

## Lesson A3–16

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# Working with Galvanized Pipe

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**Unit A.** Mechanical Systems and Technology

**Problem Area 3.** Construction Systems

**Lesson 16.** Working with Galvanized Pipe

### **New Mexico Content Standard:**

**Pathway Strand:** Power, Structural and Technical Systems

**Standard: VIII:** Plan, implement, manage, and/or provide support services to facility design and construction; equipment design, manufacture, repair, and service; and agricultural technology.

**Benchmark: VIII-B:** Follow architectural and mechanical plans to construct building and facilities.

**Performance Standard:** 1. Identify and select appropriate building materials. 2. Install plumbing equipment and fixtures.

**Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

1. Describe how to select and purchase fittings and pipe.
2. Describe how to measure, mark, cut, ream, thread, and join pipe.

**List of Resources.** The following resources may be useful in teaching this lesson:

**Recommended Resources.** One of the following resources should be selected to accompany the lesson:

Black & Decker. *The Complete Guide to Home Plumbing*. Minnetonka, Minnesota: Creative Publishing, 1998.

Burkybile, Carl. *Designing, Installing, Maintaining, and Repairing Plumbing Systems*. University of Illinois: Information Technology & Communication Systems (U3056).

Herren, Ray V., and Elmer L. Cooper. *Agricultural Mechanics Fundamentals & Applications*. Albany, New York: Delmar Publishers, 2002. (Textbook, Chapter 35)

Hogan, Elizabeth L. *Basic Plumbing Illustrated*. Menlo Park, California: Sunset Publishing Corp., 1992.

Phipps, Lloyd J., et al. *Introduction to Agricultural Mechanics*, Second Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2004. (Textbook, Chapter 16)

**Other Resources.** The following resources will be useful to students and teachers:

Burke, Stanley R., and T.J. Wakeman. *Modern Agricultural Mechanics*. Danville, Illinois: Interstate Publishers, Inc., 1992. (Textbook, Chapter 16)

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters  
Copies of student lab sheet  
Galvanized pipe and fittings

**Terms.** The following terms are presented in this lesson (shown in bold italics):

Coupling  
Drainage fittings  
Galvanized pipe  
Pipe cap  
Pipe elbows  
Pipe nipples  
Pipe plug  
Pipe tees  
Power hacksaw  
Pressure fittings  
Reaming

Reducing bushing  
Reducing tee  
Street ells  
Union  
Wheel type pipe cutter

**Interest Approach.** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

*Show galvanized pipe and fittings along with the tools needed to measure, mark, cut, thread, and join the pipe. Determine the skill level of your students in these areas. Use the experienced students to assist in teaching the skills to the other students.*

## Summary of Content and Teaching Strategies

**Objective I:** Describe how to select and purchase fittings and pipe.

**Anticipated Problem:** What galvanized pipe and fittings are available?

- I. Steel and wrought iron are terms used interchangeably to refer to either black or galvanized pipe. **Galvanized pipe** is a zinc coated pipe that can be used for water supply and DWV lines and is less likely to rust and corrode than black pipe. Black pipe is recommended for oil, air, and gas lines.
  - A. Steel pipe is sold in three grades: standard, extra strong, and double extra strong. Standard weight, suitable for most plumbing, comes in 21 foot lengths. The size of the pipe is designated by its inside diameter. The actual inside diameter of a pipe, however, is slightly larger than its nominal or designated size. For example,  $\frac{3}{4}$  inch pipe measures slightly more than  $\frac{3}{4}$  inch in diameter. The most common sizes of iron pipe are  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , and 2 inches.
  - B. Iron pipe is joined by using threaded fittings. The fittings are sized by the size pipe that they fit on. **Drainage fittings** leave a smooth, unobstructed flow and can be used for air, gas, and water, as well as drainage lines. **Pressure fittings** create an offset so they are suitable for air, gas, and water, but not for drainage lines since they tend to clog. Pipe fittings come in a variety of shapes and sizes. **Pipe nipples** are short pieces of pipe threaded on both ends. A **coupling** is used to join two pieces of pipe together that you do not intend to disassemble. A **union** is a fitting that joins two pieces of pipe but can be unscrewed at any time. **Pipe elbows**, either 45 or 90 degree, have a piece of pipe threaded into both ends. **Street ells**, either 45 or 90 degree, have a piece of pipe threaded into one end and another fitting screwed onto the outside of the other end. **Pipe tees** allow three pieces of pipe to be threaded into them. A **reducing tee** allows a change in size from the input pipe to the output pipe. A **pipe cap** screws onto the outside of a pipe while a **pipe plug** screws

into a fitting. A **reducing bushing** used in connection with a fitting allows you to change sizes of pipe from the input to the output side. Other fittings such as the floor flange and pipe cross are available for special uses.

Use readings in the recommended textbooks to help students in understanding this topic. Show samples of galvanized pipe, pipe nipples, and pipe fittings. Use the samples and TM: A3-16A and TM: A3-16B to learn identify the materials.

**Objective 2:** Describe how to measure, mark, cut, ream, thread, and join pipe.

**Anticipated Problem:** How is galvanized pipe measured, marked, cut, reamed, threaded, and joined?

- II. Careful planning will result in fewer joints, fewer fittings, less expense, and less work. Remember that the size of a pipe fitting is determined by the size of pipe it will fit. Also remember that the size of wrought iron pipe is determined by measuring the inside diameter.
  - A. When measuring pipe length before cutting, take the total length needed, minus the length of the fittings, plus the distance the pipe is to be screwed into the standard fittings.
  - B. Pencil or chalk marks on steel pipe should be considered only rough, temporary marks, because they may be rubbed off easily. Use a three-cornered file or scratch awl to make a permanent mark on the pipe prior to cutting.
  - C. To cut the pipe, first secure the pipe in a pipe vise. The pipe may be cut with a hand hacksaw. Moderate pressure should be applied on the blade while using long, moderately slow strokes. Release the pressure on the backstroke. Select a hacksaw blade that has two or more teeth in contact with the pipe at all times (18, 24, or 32 teeth per inch). Keep the blade stretched tight in the saw frame and take care to keep the saw cutting square with the pipe.
  - D. A **power hacksaw** is not only easier to use than a hand hacksaw, but also more likely to result in square cuts. Power hacksaws offer the advantage of a built-in vise to secure the pipe while it is being cut.
  - E. A **wheel type pipe cutter**, probably the best way to cut pipe, has two guide wheels and one cutting wheel that is tightened against the pipe as the cutter is rotated around the pipe. Continue tightening as the cutter is rotated until the pipe is cut in two. The pipe cutter leaves a smoother end on the pipe than a hacksaw does, but forms a burr inside that must be reamed out.
  - F. **Reaming** is the process of removing raised places or burrs from the inside of a pipe that reduces the inside diameter of the pipe. Reamers are available to be used with a brace, as a T-handle reamer, or as a ratchet reamer.
  - G. To thread pipe, first grind a slight taper on the end of the pipe and then clamp the pipe securely in a vise. Place the correct size pipe guide and die into the pipe threader. Position the threader on the pipe, guide end first. Apply uniform pressure and turn the threader slowly. As soon as the threader begins to cut into the pipe, apply thread cutting

oil. Do not turn the die back and forth when cutting threads or the threads may be chipped. Continue to turn the threader onto the pipe until about one thread projects through the die. Before removing the pipe threader, tap the cuttings from the die or blow them out with compressed air.

- H. Now that threading is completed, the pipe and fittings can be joined. To prevent leaks, use a pipe compound or Teflon tape on the pipe threads. Pipe compound may be purchased as a pipe stick or as a paste in a can with a brush attached to the lid. Thick paint might be suitable for permanent installation. Pipe compound or Teflon tape would be better choices when the pipework might need to be disassembled later. Once the joint sealer is applied, screw the pipe and fitting together by hand. When you can no longer turn them by hand, use two pipe wrenches, one to hold the pipe and one to turn the fitting to finish the job.

*Have students read the suggested chapters in the recommended textbooks. They contain good introductory information on the content associated with this objective. Use TM: A3–16C to illustrate the measuring, marking, cutting, reaming, and threading of galvanized pipe. Demonstrate the techniques and have the students use LS: A3–16A to do the skills.*

**Review/Summary.** Review the galvanized pipe fittings. Review the measuring, marking, cutting, reaming, threading, and joining of galvanized steel pipe using the transparencies.

**Application.** Using LS: A3–16A: Measure, mark, cut, ream, thread, and join galvanized pipe.

**Evaluation.** Take the written test and evaluate the skills demonstrated on the lab sheet exercises.

## Answers to Sample Test:

### Part One: Matching

1 = d, 2 = g, 3 = c, 4 = k, 5 = h, 6 = e, 7 = j, 8 = f, 9 = b, 10 = i, 11 = a, 12 = l

### Part Two: Completion

1. triangular file, scratch awl
2. hacksaw
3. wheel type pipe cutter, reamed
4. guide
5. one
6. inside
7. rust or corrode

**Part Three: Short Answer**

1. Determine the total length needed. Subtract the length of the two fittings and add the length of the pipe that will thread into the fittings.
2. Seal pipe threads with pipe compound, Teflon tape, and thick paint.

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# Test

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## Lesson A3–16: Working with Galvanized Pipe

### Part One: Matching

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- |                     |                     |
|---------------------|---------------------|
| a. coupling         | g. pipe plug        |
| b. drainage fitting | h. pipe tee         |
| c. elbow            | i. pressure fitting |
| d. pipe cap         | j. reducing bushing |
| e. pipe cross       | k. street ell       |
| f. pipe nipple      | l. union            |

- \_\_\_\_\_ 1. Fitting that screws onto the outside of a pipe to seal it.
- \_\_\_\_\_ 2. Fitting that screws into the inside of a pipe fitting to seal it.
- \_\_\_\_\_ 3. Fitting in a 45 or 90 degree angle that pipe screws into both ends.
- \_\_\_\_\_ 4. Fitting in a 45 or 90 degree angle that screws onto a fitting at one end and a pipe screws into the fitting on the other end.
- \_\_\_\_\_ 5. Fitting that allows three pipes to screw into it.
- \_\_\_\_\_ 6. Fitting that allows four pipes to screw into it.
- \_\_\_\_\_ 7. Fitting used to change from one pipe size to another.
- \_\_\_\_\_ 8. Short piece of pipe threaded on both ends.
- \_\_\_\_\_ 9. Fitting that leaves a smooth, unobstructed flow and can be used for air, gas, water, and drain lines.
- \_\_\_\_\_ 10. Fitting that creates an offset so that it is suitable for air, gas, and water, but would tend to clog if used with a drain line.
- \_\_\_\_\_ 11. Fitting used to joint two pieces of pipe together in a straight line that you do not intend to disassemble.
- \_\_\_\_\_ 12. Fitting used to joint two piece of pipe together in a straight line that you can easily disconnect.

## **Part Two: Completion**

*Instructions.* Provide the word or words to complete the following statements.

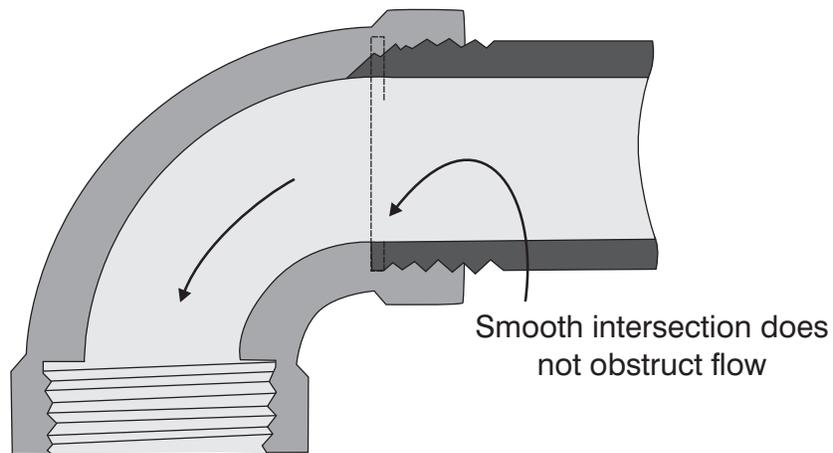
1. Mark pipe with a \_\_\_\_\_ or \_\_\_\_\_.
2. Using a power \_\_\_\_\_ to cut pipe has the advantage of a built-in vise.
3. Cutting with a \_\_\_\_\_ leaves a burr on the inside that must be \_\_\_\_\_ out.
4. To thread pipe, place the threader \_\_\_\_\_ end first onto the pipe.
5. When threading pipe, thread until \_\_\_\_\_ thread comes through the threader.
6. The size of galvanized steel pipe is by the \_\_\_\_\_ (inside or outside) diameter of the pipe.
7. Galvanized, rather than black pipe, should be used for water lines because it is less likely to \_\_\_\_\_.

## **Part Three: Short Answer**

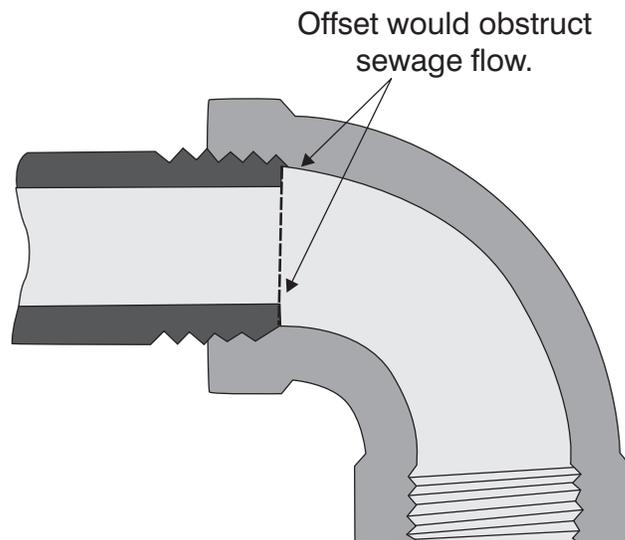
*Instructions.* Provide information to answer the following questions.

1. Describe how the correct length to cut a piece of pipe with two fittings screwed onto it would be determined: (use the back of this test sheet)
2. What materials could be used on threads to seal pipe fittings?

# COMPARING DRAINAGE AND PRESSURE FITTINGS



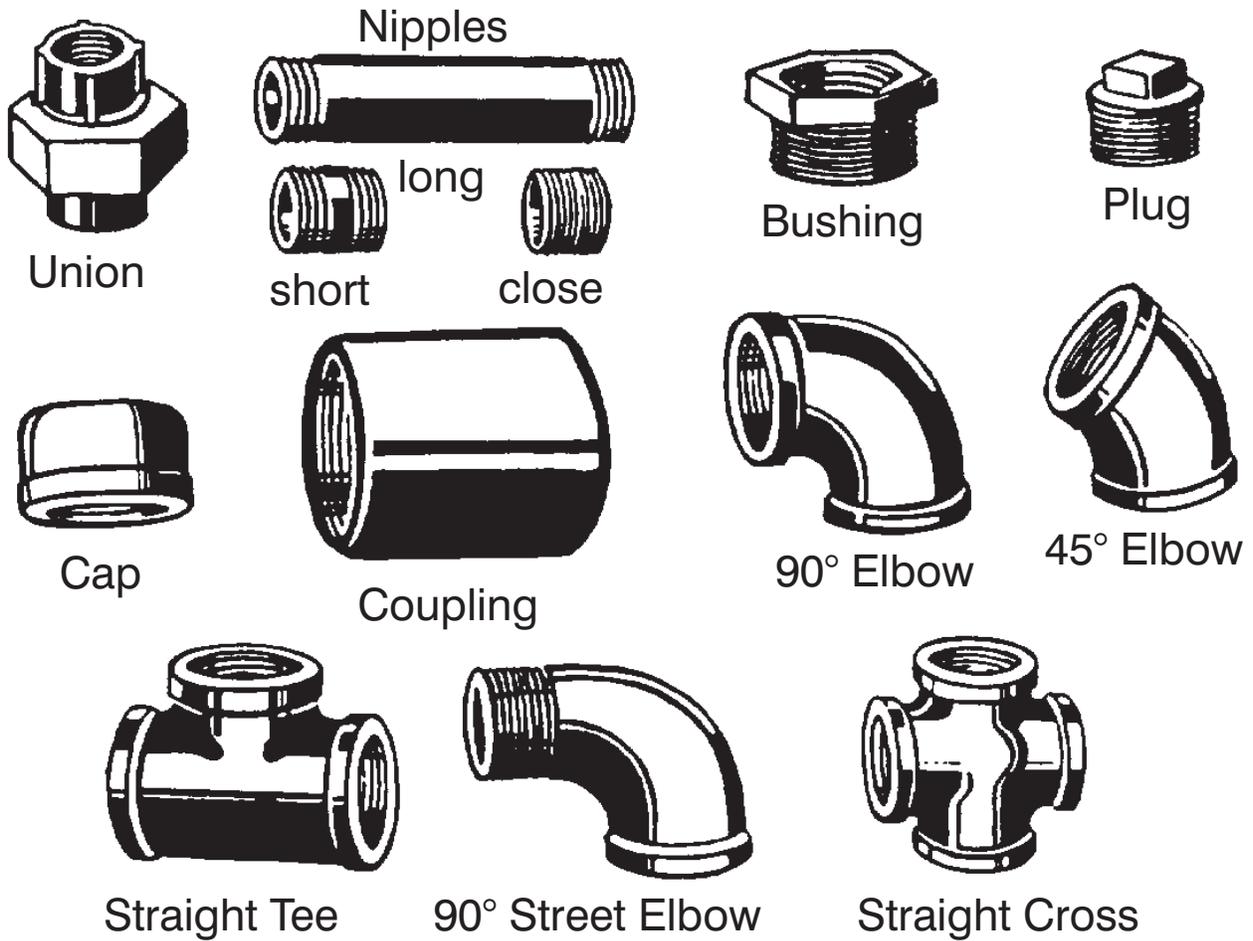
**Drainage fitting**



**Pressure fitting**

*(Courtesy, Interstate Publishers, Inc.)*

# COMMON GALVANIZED PIPE FITTINGS



*(Courtesy, Interstate Publishers, Inc.)*

# MEASURING, MARKING, CUTTING, REAMING, AND THREADING GALVANIZED PIPE

## Measuring and Marking

### DISTANCE PIPE IS SCREWED INTO STANDARD FITTINGS

Pipe Size	Distance
1/2"	1/2"
3/4"	1/2"
1"	5/8"
1 1/4"	5/8"
1 1/2"	5/8"
2"	3/4"

Pipe length + Fitting length –  
pipe threaded into the fitting.

## Cutting, Reaming, and Threading



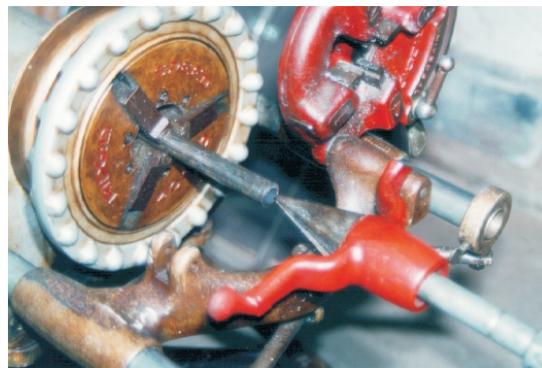
Using a wheel type pipe cutter.



End of cut pipe showing a burr.



Using a ratchet pipe threader.



Using a power reamer to remove a burr.

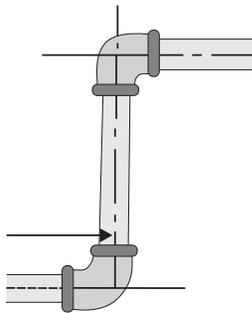
(Courtesy, Interstate Publishers, Inc.)

# Lab Sheet

## Measure, Mark, Cut, Ream, Thread, and Join Galvanized Steel Pipe

**Materials:**

- 1' of 1/2" galvanized pipe
- 1 1/2" coupling
- 1 1/2" 90° elbow
- Teflon tape
- Pipe compound



**DISTANCE PIPE IS SCREWED INTO STANDARD FITTINGS**

PIPE SIZE	DISTANCE
1/2"	1/2"
3/4"	1/2"
1"	5/8"
1 1/4"	5/8"
1 1/2"	5/8"
2"	3/4"

Check as completed:

- \_\_\_\_\_ 1. Measure the pipe so that when tightened into the elbow and coupling the total length will be 10 inch.
- \_\_\_\_\_ 2. Mark the pipe with a scratch awl or three-cornered file
- \_\_\_\_\_ 3. Using the wheel type pipe cutter to cut the pipe
- \_\_\_\_\_ 4. Use the reamer available to ream the cut pipe
- \_\_\_\_\_ 5. Taper the outside of both ends of the pipe slightly on the grinding wheel
- \_\_\_\_\_ 6. Insert the 1/2' guide and die into the pipe threader
- \_\_\_\_\_ 7. Place the threader, guide end first, onto the pipe
- \_\_\_\_\_ 8. Thread the pipe until one thread comes through the die
- \_\_\_\_\_ 9. Use compressed air to blow out the filings prior to removing the threader
- \_\_\_\_\_ 10. Repeat steps 7–9 to thread the other end of the pipe
- \_\_\_\_\_ 11. Paint one threaded end with pipe compound, screw on the pipe, and tighten with two pipe wrenches
- \_\_\_\_\_ 12. Wrap the other end of the pipe with Teflon tape, thread on the elbow, and tighten with two pipe wrenches
- \_\_\_\_\_ 13. Measure the total length to see if the length is 10 inches