fittings
CPVC pipe and fittings
PE, PEX, and PB pipe and fittings
Water supply and DWV fittings
Reamers
Tubing cutters
Sandpaper
Teflon® tape
Copies of the Quick Quiz*
Module Examinations**
Performance Profile Sheets**

*Located in the back of this module.

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

SAFETY CONSIDERATIONS

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. This module requires trainees to use hand tools and solvent cements. Ensure all trainees are briefed on hand tool safety, chemical safety, and shop safety procedures. This module may require trainees to visit construction sites. Ensure all trainees are briefed on site safety procedures.

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.

IPT's Pipe Trades Handbook. Robert A. Lee. Clinton, NC: Construction Trades Press.

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 *Underground Pipe Installation*. 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. Underground Pipe Installation Guidelines	
A. Introduction	_____
B. Underground Pipe Installation Guidelines	_____
C. Storage and Handling of Underground Pipe	_____
Session II and III. Cast Iron and Ductile Iron Pipe	
A. Cast Iron Pipe	_____
B. Ductile Iron Pipe	_____
C. Laboratory – Trainees practice joining ductile iron pipe. This laboratory corresponds to Performance Task 2.	_____

Session IV. Concrete Pipe

A. Pipe Sizes _____
B. Joining Concrete Pipe _____
C. Cutting Concrete Pipe _____
D. Installation _____

Session V. Carbon Steel, Iron Alloy, and Fiberglass Pipe

A. Carbon Steel Pipe _____
B. Iron Alloy Pipe _____
C. Fiberglass Pipe _____

Sessions VI and VII. Thermoplastic Pipe

A. Properties _____
B. Sizing and Labeling _____
C. Types _____
D. Fittings _____
E. Cutting _____
F. Joining _____
G. Laboratory – Trainees joining PVC and CPVC pipe. This laboratory corresponds to Performance Task 1. _____

Session VIII. Review and Testing

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