Pipefitting Level Two

Course Planning Tools
Overview

Piping systems vary widely in materials, components, and procedures. The systems are subject to specific standards, depending on the materials being transported and the context of the system. Color codes warn personnel of the safety requirements for piping systems. Expansion of pipe materials due to heating and cooling is a factor in the design of pipe systems. Insulation serves several purposes in piping systems, including preventing flow interruption by freezing or liquefaction, and protecting personnel from injury.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify and describe various piping systems and their applications.

a. Describe chemical piping systems.
b. Describe compressed air piping systems.
c. Describe fuel oil piping systems.
d. Describe steam and water piping systems.
e. Explain how to visually identify piping systems.
f. Explain how thermal expansion affects piping and how it is addressed.
g. State the purposes of pipe insulation.

Performance Tasks

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

Recommended Teaching Time: 5.0 hours
Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08201
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
Drawings and Detail Sheets

Pipefitting

Overview

Drawings are the instructions for pipefitters. Site plans show where all of the runs are on the job site; line lists and specifications tell the particular material, connections, and fittings for each run of pipe. Notes convey specific information on some aspect that cannot be derived from the drawing itself, and the elevations and sections show how everything goes together. Pipefitters must be able to read, understand, and communicate what is detailed on various types of drawings, and they must be able to create sketches for use in the field. Each type of drawing has a different purpose and functionality; the Piping & Instrumentation Drawing (P&ID) is key to the work of pipefitters because it describes each component needed for pipeline installation and maintenance.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe the use of drawings and detail sheets in the pipefitting environment.

a. Identify the common parts of drawings.
b. Identify various types of drawings.
c. Explain how to create field sketches.

Learning Objective 2

Successful completion of this module prepares trainees to:
Explain how to read and interpret P&IDs and piping arrangement drawings.

a. Explain the purpose of a mechanical symbology page in a set of drawings.
b. Explain the purpose of the instrumentation symbology page in a set of drawings.
c. Describe the components covered in the general arrangement pages of a set of drawings.

Learning Objective 3

Successful completion of this module prepares trainees to:
Explain how to read and interpret isometric drawings.

   a. Define isometrics and what they portray in a set of drawings.
   b. Explain the components of spool drawings and their purpose.
   c. Describe vessel or unit drawings and how they are used by pipefitters.

**Performance Tasks**

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

**Recommended Teaching Time:** 15.0 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
• PowerPoint® Presentations for Module 08202
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations
• Additional Resources
  • Appropriate PPE as directed by the instructor or training facility provider
• Drawing set that includes the following components:
  ◦ Title block
  ◦ Scales and measurements
  ◦ Symbols and abbreviations
  ◦ Notes
  ◦ Revision blocks
  ◦ Coordinates
  ◦ Drawing set that includes an index and line lists
• Drawing set(s) that includes the following drawing types:
  ◦ Plot plan
  ◦ Structural drawings
  ◦ Elevation and section drawings
  ◦ Equipment arrangement drawings
  ◦ P&IDs
  ◦ Isometric drawings
  ◦ Spool drawings
  ◦ Pipe support drawings and detail sheets
  ◦ Orthographic drawings
• An isometric drawing of an object, such as the isometric views shown in Figure 17 and Figure 18
• A floor plan showing a piping route, marked with elevation dimensions
Overview

Valves are the steering wheels, brakes, and switches of pipe systems. Some valves function as on-and-off flow controls, while others regulate the amount of flow. Some divert flow from one direction to another. The selection and proper installation of valves is a critical pipefitting skill. To install and use valves properly, it is essential to understand the function of the valve and its characteristics, such as linings and part interactions. Each has advantages and limitations with which pipefitters must be familiar.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe valves that start and stop flow.

a. Identify and describe gate valves.
b. Identify and describe ball valves.
c. Identify and describe plug valves.

Learning Objective 2

Successful completion of this module prepares trainees to:
Identify and describe valves that regulate flow.

a. Identify and describe globe valves.
b. Identify and describe butterfly valves.
c. Identify and describe diaphragm and needle valves.

Learning Objective 3

Successful completion of this module prepares trainees to:
Identify and describe valves that regulate flow direction or relieve pressure.
a. Identify and describe valves that regulate flow direction.
b. Identify and describe valves that relieve pressure.

Learning Objective 4

Successful completion of this module prepares trainees to:
Identify and describe common valve operators and actuators.

a. Identify and describe gear operators.
b. Identify and describe chain operators.
c. Identify and describe pneumatic and hydraulic actuators.
d. Identify and describe electric actuators.

Learning Objective 5

Successful completion of this module prepares trainees to:
Describe how valves are marked, selected, and installed.

a. Describe valve markings and nameplate data.
b. Describe the valve selection process.
c. Describe how valves are handled and installed.
d. Explain how to remove and install threaded and flanged valves.

Performance Tasks

1. Identify valves that start and stop flow.
2. Identify valve actuators.
3. Identify valves that regulate flow.
4. Identify valves that regulate the direction of flow.
5. Identify valves that relieve pressure.
6. Given a select number of valves, match each valve to its given application.
7. Interpret valve markings and nameplate information.
8. Install a bolted valve from the following list:
   • Gate
   • Ball
   • Plug
- Globe
- Butterfly
- Diaphragm
- Needle
- Check
- Safety

Recommended Teaching Time: 20.0 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08203
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- Additional Resources
- Appropriate PPE as directed by the instructor or training facility provider
- A selection of valves and components, or photos thereof, that represent the following categories:
  - Valves that start and stop flow
  - Valve actuators
  - Valves that regulate flow
  - Valves that control the direction of flow
  - Pressure relief valves
- A selection of valves, or photos thereof, that represent the following categories:
  - Valves that start and stop flow
  - Valves that regulate flow
  - Valves that control the direction of flow
  - Pressure relief valves
- A selection of valves with clear and readable markings and/or nameplates with ratings, trim, and size information
- One or more bolted valve types from the following list:
  - Gate
◦ Ball
◦ Plug
◦ Globe
◦ Butterfly
◦ Diaphragm
◦ Needle
◦ Check
◦ Safety

• Drift pins
• Torque wrenches
• Common hand tools
• Chain fall or similar rigging equipment (if rigging is required)
• Flange hardware
• Flange gaskets
• Mounting point in a piping system with flanges matching the chosen valve(s)
Pipefitting Trade Math

Overview
Pipefitters use math every day to make decisions about connections. Basic geometric equations show the relationships between the figures that are seen, such as those involving area and volume. Mathematical relationships between the sides of triangles, for example, are used in determining the unknown length of a pipe. Understanding the properties of circles and cylinders directly relates to the configuration and arrangement of pipes. Rectangles and rectangular solids are tools for understanding machine pads and tanks. With an understanding of the basics outlined in this module, a number of pipefitting tasks are made easier.

Learning Objective 1
Successful completion of this module prepares trainees to:
Use special measuring devices and tables to determine mathematical values.

a. Use architects’ and engineers’ scales for measurement.
b. Use tables to determine mathematical values.

Learning Objective 2
Successful completion of this module prepares trainees to:
Use mathematical formulas to calculate geometric and trigonometric values.

a. Describe and evaluate formulas.
b. Use formulas to calculate area.
c. Use formulas to calculate volume.
d. Use formulas to calculate circumference.
e. Use the Pythagorean theorem to calculate right triangle line lengths.

Performance Tasks
This is a knowledge-based module; there are no Performance Tasks.
Recommended Teaching Time: 15.0 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08204
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
Threaded Pipe Fabrication

Pipefitting

Overview

Every pipefitter must be able to install threaded pipe in accordance with job requirements and specifications. Threaded connections are relatively inexpensive to fabricate and are a common way to join pipe. Threaded piping systems vary greatly based on the variety of materials used for the job, so pipefitters must understand appropriate processes and procedures for each. From reading and interpreting drawings to making up the pipe and fittings, threaded pipe fabrication calls for careful attention to details of materials selection and measurement.

Learning Objective 1

Successful completion of this module prepares trainees to:

Identify and describe threaded-pipe materials and fittings.

a. Identify and describe pipe threads.
b. Identify and describe pipe materials suitable for threading.
c. Identify and describe threaded pipe fittings.
d. Identify threaded-pipe materials and connections from drawings and specifications.

Learning Objective 2

Successful completion of this module prepares trainees to:

Explain how to measure, thread, and assemble threaded piping systems.

a. Explain how to measure intermediate pipe lengths.
b. Explain how to calculate offsets.
c. Explain how to thread pipe.
d. Identify various threaded-joint compounds.
e. Explain how to assemble threaded piping systems.
Performance Tasks

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.
8. Calculate the travel of a rolling offset.
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.

Recommended Teaching Time: 15 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 08205
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations
• Additional Resources
• Appropriate PPE as directed by the instructor or training facility provider
• Drawings that include details of threaded joints
• Drawing or sketch showing two ells connected by a piece of threaded pipe, with center-to-center dimensions and pipe size shown
• Drawing or sketch showing a tee or ell connected to a threaded flange with pipe, with center-to-face dimensions and pipe size shown
• Drawing or sketch showing two flanges connected by a piece of threaded pipe, with face-to-face dimensions and pipe size shown
• Threaded fitting makeup charts
• Calculators
• Appropriate PPE as directed by the instructor or training facility provider
• Drawing(s) or sketch(es) of a 45-degree offset, showing the chosen length of travel
• Calculators
• Appropriate PPE as directed by the instructor or training facility provider
• Drawing(s) or sketch(es) of an offset, showing the chosen length of set and the elbow angles
• Tables of elbow constants (Table 5 in the Trainee Guide for common angles)
• Calculators
• Drawing(s) or sketch(es) of an offset, showing the chosen length for various sides and the elbow angle
• Tables of offset multipliers (Table 6 in the Trainee Guide for common angles)
• Calculators
• Appropriate PPE as directed by the instructor or training facility provider
• Drawing(s) or sketch(es) of a rolling offset, showing the chosen distance of the roll, the height of the offset, and the elbow angle
• Tables of constants for common angles (Table 7 in the Trainee Guide for common angles)
• Pipefitter’s or framing squares
• Yardsticks
• Calculators
• Sufficient pipe for practice and Performance Tasks (1/2” to 1” pipe recommended)
• Threaded valves to fit the chosen pipe size
• Various fittings, such as ells and tees, to fit the chosen pipe size
• Manual pipe threading kits with the correct die for the chosen pipe size
• Cutting oil sump and hand pump
• Cutting oil
• Power threaders with the correct die heads for the chosen pipe size
• Nipple chucks for power threaders (optional)
• Pipe tripod vises
• Pipe stands (for longer lengths of pipe)
• Hand reamers
• Pipe cutters
• Pipe wrenches
• Common hand tools
• Pipe joint compound
Socket Weld Pipe Fabrication

Overview

Socket weld piping is quick and relatively easy to fit properly. Since it is welded together at the end, remember to measure twice and cut once, as it is better to do the fit only once. The pipefitter establishes the correct alignment between all of the parts, including the expansion gap inside the socket. The welder tack-welds the assembly for the pipefitter in places where tacks are requested, and the pipefitter aligns the openings and pipes correctly. Symbols are used to denote specific types of connections in piping systems; these are used in conjunction with math applications for determining pipe lengths between fittings and preparing and aligning pipe and fittings.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe socket welded pipe materials and fittings.

a. Identify and describe pipe materials suitable for socket welding.
b. Identify and describe socket weld pipe fittings.
c. Identify socket weld pipe materials and connections from drawings and specifications.

Learning Objective 2

Successful completion of this module prepares trainees to:
Explain how to measure and fit socket weld piping systems.

a. Explain how to measure pipe lengths using the various measurement methods.
b. Explain how to fit socket weld piping systems
c. Explain how to cut out a socket weld to save the fitting, pipe, or valve.

Performance Tasks

1. Identify various socket weld fittings.
2. Interpret a socket weld drawing.
3. Demonstrate how to cut out a socket weld to save the fitting, pipe, or valve.
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 a 90-degree elbow to the end of a pipe.
8. Square a pipe into a 90-degree elbow.
9. Align a flange to the end of a pipe.
10. Align a 45-degree elbow to the end of a pipe
11. Align pipes joined by a coupling.
12. Describe how to prep and install a valve.

Recommended Teaching Time: 15 hours

**Classroom Equipment and Materials**

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08101
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- Appropriate PPE as directed by the instructor or training facility provider
- Drawing(s) showing a run of socket-welded pipe with various fittings depicted
- A variety of socket-weld pipe fittings, ideally including a sockolet, elbolet, and latrolet
- Sections of pipe with one or more socket-welded fittings or valves in place
- Portable bandsaws and suitable blades
- Right-angle grinders with cut-off wheels
- Pipe vises
- Ball peen or light, short sledge hammers
- Soapstone or permanent markers
- Drawing or sketch showing two socket-weld ells connected by a piece of pipe, with center-to-center dimensions and pipe size shown
- Drawing or sketch showing a socket-weld tee or ell connected to a socket-weld flange with pipe, with center-to-face dimensions and pipe size shown
• Drawing or sketch showing two socket-weld flanges connected by a piece of pipe, with face-to-face dimensions and pipe size shown
• Socket-weld fitting makeup chart or table (Table 3 in the Trainee Guide for common pipe sizes and fitting weights)
• Calculators
• Sections of the chosen pipe size
• 90- and 45-degree socket-weld elbows to fit the chosen pipe size
• Socket-weld flanges to fit the chosen pipe size
• Socket-weld couplings to fit the chosen pipe size
• Pipe vises
• Right-angle grinders and grinding wheels
• Portable band saws and suitable blades
• Levels
• Pipefitter’s or framing squares
• Ball peen hammers
• Soapstone or permanent markers
• Welding equipment and consumables suitable for the pipe in use
• Qualified welder
• Sections of the chosen pipe size
• Socket-weld valves to fit the chosen pipe size
• Pipe vises
• Portable band saws and suitable blades
• Pipefitter’s or framing squares
Butt Weld Pipe Fabrication

Overview

Most large, aboveground, industrial piping systems are crafted through a combination of butt welds and bolt-ups. The oil, chemical, and power industries require pipefitters who are skilled with these tasks. Butt welding is more difficult than socket welding because alignment of the pipe ends is critical. The right tools and jigs are central to getting the alignment correct for the first tack, and for determining and adjusting for small differences in the actual shapes and sizes of pipes and fittings. With this and other types of welds, the craftsmanship of the pipefitter relates directly to that of the welder: if the first isn’t right, the second won’t be either. But where pipefitting precision comes into play, welding and completion of the pipeline are both set up for efficient operations.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify and describe butt weld pipe materials and fittings.

a. Identify and describe pipe materials suitable for butt welding.
b. Identify and describe butt weld pipe fittings.
c. Identify butt weld materials and connections from drawings and specifications.

Learning Objective 2

Successful completion of this module prepares trainees to:
Explain how to measure and prepare pipe components for butt welding.

a. Explain how to determine the takeout for various butt weld fittings.
b. Explain how to determine the pipe length between butt weld fittings.
c. Explain how to bevel pipe for butt welding.
d. Explain how to clean pipe with a grinder prior to welding.
Learning Objective 3

Successful completion of this module prepares trainees to:

Identify and describe how to use various tools to align piping components for welding.

a. Identify and describe how to use alignment jigs and clamps.
b. Explain how to align piping components for welding.
c. Explain how to cut out a butt weld to save the fitting, pipe, or valve.

Performance Tasks

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

Recommended Teaching Time: 37.5 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08207
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations
• Additional Resources
• Appropriate PPE as directed by the instructor or training facility provider
• Drawing(s) showing a run of butt-welded pipe with various fittings depicted
• A variety of butt-weld pipe fittings
• Sections of pipe with unbeveled ends
• Portable band saw (to cut off beveled ends)
• Right-angle grinders with appropriate grinding wheels
• Pipe vises
• Sections of pipe with one or more butt-welded fittings or valves in place
• Portable bandsaws and suitable blades
• Right-angle grinders with cut-off wheels
• Pipe vises
• Ball peen or light, short sledge hammers
• Soapstone or permanent markers
• Drawing or sketch showing two butt-weld ells connected by a piece of pipe, with center-to-center dimensions and pipe size shown
• Drawing or sketch showing a butt-weld tee or ell connected to a butt-weld flange with pipe, with center-to-face dimensions and pipe size shown
• Drawing or sketch showing two butt-weld flanges connected by a piece of pipe, with face-to-face dimensions and pipe size shown
• Socket-weld fitting makeup chart or table (Table 3 in the Trainee Guide for common pipe sizes and fitting weights)
• Table or chart showing essential butt-weld fitting dimensions (Figure 17 in the Trainee Guide may be sufficient)
• Calculators
• Sections of the chosen pipe size
• 90- and 45-degree butt-weld elbows to fit the chosen pipe size
• Butt-weld flanges to fit the chosen pipe size
• Backing rings to fit the chosen pipe size.
• Pipe vises
• Jack stands (optional, depending on pipe size and length)
• Right-angle grinders and grinding wheels
• Portable band saws and suitable blades
• Levels
• Pipefitter’s or framing squares
• Ball peen hammers
• Soapstone or permanent markers
• Welding equipment and consumables suitable for the pipe in use
• Qualified welder
• Sections of the chosen pipe size
• Butt-weld valves to fit the chosen pipe size
• Pipe vises
• Portable band saws and suitable blades
• Pipefitter’s or framing squares
Overview

The two most dangerous environments for a pipefitter are those that require working at high elevations or at excavations. Recognizing hazards and how to address them with appropriate safety equipment and operating procedures helps reduce the risks associated with working below the ground. Pipefitters must know how to lay out the pipeline using the surveyor’s reference points, as well as how to use specialized equipment for getting the pipeline trenches to hold pipe in place. Identifying soil types and characteristics of each type, as well as understanding OSHA requirements for trenching safety are fundamental to working in or around excavations.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify the safety hazards of working in and around a trench.

a. Identify soil types and soil-related hazards.
b. Identify trench hazards and basic guidelines for working in and around trenches.

Learning Objective 2

Successful completion of this module prepares trainees to:
Describe the equipment and techniques used to maximize trench safety.

a. Identify and describe trench shoring systems.
b. Identify and describe trench shielding systems.
c. Identify and describe combined systems for trench reinforcement.
d. Describe sloping systems and slope requirements by soil type.

Learning Objective 3

Successful completion of this module prepares trainees to:
Explain how to set trench grade and elevation, then backfill a trench.
a. Explain how to set the trench grade using a string line.
b. Explain how to set the trench grade using laser levels.
c. Explain how to properly backfill a trench.

Performance Tasks

This is a knowledge-based module; there are no Performance Tasks.
Recommended Teaching Time: 10 hours

Classroom Equipment and Materials

• Whiteboard and markers
• Pencils and paper
• PowerPoint® Presentations for Module 08208
• A variety of standard marker sizes
• Poster board
• Flip chart
• LCD projector and screen
• Computer with Internet access
• Module Review answer key
• Module Examinations
Overview

Most municipal piping systems are underground and convey water, gas, oil, storm drain water, and sewage. Installing pipe for these systems is among the most dangerous of jobs for the pipefitter and for this reason, thorough safety training is the top priority. Also important is understanding the connection systems used underground and the ways in which they are assembled. New technologies involving trenchless pipelaying help reduce some risks, yet knowledge of traditional methods is still important. A range of pipefitting skills, combined with solid attention to safety, are the keys to meeting the challenges involved in serving entire communities with dependable piping systems.

Learning Objective 1

Successful completion of this module prepares trainees to:
Identify basic underground pipe installation guidelines.

- a. Identify guidelines for working in or near pipe trenches.
- b. Explain how to prepare a trench, the bedding material, and thrust blocks.
- c. Identify basic installation guidelines for laying pipe in trenches.
- d. Explain how trenchless pipelaying is accomplished.
- e. Explain how to properly store and handle underground piping materials.

Learning Objective 2

Successful completion of this module prepares trainees to:
Identify and describe how to join cast-iron and iron-alloy soil pipe.

- a. Identify common cast iron pipe sizes.
- b. Identify common cast iron pipe fittings.
- c. Describe how to cut cast iron pipe.
- d. Describe how to join and install bell-and-spigot cast iron pipe.
- e. Describe how to join and install hubless cast iron pipe.
f. Describe iron-alloy pipe and the common sizes available.

**Learning Objective 3**

*Successful completion of this module prepares trainees to:*
Identify and describe how to join ductile iron pipe.

   a. Identify common ductile iron pipe sizes and fittings.
   b. Describe how to cut ductile iron pipe.
   c. Describe how to join ductile iron pipe.

**Learning Objective 4**

*Successful completion of this module prepares trainees to:*
Identify and describe how to join concrete pipe.

   a. Identify common concrete pipe sizes.
   b. Describe how to join concrete pipe.

**Learning Objective 5**

*Successful completion of this module prepares trainees to:*
Identify and describe how to join carbon steel pipe.

   a. Identify carbon steel pipe sizes and weights.
   b. Describe how to join carbon steel pipe.

**Learning Objective 6**

*Successful completion of this module prepares trainees to:*
Identify and describe how to join fiberglass pipe.

   a. Identify common adhesives for fiberglass pipe.
   b. Describe how to join fiberglass pipe.
Learning Objective 7

Successful completion of this module prepares trainees to:
Identify and describe how to join plastic pipe.

a. Identify basic properties and types of plastic pipe.
b. Identify the advantages and disadvantages of using plastic pipe.
c. Identify plastic pipe sizes and labeling.
d. Identify various plastic pipe fittings.
e. Describe how to measure and cut plastic pipe.
f. Describe how to join plastic pipe.

Performance Tasks

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

Recommended Teaching Time: 20 hours

Classroom Equipment and Materials

- Whiteboard and markers
- Pencils and paper
- PowerPoint® Presentations for Module 08209
- A variety of standard marker sizes
- Poster board
- Flip chart
- LCD projector and screen
- Computer with Internet access
- Module Review answer key
- Module Examinations
- Appropriate PPE as directed by the instructor or training facility provider
- Sufficient stock of bell-and-spigot ductile iron pipe (4" to 8" recommended for economy and ease of handling)
- Hub gaskets for the chosen pipe size
- Gasket/pipe lubricant
- Two 1-ton chain hoists, each with 25 feet of chain and two choker slings for 4" to 24" pipe (optional)
• Abrasive wheel saws (gas or electric)
• Rotary wheel cutter for the chosen pipe size
• Right-angle grinders and grinding wheels
• Half-round files
• Tape measures
• Wraparounds
• Soapstone or permanent markers
• Common hand tools
• Sufficient stock of CPVC and PVC pipe
• CPVC and PVC fittings to fit the chosen pipe sizes
• CPVC and PVC cement
• CPVC and PVC primer/cleaning solvent
• Cutting tools appropriate for the selected pipe size, e.g. handsaws, abrasive blade saws, and miter boxes
• Pipe reamers for the chosen pipe size, OR
• Half-round files for larger pipe sizes
• Emery or sand cloth
• Tape measures
• Wraparounds
• Permanent markers
• Common hand tools