

MODULE OVERVIEW

This module covers P&IDs, plan views, section views, isometric drawings, and spool drawings. It teaches the trainee to work through a set of drawings and extract the information from one drawing that is necessary to interpret other drawings. It explains how to use plan views to draw isometrics and use isometrics to put together spools. The drawings supplied fit together to design a main steam line for a power plant.

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; Pipefitting Level Two; and Pipefitting Level Three.*

OBJECTIVES

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

1. Identify symbols and abbreviations on P&IDs.
2. Identify piping arrangement drawings.
3. Read and interpret GPS coordinates, control points, and elevation.
4. Read and interpret P&IDs, plan views, and section views.
5. Identify isometric drawings.
6. Read isometric drawings taken from plan views.
7. Draw isometric drawings.
8. Read and interpret spool drawings from isometric drawings.

PERFORMANCE TASKS

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

1. Calculate the total line length from an ISO.
2. Sketch an ISO from a plan view.

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

Drawing set* (Blueprints One – Nine)

Quick Quiz**

Module Examinations***

Performance Profile Sheets***

* Included with this Instructor's Guide

** Located in the back of this module

*** 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 may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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, Weaver, Rip; Gulf Publishing Company, Book Division, Houston, TX, 1986.

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

Topic	Planned Time
Sessions I and II. Introduction and P&IDs	
A. Introduction	_____
B. Piping and Instrument Drawings	_____
C. Piping Arrangement Drawings	_____
Sessions III through VI. Reading and Interpreting P&IDs	
A. Reading and Interpreting P&IDs and Piping Arrangement Drawings	_____
Sessions VII through IX. Reading and Interpreting Isometric Drawings	
A. Reading and Interpreting Isometric Drawings	_____
Sessions X through XIV. Following a Single Line	
A. Following a Single Line	_____
B. Laboratory	_____
Trainees practice sketching an ISO from a plan view. This laboratory corresponds to Performance Task 2.	
Sessions XV through XIX. Drawing ISOs	
A. Drawing ISOs	_____
B. Laboratory	_____
Trainees practice calculating a total line length from an ISO. This laboratory corresponds to Performance Task 1.	
Session XX. Review and Testing	
A. 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 presents various piping offsets: three-line, 45-degree, equal spread offsets around a vessel, and three-line, 45-degree, unequal offsets. It also covers how to fabricate tank coils; three, four, and five-piece mitered turns; 45-degree laterals using both references; and contour markers, dummy legs out of both pipe and structural steel, and mitering procedures.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Module 08401-07.*

OBJECTIVES

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

1. Calculate simple piping offsets.
2. Calculate three-line, 45-degree, equal-spread offsets around a vessel.
3. Calculate three-line, 45-degree, unequal-spread offsets.
4. Fabricate tank heating coils.
5. Perform mitering procedures.
6. Lay out three- and four-piece mitered turns.
7. Lay out 45-degree laterals, using references or a calculator.
8. Fabricate dummy legs and trunions out of pipe, using references.
9. Perform geometric layout of pipe laterals and supports.
10. Lay out and fabricate a fishmouth.
11. Lay out and fabricate a wye.

PERFORMANCE TASKS

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

1. Solve a simple piping offset.
2. Calculate a three-line, 45-degree, equal-spread offset.
3. Calculate a three-line, 45-degree, unequal-spread offset.
4. Calculate and lay out a tank coil.
5. Lay out and fabricate a three-piece mitered turn, degree to be determined by the instructor.
6. Lay out and fabricate a four-piece, 90-degree, mitered turn.
7. Lay out and fabricate a 45-degree lateral, using reference charts.
8. Lay out and fabricate a type 1 pipe support.
9. Lay out a 45-degree lateral by performing geometric layout.
10. Lay out and fabricate a fishmouth.
11. Lay out and fabricate a wye.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Pipe vises
Transparencies	Portable grinders
Blank acetate sheets	Scientific calculators
Transparency pens	Soapstones
Whiteboard/chalkboard	Tape measure
Markers/chalk	Torpedo levels
Pencils and scratch paper	Wraparounds
Appropriate personal protective equipment	Ruler
14-inch half-round bastard files	T-square
24-inch spirit levels	45-degree right triangle
Angle iron	Compass
Ball-peen hammers	Dividers
Center punches	3-, 4-, 6-, and 8-inch, carbon steel, schedule 40 pipe
Channel lock pliers	Butt weld elbows
Combination tri squares	Horseshoe
Contour markers	PVC pipe and fittings
Framing squares	PVC cement and application tools
Hacksaws	Quick Quiz*
Jack stands	Module Examinations**
Oxyacetylene cutting equipment	Performance Profile Sheets**
<i>Pipe Fitters Blue Book</i>	

* Located in the back of this module

**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 that trainees fabricate pipe. Ensure all trainees are briefed on fire safety. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.sosmath.com/trig/trig.html

www.analyzemath.com/trigonometry.html

www.counon.org/alevel/pure/purtuttri.htm

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 50 hours are suggested to cover *Advanced 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. Introduction and Calculating Simple Offsets	
A. Introduction	_____
B. Determining Pipe Offsets	_____
C. Laboratory	_____
Trainees practice solving a simple piping offset. This laboratory corresponds to Performance Task 1.	
Sessions II and III. Calculating Three-Line Offsets I	
A. Calculating Three-Line, 45-Degree, Equal-Spread Offsets	_____
B. Laboratory	_____
Trainees practice calculating three-line, 45-degree, equal-spread offsets. This laboratory corresponds to Performance Task 2.	
Sessions IV and V. Calculating Three-Line Offsets II	
A. Calculating Three-Line, 45-Degree, Unequal-Spread Offsets	_____
B. Laboratory	_____
Trainees practice calculating three-line, 45-degree, unequal-spread offsets. This laboratory corresponds to Performance Task 3.	
Sessions VI and VII. Laying Out and Fabricating Tank Heating Coils	
A. Laying Out and Fabricating Tank Heating Coils	_____
B. Laboratory	_____
Trainees practice laying out and fabricating tank heating coils. This laboratory corresponds to Performance Task 4.	
Sessions VIII and IX. Fabricating Miter Turns I	
A. Laying Out Ordinate Lines	_____
B. Laying Out Cutback Lines	_____
C. Laying Out Mitered Turns	_____
D. Laying Out and Fabricating Three-Piece Mitered Turns	_____
E. Laboratory	_____
Trainees practice laying out and fabricating a three-piece mitered turn. This laboratory corresponds to Performance Task 5.	
Sessions X and XI. Fabricating Mitered Turns II	
A. Laying Out and Fabricating Four-Piece Mitered Turns	_____
B. Laboratory	_____
Trainees practice laying out and fabricating a four-piece mitered turn. This laboratory corresponds to Performance Task 6.	

Sessions XII and XIII. Fabricating Mitered Turns III

- A. Laying Out Miters Using a Horseshoe
- B. Mitering a Wye
- C. Laboratory

Trainees practice laying out and fabricating a wye. This laboratory corresponds to Performance Task 11.

Session XIV. Fishmouth

- A. Laying Out and Fabricating a Fishmouth
- B. Laboratory

Trainees practice laying out and fabricating a fishmouth. This laboratory corresponds to Performance Task 10.

Session XV and XVI. Fabricating Using Charts

- A. Determining Lateral Dimensions
- B. Laboratory

Trainees practice laying out and fabricating a 45-degree lateral using reference charts. This laboratory corresponds to Performance Task 7.

- C. Fabricating Dummy Legs and Trunions Out of Pipe

Session XVII and XVIII. Performing Geometric Layout

- A. Laying Out Laterals
- B. Laboratory

Trainees practice laying out a 45-degree lateral by performing geometric layout. This laboratory corresponds to Performance Task 9.

Session XIX. Pipe Supports

- A. Laying Out Pipe Supports
- B. Laboratory

Trainees practice laying out and fabricating a type 1 pipe support. This laboratory corresponds to Performance Task 8.

Session XX. Review and Testing

- A. 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 thermal expansion methods of stress-relieving, including preheating, interpass heating, and postheating. It also shows how to perform stress-relief and dry washing weld procedures to align pipe flanges to equipment nozzles.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four*, Modules 08401-07 and 08402-07.

OBJECTIVES

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

1. Explain thermal expansion, anchors, and cold springing.
2. Explain stress-relief procedures.
3. Explain grouting.
4. Explain types of misalignment.
5. Align pipe flanges to rotating equipment nozzles.

PERFORMANCE TASKS

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

1. Identify three methods used to stress-relieve welds.
2. Indicate the area of a pipe that needs to be stress-relieved.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Rosebud torch
Transparencies	Soapstones
Blank acetate sheets	Tape measure
Transparency pens	Torque wrenches
Whiteboard/chalkboard	Welding machine
Markers/chalk	Temperature indicating crayons
Pencils and scratch paper	Heating tips
Appropriate personal protective equipment	Portable preheating torches
Flanged nuts and bolts	Pyrometer
Flange gaskets	Thermocouple devices
Flanged piping spools to align	Temperature-sensitive indicators
Dial indicators	Quick Quiz*
Feeler gauges	Module Examinations**
Oxyacetylene heating equipment	Performance Profile Sheets**
Portable grinders	

* Located in the back of this module

** 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 that trainees work with oxyacetylene heating equipment and torches. Ensure that all trainees are briefed on equipment and fire safety. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.

Welding Trainee Guide, Contren® Learning Series, Prentice Hall, 2003.

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 *Stress Relieving and Aligning*. 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. Thermal Expansion and Stress Relief	
A. Introduction	_____
B. Thermal Expansion	_____
C. Laboratory	_____
Trainees practice indicating the area of a pipe that needs to be stress-relieved. This laboratory corresponds to Performance Task 2.	
D. Performing Stress Relief	_____
Session II. Stress Relief Methods	
A. Measuring Temperatures	_____
B. Interpass Temperature	_____
C. Postheating	_____
D. Laboratory	_____
Trainees practice identifying three methods used to stress-relieve welds. This laboratory corresponds to Performance Task 1.	
Session III. Aligning Pipe	
A. Aligning Pipe to Rotating Equipment	_____
B. Laboratory	_____
Trainees practice aligning pipe to rotating equipment.	
C. Aligning Pipe Flanges to Equipment Nozzles	_____
D. Laboratory	_____
Trainees practice aligning pipe flanges to equipment nozzles.	

Session IV. Review and Testing

A. 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.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module identifies types of steam traps, including mechanical, thermostatic, and thermodynamic. It explains how to install steam traps and troubleshoot steam trap systems.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Modules 08401-07 through 08403-07.*

OBJECTIVES

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

1. Identify types of steam traps.
2. Install steam traps.
3. Troubleshoot steam trap systems.

PERFORMANCE TASKS

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

1. Identify the different types of steam traps.
2. Install steam traps.
3. Identify specific problems and corrective actions required for faulty steam traps.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Sample steam traps
Transparencies	Manufacturer's instructions for steam trap installation
Blank acetate sheets	Pyrometer
Transparency pens	Ultrasonic tester
Whiteboard/chalkboard	Quick Quiz*
Markers/chalk	Module Examinations**
Pencils and scratch paper	Performance Profile Sheets**
Appropriate personal protective equipment	

* Located in the back of this module

**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 that trainees install and troubleshoot steam traps. Ensure all trainees are briefed on equipment and hot hazard safety. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.

Armstrong Steam Conservation Guidelines for Condensate Drainage, Armstrong Steam Specialty Products, Three Rivers, MI 49093, (616) 273-1415.

Design of Fluid Systems, Steam Utilization, Spirax Sarco Inc., P.O. Box 119, Allentown, PA 18105, (610) 797-5830.

Velan Steam Traps, www.velansteamtraps.com

www.yarway.com/literature.asp

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 *Steam Traps*. 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. Types of Steam Traps	
A. Introduction	_____
B. Mechanical Steam Traps	_____
C. Thermostatic Steam Traps	_____
D. Thermodynamic Steam Traps	_____
E. Strainers	_____
F. Laboratory	_____
Trainees practice identifying different types of steam traps. This laboratory corresponds to Performance Task 1.	
Session II. Steam Trap Installation	
A. Steam Trap Installation	_____
B. Laboratory	_____
Trainees practice installing steam traps. This laboratory corresponds to Performance Task 2.	
Session III. Troubleshooting and Maintaining Steam Traps	
A. Diagnostic Methods	_____
B. Maintaining Steam Traps	_____
C. Laboratory	_____
Trainees practice identifying specific problems and corrective actions required for faulty steam traps. This laboratory corresponds to Performance Task 3.	

Session IV. Review and Testing

A. 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 a variety of in-line specialties and their uses. It explains how to store and handle them, and discusses potential hazards that pipefitters need to be aware of.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Modules 08401-07 through 08404-07.*

OBJECTIVES

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

1. Identify the potential hazards associated with in-line specialties.
2. Identify in-line specialties.
3. Explain how to store and handle in-line specialties.

PERFORMANCE TASKS

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

1. Identify a number of specialties, at the discretion of the 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

Samples of in-line specialty equipment

Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module

** 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 may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.yarway.com/literature.asp

www.spiraxsarco.com/resources/steam-engineering-tutorials.asp

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 *In-Line Specialties*. 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. Safety and Types of In-Line Specialties I	
A. Introduction	_____
B. Safety and Potential Hazards	_____
C. Snubbers	_____
D. Ball Joints	_____
E. Bleed Rings	_____
F. Drip Legs	_____
Session II. Types of In-Line Specialties II	
A. Expansion Joints	_____
B. Filters	_____
C. Flowmeters	_____
D. Level Measurement Devices	_____
E. Flow Pressure Switches	_____
Session III. Types of In-Line Specialties III, Storage, and Handling	
A. Rupture Discs	_____
B. Thermowells	_____
C. Desuperheaters	_____
D. Laboratory	_____
Trainees practice identifying in-line specialties. This laboratory corresponds to Performance Task 1.	
E. Storage and Handling In-Line Specialties	_____

Session IV. Review and Testing

A. 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.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains how to assemble flared and compression joints using copper tubing, how to solder and braze joints using copper tubing, and how to bend pipe to a specified radius. It also explains how to install glass-lined pipe, hydraulic fitted compression joints, and grooved pipe couplings.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Modules 08401-07 through 08405-07.*

OBJECTIVES

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

1. Install flared and compression joints, using copper tubing.
2. Solder and braze joints, using copper tubing.
3. Bend pipe to a specified radius.
4. Install glass-lined pipe.
5. Explain how to install hydraulic fitted compression joints.
6. Install grooved pipe couplings.

PERFORMANCE TASKS

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

1. Install flared fittings using copper tubing.
2. Install compression fittings using copper tubing.
3. Solder copper tubing joints.
4. Braze copper tubing joints.
5. Bend pipe or tubing to a specified radius.
6. Install grooved pipe couplings.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Schedule 40, carbon steel pipe
Transparencies	Schedule 40, carbon steel pipe with grooved ends
Blank acetate sheets	Glass-lined flanged piping
Transparency pens	Sample tubing bends
Whiteboard/chalkboard	Flared joints
Markers/chalk	Compression joints
Pencils and scratch paper	Flared fittings
Appropriate personal protective equipment	Solder
Samples of copper tubing	Soldering flux
1-inch, light walled pipe	Protractor
2-inch, schedule 40 pipe	Straightedges
Type K copper tubing	Combination tri squares
Type L copper tubing	Framing squares

continued

Indelible marking pens	Oxyacetylene heating torch
Tape measures	Pipe cutter
Soapstones	Pipe vise
Spark lighters	Propane bottle torch
Antiseize compound	Rigid pipe mule
Brazing filler metals	Harp knives
Brazing fluxes	Small chisels
Emory cloths	Teflon [®] envelope gaskets
Machinist's blue layout fluid	Teflon [®] gasket shims
No. 00 steel wool	Lokring [®] Loktool
Torpedo levels	Lokring [®] NO GO gauge
Hydraulic and manual pipe bending tools	Lokring [®] Tritool pipe facing tool
Hydraulic ram pipe bender	Lokring [®] compression fittings
Ball-peen hammers	Lokring [®] Locquic N primer
Belt sander with 80-grit paper	Lokring [®] Loctite sealant
Channel-lock pliers	Victaulic power grooving machine
Crescent wrenches	Victaulic flexible grooved pipe couplings
Torque wrenches	Victaulic gaskets
Tubing cutters	Victaulic rigid grooved pipe couplings
Hammer-type flaring tool	Quick Quiz*
Crew-in type flaring tools	Module Examinations**
Jack stands	Performance Profile Sheets**
Light peen hammers	

* Located in the back of this module

** 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 torches and soldering equipment. Ensure that all trainees are properly briefed on equipment use and fire safety procedures. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.

Victaulic Field Assembly and Installation Instruction Pocket Handbook I-100, Victaulic Company of America, P.O. Box 31, Easton, PA 18044-0031, (610) 559-3300.

LP-101 or LP-105 Installation Procedure for Lokring Type 316/316 L Fittings, Lokring Corporation, 396 Hatch Drive, Foster City, CA 94404, (415) 578-9999.

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 *Special Piping*. 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. Installing Flared and Compression Joints Using Copper Tubing	
A. Introduction	_____
B. Flared Compression Methods	_____
C. Fittings	_____
D. Installing Flared Fittings	_____
E. Laboratory Trainees practice installing flared fittings. This laboratory corresponds to Performance Task 1.	_____
F. Installing Compression Fittings	_____
G. Laboratory Trainees practice installing compression fittings. This laboratory corresponds to Performance Task 2.	_____
Sessions III and IV. Soldering and Brazing Copper Tubing and Fittings	
A. Soldering Copper Tubing and Fittings	_____
B. Laboratory Trainees practice soldering copper tubing joints. This laboratory corresponds to Performance Task 3.	_____
C. Brazing Copper Tubing and Fittings	_____
D. Laboratory Trainees practice brazing copper tubing joints. This laboratory corresponds to Performance Task 4.	_____
Sessions V and VI. Pipe Bends	
A. Calculating Pipe Bends	_____
B. Laying out Bends	_____
C. Methods of Bending Pipe	_____
D. Laboratory Trainees practice bending pipe or tubing to a specified radius. This laboratory corresponds to Performance Task 5.	_____
Session VII. Installing Glass-Lined Piping	
A. Removing and Installing Glass-Lined Piping	_____
B. Performing Preventive Maintenance on Glass-Lined Piping	_____
Session VIII. Hydraulic Fitted Compression Joints	
A. Lokring® Hydraulic Compression System	_____
B. Installing Lokring® Fittings	_____

Session IX. Grooved Piping Systems

- A. Preparing Pipe Ends
- B. Selecting Gaskets
- C. Installing Grooved Pipe Couplings
- D. Laboratory

Trainees practice installing grooved pipe couplings. This laboratory corresponds to Performance Task 6.

Session X. Review and Testing

- A. 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.

Annotated Instructor's Guide**MODULE OVERVIEW**

This module explains hot tap safety and potential hazards, how to identify and install the fittings used with hot taps, and how to operate a hot tap machine. It also covers how to identify and understand the different types of stopples.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four* Modules 08401-07 through 08406-07.

OBJECTIVES

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

1. Explain hot tap safety and potential hazards.
2. Identify fittings used with hot taps.
3. Explain the use of hot tap machines.
4. Identify and explain the use of stopples.

PERFORMANCE TASKS

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

1. Identify mechanical joint stops and fittings.
2. Identify bolt-weld stops and fittings.
3. Identify split tee fittings.

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

Channel-lock pliers

Combination wrenches

Flange, full port gate valves

Gaskets

Hand-operated hot tap machine

Sharp knives

Soapstones

Socket sets

Tape measures

Various types of stopples

Welding equipment

Bolt-weld fittings

Carbon steel pipe to match fittings

Mechanical joint fittings

Split tee fittings

Weld-neck flanges

Plastic pipe

Pipe caps

Water

Quick Quiz*

Module Examinations**

Performance Profile Sheets**

* Located in the back of this module

**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 hot tap equipment. Ensure that all trainees are properly briefed on equipment use and hand tool safety procedures. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.

www.midwestpiperepair.com/page2.html

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 *Hot Taps*. 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. Safety and Mechanical Fittings	
A. Introduction	_____
B. Hot Tap Safety and Potential Hazards	_____
C. Installing Mechanical Joint Fittings	_____
D. Laboratory	_____
Trainees practice identifying mechanical joint stops and fittings. This laboratory corresponds to Performance Task 1.	
Session II. Other Fittings	
A. Installing Bolt-Weld Fittings	_____
B. Laboratory	_____
Trainees practice identifying bolt-weld stops and fittings. This laboratory corresponds to Performance Task 2.	
C. Installing Split Tee Fittings	_____
D. Laboratory	_____
Trainees practice identifying split tee fittings. This laboratory corresponds to Performance Task 3.	
Session III. Operating Hot Tap Machines and Stopples	
A. Hand-Operated Hot Tap Machines	_____
B. Power-Operated Hot Tap Machines	_____
C. New Technologies in Hot Tap Machines	_____
D. Line Stop Plugs	_____

Session IV. Review and Testing

A. 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 how to remove threaded and flanged valves, how to replace valve stem O-ring and bonnet gaskets, and how to repack a valve stuffing box. It also discusses the purpose of valve packing.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Modules 08401-07 through 08407-07.*

OBJECTIVES

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

1. Remove and install threaded valves.
2. Remove and install flanged valves.
3. Replace valve stem O-rings.
4. Replace bonnet gaskets.
5. Explain the purpose of valve packing.
6. Explain or demonstrate how to repack a valve.

PERFORMANCE TASKS

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

1. Demonstrate how to remove and install threaded valves.
2. Remove and install flanged valves.
3. Replace valve stem O-rings.
4. Replace bonnet gaskets.
5. Demonstrate repacking a valve.

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Pipe cutters
Transparencies	Pipe threaders
Blank acetate sheets	Pipe vises
Transparency pens	Pipe wrenches
Whiteboard/chalkboard	Putty knives
Markers/chalk	Sharp knives
Pencils and scratch paper	Tape measure
Appropriate personal protective equipment	Torque wrenches
Assorted screwdrivers	Tri squares
Channel-lock pliers	Valve O-rings
Combination wrenches	Valve packing removal tools
Drift pins	Antiseize compound
Hacksaws	Bonnet gaskets
Levels	Carbon steel pipe to match valve sizes

continued

Flange gaskets
 Flanged valves in a small system
 Pipe joint compound
 Thread cutting oil
 Threaded pipe unions
 Threaded valves in a small system

Valve packing
 Valves that contain O-rings
 Quick Quiz*
 Module Examinations**
 Performance Profile Sheets**

* Located in the back of this module

** 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 valves. Ensure that all trainees are properly briefed on equipment use and hand tool safety procedures. This module may require that the trainees visit job sites. Ensure that trainees are briefed on site safety policies prior to any site visits.

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.

www.dezurikwater.com/basic_valves_instruction_index.htm

www.valmatic.com/manuals.jsp

www.velan.com/products/index.htm

www.acipco.com

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 *Maintaining 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
Session I. Removing and Installing Valves	
A. Introduction	_____
B. Removing and Installing Threaded Valves	_____
C. Laboratory	_____
Trainees practice removing and installing threaded valves. This laboratory corresponds to Performance Task 1.	
D. Removing and Installing Flanged Valves	_____
E. Laboratory	_____
Trainees practice removing and installing flanged valves. This laboratory corresponds to Performance Task 2.	
F. Troubleshooting Valves	_____

Session II. Valve Stem O-Rings and Bonnet Gaskets

A. Types of O-Rings

B. Replacing Valve Stem O-Rings

C. Laboratory

Trainees practice replacing valve stem O-rings. This laboratory corresponds to Performance Task 3.

B. Replacing Bonnet Gaskets

C. Laboratory

Trainees practice replacing bonnet gaskets. This laboratory corresponds to Performance Task 4.

Session III. Repacking Valves

A. Packing Shapes and Materials

B. Repacking Valves

C. Laboratory

Trainees practice repacking valves. This laboratory corresponds to Performance Task 5.

Session IV. Review and Testing

A. 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 covers the basic skills required for supervising personnel, including diversity, project organization, problem solving, and safety.

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; Pipefitting Level Two; Pipefitting Level Three; and Pipefitting Level Four, Modules 08401-07 through 08408-07.*

OBJECTIVES

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

1. Explain the importance of training for construction industry personnel.
2. Identify the gender and minority issues associated with a changing workforce.
3. Describe what employers can do to prevent workplace discrimination.
4. Describe the four major categories of construction projects.
5. Describe the difference between formal and informal organizations, as well as the difference between authority and responsibility.
6. Explain the purpose and content of a job description and a policy/procedure document.
7. List the characteristics and behavior of effective leaders, as well as the different leadership styles.
8. Explain the difference between problem solving and decision making.
9. Describe strategies for reducing absenteeism and turnover.
10. Explain the duties of a crew leader in enforcing safety on the job.

PERFORMANCE TASKS

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

MATERIALS AND EQUIPMENT LIST

Overhead projector and screen	Personnel chart from a local company
Transparencies	Company sexual harassment policy
Blank acetate sheets	Equal opportunity guidelines from an employer handbook
Transparency pens	Company policies and procedures manual
Whiteboard/chalkboard	Quick Quiz*
Markers/chalk	Module Examinations**
Pencils and scratch paper	
Appropriate personal protective equipment	

*Located in the back of this module

**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.

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.

- American Medical Association (AMA), www.ama-assn.org
- American Society for Training and Development (ASTD), www.astd.org
- Architecture, Engineering, and Construction Industry (AEC), www.aecinfo.com
- Bureau of Labor Statistics, www.bls.gov
- CIT Group, www.citgroup.com
- Contren® Management Learning Series, www.nccer.org
- Equal Employment Opportunity Commission (EEOC), www.eeoc.gov
- Jamestown Area Labor Management Committee (JALMC), www.jalmc.com
- Knowledge Center's Manager's Toolkit, www.knowledgecenters.versaware.com
- National Association of Women in Construction (NAWIC), www.nawic.org
- National Center for Construction Education and Research (NCCER), www.nccer.org
- National Institute of Occupational Safety and Health (NIOSH), www.cdc.gov/niosh
- National Safety Council, www.nsc.org
- Occupational Safety and Health Administration, www.osha.gov
- Society for Human Resources Management (SHRM), www.shrm.org
- United States Census Bureau, www.census.gov
- United States Department of Labor, www.dol.gov

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 *Introduction to Supervisory Roles*. 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 to Supervision	
A. Introduction	_____
B. The Construction Industry Today	_____
C. Gender and Minority Issues	_____
Session II. Leadership	
A. Construction Projects	_____
B. The Construction Organization	_____
C. Becoming a Leader	_____
D. Problem Solving and Decision Making	_____
Session III. Safety Responsibilities, Review, and Testing	
A. Safety Responsibilities	_____
B. Review	_____
C. 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.	