

## Lesson 4: Measuring, Cutting, and Connecting Pipes

### Lesson 4: Measuring, Cutting, and Connecting Pipes

Plumbing nearly always involves measuring, cutting, and joining of pipe and tubing. This lesson will describe how to perform these essential tasks properly.

#### Measuring Pipe

Most of the pipe used in plumbing is rigid, so accurate measurements are essential for the pipe system to connect properly to outlets and appliances. The first factor to consider in measuring pipe is the distance from the water source to the desired outlet along the exact path that the pipe will take. Another consideration is the length of the pipe being installed. The distance from the source to the outlet is divided by the length of the pipe. For a measurement of 50 feet, for example, five 10-foot lengths of pipe seem appropriate. However, the fittings used to join the sections of pipe also must be considered; they increase the length of the system. The amount of increase is dependent on the size of fittings and any angles made by the fittings. The length of the pipes may have to be adjusted to account for the fittings.

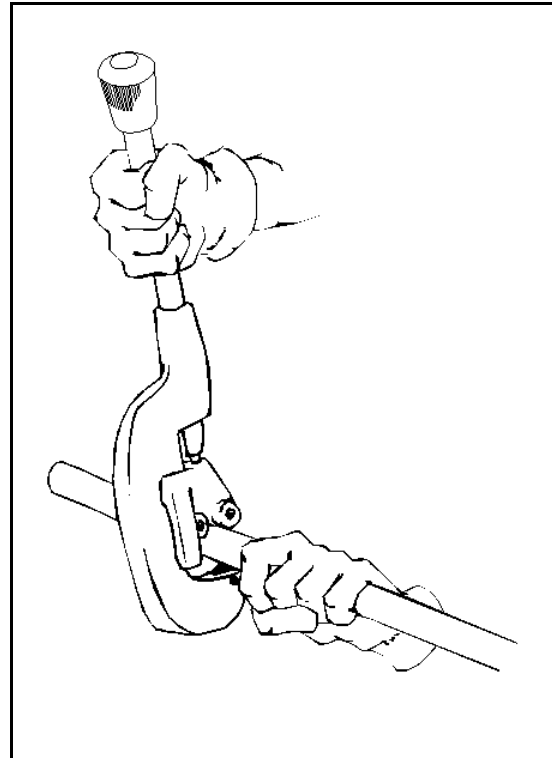
#### Cutting Pipe

Pipe may be cut easily with the proper tools. As discussed in Lesson 2, these tools consist of pipe cutters, which may be used with either plastic or copper pipe, and hacksaws for use on plastic pipes.

Pipes must be carefully measured before being cut. The pipe is measured with a tape measure or folding ruler. An allowance for the fittings must be made when determining the length of the pipe. The length to which the pipe will slide or screw into the fitting needs to be added to the length that will run between fittings. The point where the pipe should be cut is marked with a pencil; the marking should extend all the way around the pipe to make it easier to find. Because accurate measurements are necessary for correct installation of plumbing systems, measurements should be made to the nearest  $\frac{1}{32}$  of an inch regardless of the type of pipe used.

After the pipe has been measured, it can be cut.

To use the wheel-type cutters for copper pipe illustrated in Lesson 2, the cutter is opened by turning the handle until the pipe will fit between the wheel and roller. The pipe is placed in the base of the cutter and the handle is turned until the pipe touches the cutter wheel. The wheel is positioned on the point where the pipe is to be



cut, and the handle is turned to press the wheel into the pipe. The tool is rotated around the pipe once, and then the handle is tightened and the tool is rotated again. This process is repeated until the pipe is cut. Figure 4.1 shows a wheel-type cutter in use.

A hacksaw is used to cut plastic pipe. If possible, the pipe is first placed in a vise to hold it still. The hacksaw blade is positioned on the mark for cutting. The hacksaw is pulled backwards, placing no pressure on the pipe, and then the blade is brought forward with pressure exerted to cut into the pipe. While sawing, the saw should be held at a 90-degree angle to the pipe, resulting in a square cut. Excessive force should not be exerted on the pipe while cutting. The process is repeated until the pipe is sawn through completely.

## Plumbing

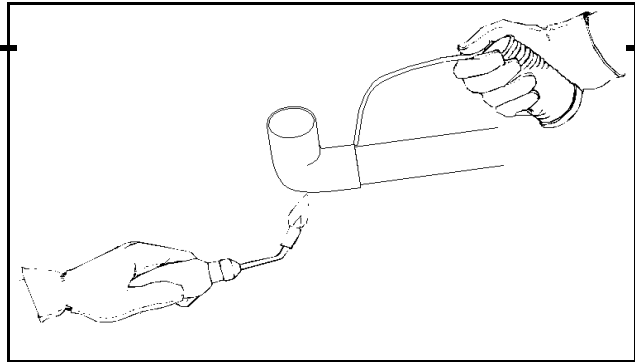
Any burrs, or sharp edges, and ridges left on the inside or outside of the pipe from cutting should be smoothed. With copper pipe, a small file, sandpaper, or a special reaming tool can be used; sandpaper or a knife is used for plastic pipe. Smoothing these cuts helps to insure a good watertight seal between the fitting and the pipe.

### Joining Pipe

Several different methods are available for joining pipe. As discussed in Lesson 2, plastic pipes are joined using cements. Copper pipes can be soldered together; copper tubing may also be joined using flare joints.

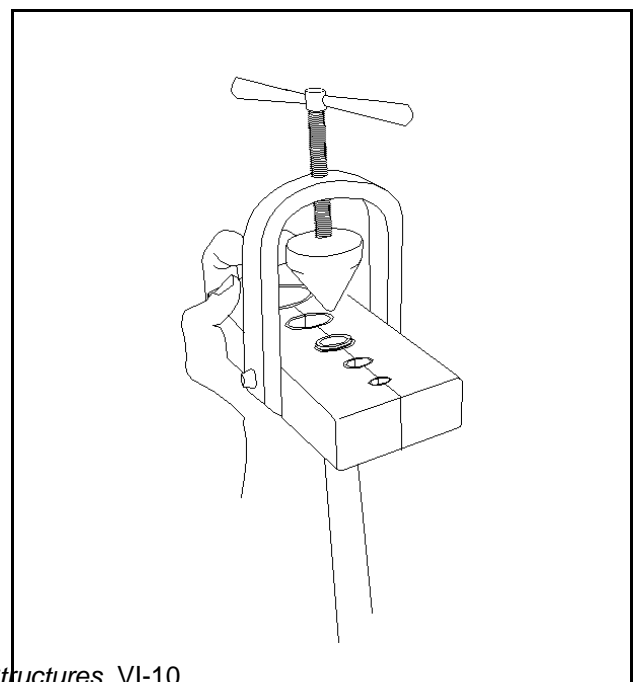
Joining plastic pipe using cements is a relatively easy process. The end of the pipe and the fitting must be smooth and clean. A chemical cleaner is the best way to clean this material. Once the fitting and pipe end are clean, they are covered with an even coating of cement on the pipe and fitting socket. This cement usually acts quickly, so the pieces need to be joined together immediately and firmly to make sure they are seated correctly. The pipe should be given a quarter turn to make sure it is seated securely. A solid and permanent joint will be created after the pipe and fitting are held together ten seconds to a minute. A line of cement should appear all the way around the joint, indicating that enough cement was used. Joints created using cement are very durable and solid, and any mistakes will have to be cut out, since separating the joint is not possible without destroying the pipe and fitting. The directions and recommendations for cements should always be read before they are used.

Copper pipe is generally joined by soldering copper fittings to the pipe. This procedure is simple, but doing it well requires practice. First, the end of the pipe and the fitting must be clean; Sometimes soldering cannot be used to join copper tubing because of the heat of the propane torch and the location of the pipes or because the joint should not be permanent. In such cases, flaring is used to join the tubing. Making a flare joint involves using special tools to make the end of the tubing flare outward to join the fitting. After the tubing has been cut, a flare nut is placed on the tubing. The pipe is flared using some type of flaring tool. One common type of flaring tool is a yoke and screw



very fine sandpaper or emery cloth works well. The copper should be shiny and free of any oils or dirt. The use of soldering material, which looks like heavy wire, is enhanced by a compound called flux that removes impurities. Flux may need to be placed on the pipe before soldering, although some types of solder contain a core of flux or acid that makes additional flux unnecessary. Since different kinds of solder have different compositions and recommended uses, the manufacturer's instructions should be read before the material is used. To solder, the fitting is placed on the pipe or tubing, and a propane torch is used to heat first the pipe and then the fitting around the entire joint until the solder melts when touching the joint. The solder is held to the rim of the fitting, as shown in Figure 4.2, and is drawn into the joint. The solder is applied around the joint until it is found around the entire rim of the fitting. The excess solder is wiped away while the pipe and fitting are still hot.

As the solder cools in the joint, it bonds the pipe and fitting like a metal weld, providing an excellent seal.



## *Lesson 4: Measuring, Cutting, and Connecting Pipes*

---

flaring tool (see Figure 4.3), used with different sizes of pipe. The tubing is placed in the correctly sized opening of a flaring block and secured in position with the end of the tubing extending above the block about  $\frac{1}{2}$  the depth of the block chamfer. The yoke of the flaring tool is placed over the block, with the compression cone centered over the tubing. The screw is tightened to form the flare between the block and the cone; the screw should not be turned too far, since the tubing may split. When the flare is finished, the fit of the flare is checked to the seat of the flare nut. The fitting is then placed against the flare, and the nut is tightened to hold it in place.

### **Summary**

Precise measurements of the distance between a water source and outlets, pipe, and fittings are necessary to determine the lengths of the pipes needed for a plumbing system. The next step is cutting the pipe to the appropriate length using the proper tools. When pipe has been cut,

smoothed, and cleaned, the pipes and fittings are joined using one of several methods, depending on the type of pipe. When properly installed, fittings should be durable and watertight.

### **Credits**

Annis, William H. *Basic Plumbing Skills*. Athens, Ga.: American Association for Vocational Instructional Materials (AAVIM), 1989.

Brunk, Art. *Building Maintenance*. Module III, *Plumbing*. University of Missouri-Columbia: Instructional Materials Laboratory, 1990.

McConnell, Charles. *Plumbers and Pipe Fitters Library*. Vol. 3, *Water Supply · Drainage · Calculations*. New York: Macmillan, 1989.

