

## Lesson A3–18

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# Working with Plastic Pipe

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**Unit A.** Mechanical Systems and Technology

**Problem Area 3.** Construction Systems

**Lesson 18.** Working with Plastic 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. 8. Install glass, ridged plastic panels and/or film plastic.

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

1. Discuss how to select plastic pipe and fittings.
2. Discuss how to measure, mark, cut, and join plastic 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)

Hometime Video. *Plumbing*. Sponsored by Chevrolet Trucks.

**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  
Plastic pipe, fittings, tools, solvent, and glue

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

ABS (acrylonitrile-butadiene-styrene) plastic pipe  
Clamp-in fittings  
CPVC (chlorinated polyvinyl-chloride) plastic pipe  
Glue-on fittings  
Non-code pipe  
PE (polyethylene) plastic pipe  
Pressure-rated pipe  
PVC (polyvinyl-chloride) plastic pipe  
Schedule 40  
Screw-on fittings

**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.

*Especially for DWV piping, plastic pipe has become the most popular type of piping. Ask students if they can guess why (see Objective 1). Have a variety of plastic pipe and fittings on display. Briefly explain that working with plastic pipe is a set of skills that are easy to master.*

## Summary of Content and Teaching Strategies

**Objective 1:** Discuss how to select plastic pipe and fittings.

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

- I. The use of plastic pipe is growing rapidly. It will not rust, rot, or corrode. It is tough, sturdy, durable, resistant to chemical action, and light-weight. Plastic is low cost and the easiest of all piping materials to work with.
  - A. Plastic pipe may be flexible or semi-rigid. It is available in 100 foot coils or 10 and 20 foot lengths,  $\frac{3}{8}$  inch to 16 inches in diameter. Fittings are either clamped, screwed, or glued on.
  - B. Plastic pipe grades are schedule 40, pressure pipe, and non-code pipe. **Schedule 40** is plastic pipe manufactured to the same standard shapes and sizes as steel pipe with fittings to be used for DWV and some water lines. **Pressure-rated pipe** has the maximum pressure marked on it and is used for water lines. **Non-code pipe** is lightweight pipe used for septic tank leach fields and outside drainage pipe.
  - C. **PVC (polyvinyl-chloride) plastic pipe** is a semi-rigid type of plastic pipe with cemented fittings used primarily for pressure applications, such as for cold water and gas lines. **CPVC (chlorinated polyvinyl-chloride) plastic pipe** is a 100 psi rated pipe with threaded or cemented fittings. It is suitable for hot water. **ABS (acrylonitrile-butadiene-styrene) plastic pipe** is low cost cemented pipe that is popular as DWV piping. **PE (polyethylene) plastic pipe** is a flexible black pipe sold in 100 foot rolls. It is joined with slide-in compression fittings.
  - D. **Glue-on fittings**, including plugs, caps, elbows, street ells, couplings, reducers, drain flanges, Y (wyes), and sanitary tees, are glued to the outside of plastic pipe. **Screw-on fittings** are generally glued to the pipe on one side and screwed onto a fitting from the other side. Screw-on fittings usually have a compression ring to help make the seal. Compression fittings, sometimes called grip fittings, with compression rings are often used with sink drain traps. **Clamp-in fittings** are couplings, tees, and elbows that are made with ridges. They are slid into the pipe and clamps are tightened with a screwdriver or socket set to make the seal.

*Have the students read the suggested chapters in the recommended textbooks. They present good information on the content of this objective. Use the TM: A3–18A to show types of plastic pipe. Display samples and learn to identify the materials.*

**Objective 2:** Discuss how to measure, mark, cut, and join plastic pipe.

**Anticipated Problem:** How is plastic pipe measured, marked, cut, and joined?

- II. Plastic is the easiest of all piping to measure, mark, and cut.
  - A. When determining the lengths of plastic pipe needed, also consider the length of fittings. Be sure to add the length of the segment of pipe which fits into the socket of the plastic fitting. When joined, the pipe should seat firmly on the ridge inside the fitting.
  - B. After measuring lengths needed, mark with a permanent marker, scratch awl, or three-cornered file.
  - C. Plastic pipe can be cut with a wheel type pipe tuber, specialized cutters, fine-toothed hacksaw, miter saw, motorized miter saw, sabre saw, or sawsall. Whatever cutting technique is used, it is important to have squarely cut pipe that will fit fully into the socket of plastic fittings, forming leakproof joints.
  - D. After the pipe is cut, remove any burrs that are present on either the inside or outside of the pipe with a reamer, sandpaper, round file, or utility knife.
  - E. All plastic pipe except PE pipe can be joined with glue-on fittings. Match the cement to the pipe you are using. Plastic pipe-cleaning solvent, applied by the cotton swab attached to the can lid, is used to coat the outside of the pipe and the inside of the fitting, to clean and remove the gloss for better bonding. Some manufacturers suggest light sanding with fine sandpaper. Apply a light coat of cement to the inside of the fitting and a heavy coat of cement to the outside of the pipe. Immediately insert the pipe all the way into the fitting socket while turning it a quarter of a turn. The turning insures an even distribution of the cement. The joint should have a bead of cement completely around the fitting.
  - F. When screw-on fittings are used be sure the appropriate compression ring is inserted. Tighten the fitting with an adjustable wrench, channel lock pliers, or a pipe wrench. While the fitting must be tight to seal, overtightening can break the fitting. Screw together fittings are often found in “S” and “P” sink traps.
  - G. Clamp-in fittings have threads or ridges that help you to slide the fitting into the pipe. Radiator hose-type clamps are then used to fasten the fitting and pipe together. Double clamps are sometimes used for additional insurance against water leaks.

*Utilize assigned readings in the recommended resource texts. They contain good basic information on the content of this objective. Use TM: A3–18B to illustrate measuring, and cutting plastic pipe. Use TM: A3–18C to illustrate joining plastic pipe using the glue-on technique. Show the Hometime Plumbing video section on joining plastic pipe. Demonstrate the techniques illustrated on the transparencies and have the students use LS: A3–18A to demonstrate the skills.*

**Review/Summary.** Review the advantages of using plastic pipe. Use actual fittings or the transparency to review the identification of fittings. Discuss the techniques for measuring, marking, cutting, and joining plastic pipe.

**Application.** Use LS: A3–18A to measure, mark, cut, ream, and join (glue-on and clamp-in) plastic pipe.

**Evaluation.** Take the written test and evaluate the skills developed with the lab sheet.

## **Answers to Sample Test:**

### **Part One: Matching**

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

### **Part Two: Completion**

1. permanent marker, triangular file, or scratch awl
2. hacksaw, miter saw, sabre saw, or sawsall
3. round file, utility knife
4. pipe solvent
5. turn the pipe  $\frac{1}{4}$  of a turn
6. compression ring
7. radiator-type clamp

### **Part Three: Short Answer**

1. Plastic pipe will not rust, rot, or corrode. It is tough, sturdy, durable, resistant to chemical action, lightweight, low cost, and the easiest of all piping materials to work with.
2. Any five of the following are correct. Glue-on fittings include plugs, caps, elbows, street ells, couplings, reducers, drain flanges, Y (wyes), and sanitary tees.

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## Test

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### Lesson A3–18: Working with Plastic Pipe

#### Part One: Matching

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

- |                      |                           |
|----------------------|---------------------------|
| a. ABS pipe          | f. PE (polyethylene) pipe |
| b. clamp-in fittings | g. pressure-rated pipe    |
| c. CPVC pipe         | h. PVC pipe               |
| d. glue-on fittings  | i. schedule 40 pipe       |
| e. non-code pipe     | j. screw-on fittings      |

- \_\_\_\_\_ 1. Plastic pipe manufactured to the same standard shapes and sizes as steel pipe.
- \_\_\_\_\_ 2. Lightweight plastic pipe used for septic tank leach fields and outside drainage pipe.
- \_\_\_\_\_ 3. Flexible black pipe sold in 100 foot rolls.
- \_\_\_\_\_ 4. Semi-rigid type of plastic pipe with cemented fittings used primarily for pressure applications, such as for cold water and gas lines.
- \_\_\_\_\_ 5. Semi-rigid type of plastic pipe with 100 psi rating suitable for hot water lines.
- \_\_\_\_\_ 6. Fitting that slides into PE pipe and is tightened using radiator type clamps.
- \_\_\_\_\_ 7. Low cost cemented pipe that is popular as DWV piping.
- \_\_\_\_\_ 8. Threaded fitting that screws on.
- \_\_\_\_\_ 9. Fitting that is sealed to the pipe with cement.
- \_\_\_\_\_ 10. Pipe that has the maximum pressure marked on it and is used for water lines.

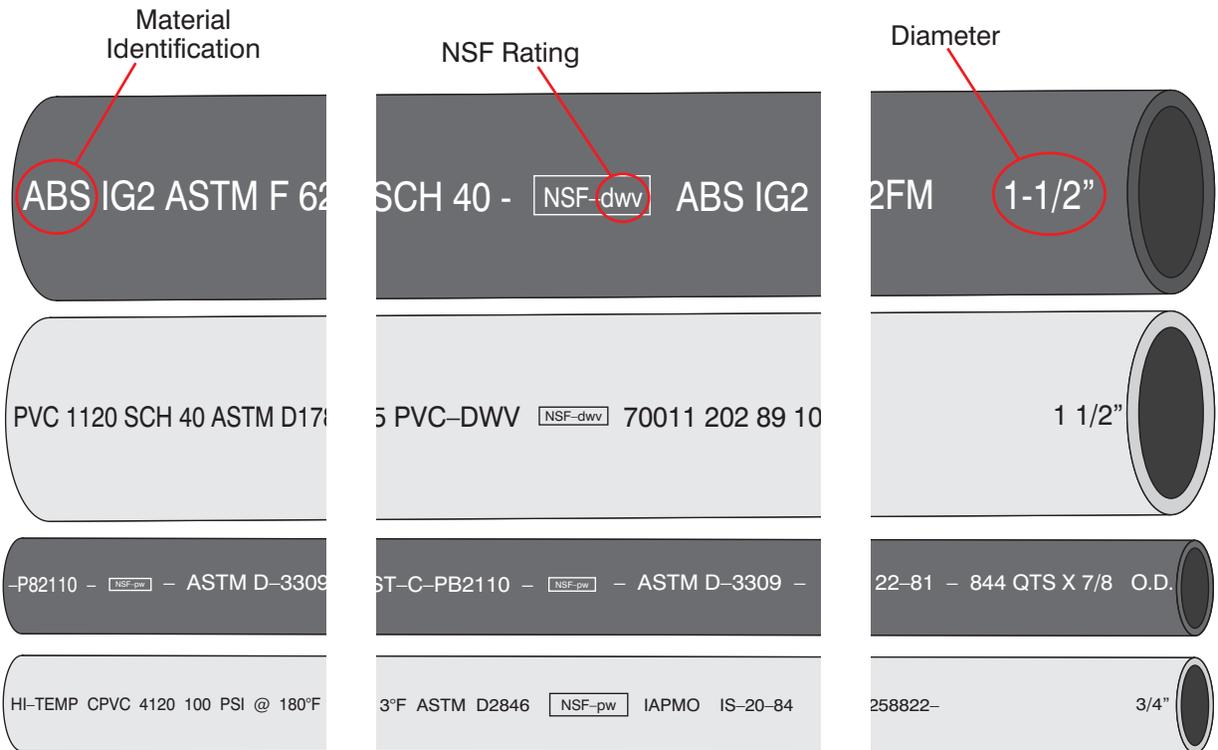
#### Part Two: Completion

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

1. Plastic pipe can be marked with a \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_.
2. Cut plastic pipe with a \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_.
3. Burrs from cutting can be removed with a \_\_\_\_\_ or \_\_\_\_\_.



# TYPES OF PLASTIC PIPE



**Material Identification:**  
For sink traps and drain pipes, use PVC or ABS pipe. For water supply pipes, use PB or CPVC pipe. PE is used for outdoor cold water supply.

**NSF Rating:** For sink traps and drains, choose PVC or ABS pipe that has a DWV (drain-waste-vent) rating from the National Sanitation Foundation (NSF). For water supply pipes, choose PB or CPVC pipe that has a PW (pressurized water) rating.

**Pipe diameter:** PVC and ABS pipes for drains usually have an inside diameter of 1/4" to 4". PB and CPVC pipes for water supply usually have an inside diameter of 1/2" or 3/4".

(Courtesy, Interstate Publishers, Inc.)

TM: A3-I8B

# MEASURING AND CUTTING PLASTIC PIPE



Marking the exact place to cut.



Cutting with cutters.

*(Courtesy, Interstate Publishers, Inc.)*

# JOINING PLASTIC PIPE



Use PVC cleaner inside the fitting and outside the pipe.



Coat the inside of the fitting and outside of the pipe with cement.



Insert the pipe into the fitting snugly and make a  $\frac{1}{4}$  turn.

*(Courtesy, Interstate Publishers, Inc.)*

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## Lab Sheet

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### Measuring, Marking, Cutting, Reaming, and Joining Plastic Pipe

**Materials:**

PVC ½ inch plastic pipe  
1½ inch PVC plastic pipe coupling  
1½ inch combination glue-on screw-on fitting  
1½ inch screw-on fitting  
PE plastic pipe  
1 clamp-in fitting with clamps  
... to match the size of the PE pipe available  
PVC pipe cleaner solvent  
PVC pipe cement  
Wiping cloth

**Tools:**

Hand hacksaw or hand miter box with backsaw  
Utility knife or round file  
Screwdriver or ¼ inch drive socket set

Check off as completed:

- \_\_\_\_\_ 1. Measure the PVC pipe to 8 inches and mark with a permanent marker.
- \_\_\_\_\_ 2. Place the plastic pipe in the miter box and cut to the line with the miter saw. (Use a hacksaw if the miter box is not available, being careful to cut the pipe square).
- \_\_\_\_\_ 3. Use the round file or utility knife to remove any burrs from the inside or outside of the pipe.
- \_\_\_\_\_ 4. Wipe the outside of the pipe with a clean cloth.
- \_\_\_\_\_ 5. Clean the outside of the pipe and the inside of the glue-on coupling with the PVC cleaner-solvent.
- \_\_\_\_\_ 6. Swab the outside end of the pipe cleaner and the inside of the end of the coupling with PVC cement.
- \_\_\_\_\_ 7. Insert the pipe into the fitting while giving the pipe a quarter of a turn.
- \_\_\_\_\_ 8. Repeat steps 5–7 with the combination glue-on screw-on fitting.

- \_\_\_\_\_ 9. Screw-on the plastic fitting.
- \_\_\_\_\_ 10. Measure and mark a piece of PE pipe at 6 inches.
- \_\_\_\_\_ 11. Cut the pipe with a hacksaw.
- \_\_\_\_\_ 12. Use the round file or utility knife to remove any burrs from the inside or outside of the pipe.
- \_\_\_\_\_ 13. Insert the clamp-in fitting into the pipe.
- \_\_\_\_\_ 14. Use the screwdriver or socket set to tighten the radiator-type clamp to seal the fitting.