

I. TIPS FOR THE BEGINNING PLUMBER

This chapter includes a variety of useful information. These facts that a plumber must know have been gleaned from years of plumbing experience. The apprentice (or even the journeyman) should find these tips useful.

Reading Blueprints

When a measurement is taken from a blueprint, it should be checked from both ends of the building to ensure accuracy.

Datum is an established level or elevation from which vertical measurements are taken. A *bench mark* (BM) is a measure on which all other elevations are based.

All buildings have a *base elevation* from which all other elevations and grades are determined. Some plans use 100.0 feet, while others use 0.00 feet.

For example, using 100.0 feet as the base level, a basement floor level of 91.5 feet would indicate a basement floor level that is 8 feet 6 inches below the first-floor level.

Bench marks permit the plumber to locate the elevations pertaining to the project at hand. A 96-foot or a 104-foot bench mark would indicate 4 feet below or 4 feet above the finish floor (FF). Examples of bench marks, thus, would include the following:

FF + 4.0 feet

FF - 2.0 feet

A *sectional elevation* drawing would provide the plumber with information as to the width and height of a specific portion of the structure.

Elevation measurements on piping plans are called *invert elevations*.

A figure in isometric position lies with one corner directly in front of you. The back corner is tilted to a 30° angle.

4 Chapter 1

A building plan may denote an invert elevation of 0.325 foot at one end of a pipeline and 0.400 foot at the opposite end—a difference of 0.75 foot. By multiplying 0.75 foot by 12, you will find that the difference in inches between the two points will be 9 inches (see Table 1-1).

Table 1-1 Converting Inches to Decimal Parts of a Foot

Inches	Parts of Foot	Inches	Parts of Foot
1	0.083	7	0.5833
2	0.1666	8	0.6667
3	0.25	9	0.75
4	0.333	10	0.8333
5	0.4167	11	0.9333
6	0.50	12	1.00

Shooting Grade Levels

Plumbers are often asked to set grade levels for various piping elevations, including catch basins, floor drains, and many other grade levels associated with their work. Therefore, it behooves every plumber and fitter to become familiar with this very important phase of the piping industry.

Two main parts to shooting grade levels are the dumpy level and the leveling rod.

The *dumpy level* (named after its inventor) is a surveyor's level with a short inverted telescope rigidly affixed. It rotates in a horizontal plane only. This level mounts onto a tripod.

The *leveling rod* is a graduated rod used in measuring the vertical distance between a point on the ground and the line of sight of a surveyor's level, or dumpy level. This rod is marked off in tenths and hundredths, and its scale is known as the *engineer's scale*.

Each foot on the leveling rod is divided into tenths and each tenth is divided into tenths (thus, 100 marks in all).

Every 10 marks have a number from 1 to 9; following each 9 will be the proper foot mark.

Always remember that each foot on the leveling rod equals 12 inches. Each tenth of this foot equals 1.2 inches. Each of the 100 marks contained in the engineer's foot equals 0.01 of a foot. The exception would be the leveling rods marked off in 0.02 of a foot. They have 5 marks to each tenth, 50 marks to each foot.

To determine inches from hundredths of a foot, you simply multiply by 12.

Fig. 1-1 shows a 1-foot section of a leveling rod marked off in 0.01 of a foot.

Note the arrow and where it is pointing (to 0.54 foot). Thus the calculation would be as follows:

$$\begin{array}{r} 0.54' \\ \times 12 \\ \hline 108 \\ 54 \\ \hline 6.48 \end{array} \text{ rounded to } 6\frac{1}{2}''$$

To convert decimal feet to inches, multiply by 12. You may then change decimal inches to inches and fractions.

Heating Systems

The compression tank plays an important part in the economical operation of a heating system. Heated water in the system expands. If no tank were installed, the expanding water would be forced out through the relief valve. In that case, cool water would be drawn in to replace the water lost by expansion.

Extra fuel is used to heat this cold water. Also, the constant adding of water brings in foreign matter (such as sediment or lime). This results in scaling of the boiler with an ever-increasing amount of fuel required for heating.

6 Chapter I

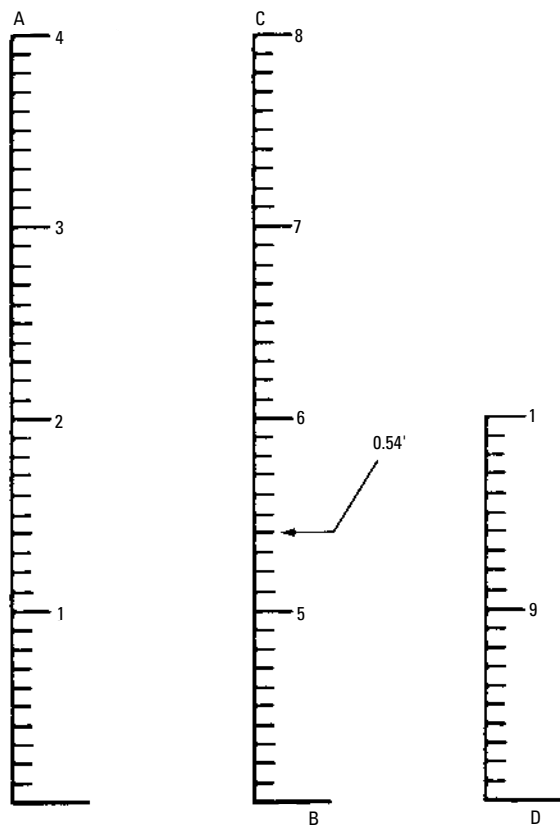


Fig. I-1 Lower section of a leveling rod.

Note

Water in a heating system, when heated from 32°F to 212°F (0°C to 100°C) will expand approximately $\frac{1}{23}$ of its original volume.

Transfer of heat occurs in three ways:

- *Convection*—This is the transference of heat by the upward movement of a warm light air current.
- *Radiation*—This is the process in which energy in the form of heat is sent through space from atoms and molecules as they undergo internal change.
- *Conduction*—This is the transference of heat by the passage of energy, particle by particle.

Convection is the method used for transferring heat in a gravity domestic hot-water circulation system. Convection (or *circulating currents*) is produced because of the difference in weight of water at different temperatures.

Absolute pressure is gage pressure plus atmospheric pressure.

Water Heaters

The maximum acceptable temperature for domestic hot water is from 140°F to 160°F (60°C to 71°C). Use of automatic laundry and dishwashing machines makes 160°F (71°C) preferable. Temperatures above 160°F (71°C) are not recommended, because they cause increased corrosion, increased deposit of lime, waste of fuel, more rapid heat loss by radiation, scalding, and other accidents.

If a 30-gallon (113.56-liter) hot-water boiler is insulated with a tank jacket, 30 percent of the total amount of fuel usually burned can be saved.

If hot-water pipes are insulated, the heat loss from pipes is reduced by up to 80 percent.

8 Chapter 1

There should be a minimum of 6 inches (15 cm) between an uninsulated water heater and any unprotected wood.

A special device called a *protector rod* is used to prevent corrosion in some water heaters.

Water Supply

Storage tanks up to 82-gallon (310.4-liter) capacity are tapped for 1-inch (25 mm) connections. Tanks over that size are generally tapped a minimum of $1\frac{1}{4}$ inches (32 mm).

The dip tube on a cold-water supply should terminate 8 inches (20 cm) above the bottom of the tank.

The standard length of asbestos cement water main pressure pipe is 13 feet or approximately 4 meters.

When water solidifies, it becomes lighter.

The amount of heat required to change ice to liquid water is 144 British thermal units (Btu) per pound (335 joules per kilogram).

Keep in mind that the installation of a water softener in a residential piping system causes some high-pressure loss.

Fixtures, Valves, and Fittings

When ordering piping elbows, an example would be as follows: 6 each, $1\frac{1}{4}$ inches (32 mm) copper, PVC, or galvanized 90° ells. If reducing elbows are ordered, list the largest measurement first: 6 each, $1\frac{1}{4}$ inches \times 1 inch (32 \times 25 mm) copper 90° reducing ells.

When ordering tees, you would begin by listing the largest measurement on the run or flow line—always listing the line measurement last. An example would be as follows: 6 each, $1\frac{1}{4}$ inches \times 1 inch \times $1\frac{1}{2}$ inches (32 \times 25 \times 38 mm) copper tees ($1\frac{1}{2}$ inches is the branch line measurement).

In plumbing, the pipe size measurement given is always nominal pipe size (N.P.S.) inside diameter (ID). In air-conditioning and refrigeration, pipe and tubing are called and ordered by their outside diameter (OD) measurement.

Therefore, a $\frac{1}{4}$ inch (19 mm) copper pipe in plumbing would be called $\frac{7}{8}$ inch (22 mm) pipe or tubing in refrigeration.

Flare fittings are sold and ordered by their OD measurement.

Brass fittings contain 85 percent copper, 5 percent zinc, 5 percent tin, and 5 percent lead.

Approximate heights above FF (or floor level) rims for plumbing fixtures are as follows:

- Sink—36 inches (91 cm)
- Built-in bathtub—16 inches (41 cm)
- Water closet—15 inches (38 cm)
- Lavatory—31 inches (79 cm)
- Wash or laundry tray—34 inches (86 cm)

An air gap of 1 inch (2.5 cm) to 2 inches (5 cm) between the flood level rim of a fixture and the water supply opening is considered safe.

A *vacuum* is a space entirely devoid of matter. A *partial vacuum* is a space where an air pressure exists that is less than atmospheric pressure. A vacuum relief valve should be installed on a copper tank to prevent collapse in the event of a vacuum occurrence. Suction pumps, barometers, and siphons depend on the natural pressure of the atmosphere in order to function.

A vacuum breaker should be at least 6 inches (15 cm) above the flood level rim, or 6 inches (15 cm) above the top of the unit.

Globe valves have a machined seat and a composition disc and usually shut off tight, while *gate valves* may leak slightly when closed (particularly if frequently operated) because of wear between the brass gates and the faces against which they operate. Globe valves create more flow resistance than gate valves.

10 Chapter 1

When copper and steel contact each other, especially when dampness is present, a chemical action called *electrolysis* occurs.

A relief line from a relief valve is generally piped to the outside, 12 inches (305 mm) or less above ground level, elbow and nipple turned down. The nipple should not be threaded on outlet end.

The temperature-sensitive element of the relief valve should be installed directly in the tank proper so that it is in direct contact with the hot water.

The recommended and safest procedure is to place the relief valve in a separate tapping, either at the top of the tank or within 4 inches from the top if tapping is located at the side.

Common Terms

Fig. 1-2 shows some common terms to remember.

Scale Rules

Fig. 1-3 shows examples of scale rules.

Drains and Sewers

The *building drain* is the lowest horizontal piping inside the building. It connects with the building sewer.

The *building sewer* extends from the main sewer or other disposal terminal to the building drain at a distance of approximately 5 feet (152 cm) from the foundation wall.

Public sewer manholes can be used to verify main sewer elevations and direction of flow.

Gases found in sewer air are carbon monoxide, methane, hydrogen sulfide, carbon dioxide, gasoline, ammonia, sulfur dioxide, and illuminating gas.

Primary treatment in a sewage treatment plant removes floating and settleable solids. Secondary treatment removes dissolved solids.

Tips for the Beginning Plumber II

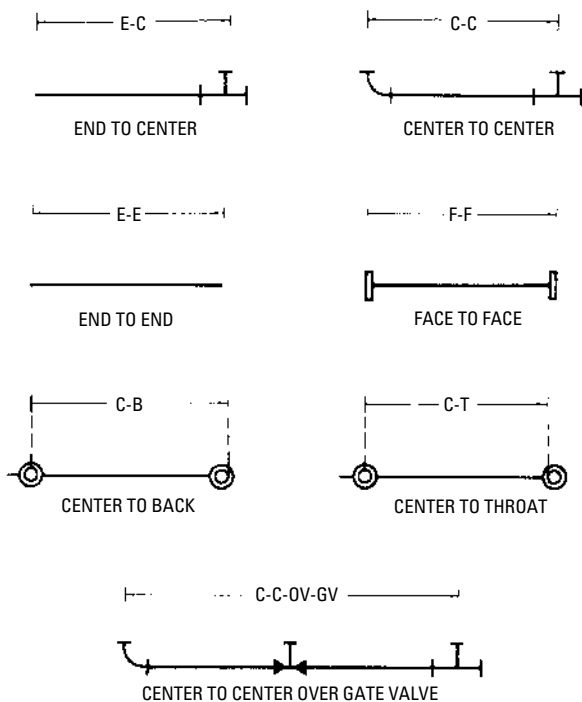
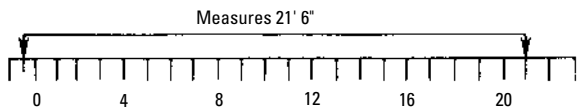
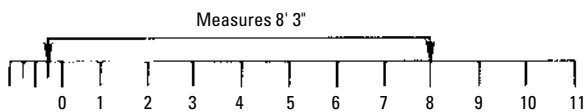


Fig. I-2 Common terms to remember.

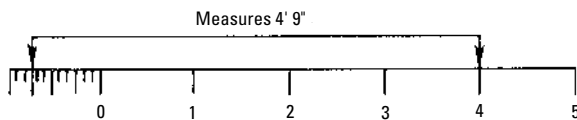
12 Chapter 1



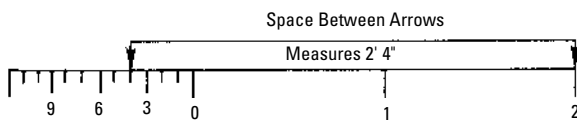
Scale: $\frac{1}{8}" = 1$ Foot



Scale: $\frac{1}{4}" = 1$ Foot



Scale: $\frac{1}{2}" = 1$ Foot



Scale: $1" = 1$ Foot

Fig. I-3 Scale rule examples for study.

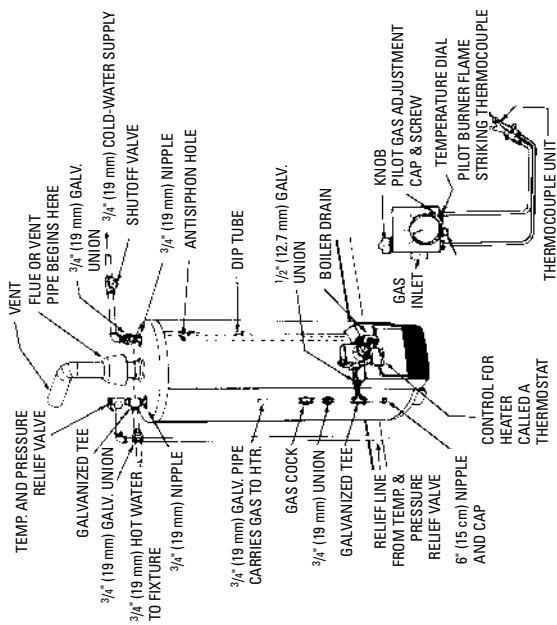


Fig. I-4 Gas hot-water heater in average residence.

Gas Water Heaters

If there are no separate tapplings on the water heater, then place the relief valve as shown in Fig. 1-4. However, use nipples as short as possible.

Never install a check valve in the water supply to a water heater, because it would confine pressure in the tank and result in an accident if the relief valve did not operate.

There is a small hole drilled in the dip tube near the top. This hole admits air to the cold-water piping to break the siphonic action.

The nipple and cap at the bottom of the tee where the gas supply turns into the heater form a dirt-and-drip pocket.

Following is the procedure for lighting a hot-water heater:

1. Turn gas cock on control to the “Off” position, and dial assembly to lowest temperature position.
2. Wait approximately 5 minutes to allow gas that may have accumulated in the burner compartment to escape.
3. Turn gas cock handle on control to the “Pilot” position.
4. Depress fully the set button and light the pilot burner.
5. Allow the pilot light to burn approximately 1 minute before releasing set button. If the pilot does not remain lighted, repeat the operation.
6. Turn the gas cock handle on the control to the “On” position and then turn the dial assembly to the desired position. The main burner will then ignite.

Note

Adjust the pilot burner air shutter (if provided) to obtain a soft blue flame.