

- 6) When installed underground, which type of copper tubing does not require a protective coating?
- Type G
 - Type K
 - Type GP
- 7) List the methods that are used to protect underground steel piping.
- 8) Match the type of pipe/tubing with the corresponding statement.
- | | |
|--|------------------------|
| a) _____ is not usually used underground: | Polyethylene pipe |
| b) You may use uncoated _____ in above ground applications where it is not exposed to corrosive elements or physical damage: | Steel and iron pipe |
| c) You may only use _____ for underground installations: | Copper pipe and tubing |
- 9) How is an underground steel piping system isolated from the above-ground piping to which it is connected?
- By the use of dielectric fittings
 - By unions
 - By plastic connectors
 - By brass connectors

5. Piping and tubing used in water distribution

Overview

Purpose

A gas technician/fitter must know how to identify, select, and install water service piping and tubing that is associated with gas-fired water heaters and boilers.

Objectives

At the end of this Chapter, you will be able to:

- identify the different types of water distribution piping and tubing material; and
- identify the joining methods for water distribution piping and fittings.

Terminology

Term	Abbreviation (symbol)	Definition
Potable		Safe to drink
Water distribution piping		Helps identify piping downstream of the main shut-off valve (control valve) usually at the water meter (with regard to potable water systems)

Water distribution piping and tubing material

The installation of water heaters and boilers is a normal part of a gas technician's/fitter's work. This type of installation requires knowledge of water distribution piping and tubing materials, installation methods, and the regulations governing such work.

There are various types of piping, tubing, and joints available to the gas technician/fitter for water distribution installations. This Chapter will give an overview of the materials and joining methods used for water distribution.

Piping and tubing

The three most common materials used for water distribution piping are:

- copper
- galvanized steel (Most codes, however, no longer permit this within potable systems.); and
- plastic.

There are other piping materials, such as cast iron, that have approval for water distribution, but are used in situations beyond the scope of a gas technician's/fitter's normal duties.

Codes and standards

You can find design standards for water service piping in the applicable plumbing code. These standards are printed or stamped on the exterior wall of the tube or pipe.

Consult local codes for such items as water supply shutoff, vacuum relief, temperature and/or pressure relief, and cross-connection control requirements. Also note that the installation of plastic piping and tubing must be in accordance with Building Code regulations concerning combustible piping and fire separations, etc.

Regulations

Most Provincial Regulations require a licensed Plumber or Steamfitter to perform any work beyond the immediate piping attached to a boiler or water heater. Since the scope of work of a gas technician/fitter does not include any work beyond that considered essential to the appliance's operation, refusal to adhere to local regulations may cause invalidity of manufacturer warranties and insurance company coverage. Further, working beyond the scope of your licensing coverage may carry liability as per your local authority having jurisdiction (AHJ).

Terminology

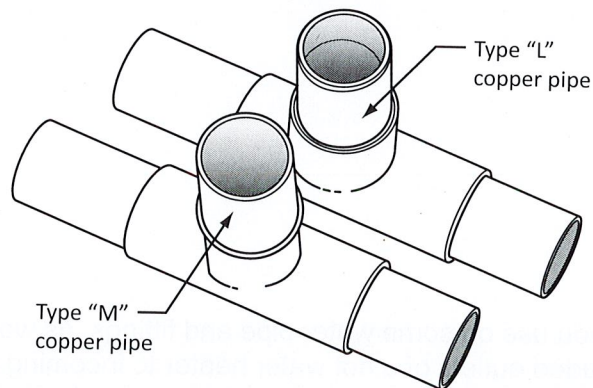
Water distribution piping, with regard to potable water systems, is what you use to identify piping downstream of the main shut-off valve (control valve) usually at the water meter.

Copper tubing

There are three types of copper tube used for water distribution. The table below lists them in descending order, according to wall thickness.

Type	Colour code	Available in
Type K copper	Green	<ul style="list-style-type: none"> • Coils (soft copper) • Rigid lengths (hard copper)
Type L copper	Blue	<ul style="list-style-type: none"> • Coils (soft copper) • Rigid lengths (hard copper)
Type M copper	Red	<ul style="list-style-type: none"> • Coils (soft copper) • Rigid lengths (hard copper) • However, you can use only the hard copper rigid lengths for water distribution piping.

Figure 5-1
Type L and type M copper pipe



Steel pipe

You may use welded and seamless steel galvanized pipe for water supply in industrial applications or for the repair of existing galvanized steel piping systems.

Plastic pipe

Several types of plastic pipe are used for water distribution; however, some are limited to cold water applications only.

The types of plastic pipe and their applications are as follows:

Type	Abbreviation	Distribution Permitted
Polyvinyl Chloride series 80, 100, 125, 160, 200	PVC	For cold water distribution only
Chlorinated polyvinyl chloride	CPVC	Hot and cold-water distribution
Polybutylene	Poly B	Hot and cold-water distribution
Polyethylene aluminum polyethylene	PE-AL-PE	Cold water distribution only
Cross-linked polyethylene aluminum cross-linked polyethylene	PEX-AL-PEX	Hot and cold-water distribution
Polypropylene	PP-R	Hot and cold-water distribution

Joining methods for water distribution piping and fittings

Pipe and tubing joining methods

Gas technicians/fitters use several methods for joining the various types of water service piping and tubing.

The types of joints used include:

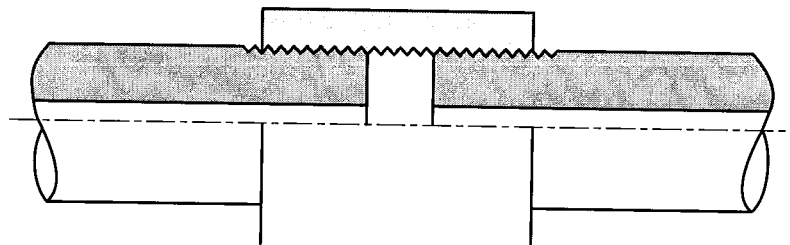
- threaded;
- soldered;
- compression;
- flared;
- solvent welded;
- crimped; and
- cold flared.

Threaded joints

Threaded joints are what you use on some water pipe and fittings, as well as adapters such as those used to join the threaded outlets of a hot water heater to incoming copper or plastic water distribution tubing. You should use an approved thread sealant with this type of joint.

Figure 5-2 shows a typical threaded joint.

Figure 5-2
Threaded joint



Solder joints

Soldering can refer to the process of joining two or more pieces of metal together by means of an alloy that has a lower melting temperature than the metal being joined. The many different solders available use alloys consisting of various combinations of tin, lead, silver, and copper.

Soft soldering vs. hard soldering

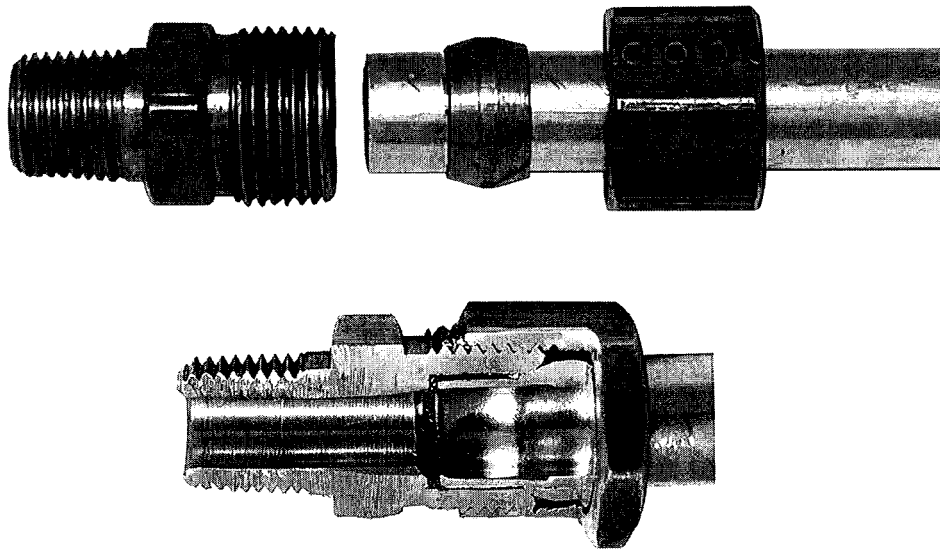
The joining of copper tubing using hard and soft solders is common in the plumbing and gas trades. The difference between a soft-soldered joint and one that is hard-soldered (also known as silver brazing) is the melting temperature of the alloy being used. Hard solders have a melting temperature above 1000°F (537 °C) and provide a stronger joint.

With concerns related to lead exposure, plumbing products such as flux and solder now come lead-free.

Compression joints

A compression-type fitting often joins copper and plastic tubing. A compression fitting is composed of a fitting body, a nut, and a ferrule. You place the nut and ferrule over the tubing, then insert the tubing into the fitting body. You then tighten the nut onto the external thread of the fitting body, compressing the ferrule and sealing the joint. In some cases when plastic tubing is used, place a supporting insert inside the tubing to prevent it from collapsing as it is being tightened. Figure 5-3 shows a typical compression joint fitting.

Figure 5-3
Compression joint fitting
Image courtesy of Terry Bell



Flared joints

Flared joints are what you use on soft copper tubing. This type of joint requires a special tool to form the flare on the end of the tubing (see Figure 5-4). It works as follows:

- 1) Cut the end of the copper tubing square and smooth. You may ream the inside edge and slightly chamfer the outside edge to ensure a clean, tight joint.
- 2) Place a flare nut and any other necessary parts of the fitting over the copper tubing in the correct orientation and slid down the tubing to leave the end clear for flaring.
- 3) Insert the tubing into the block of the flaring tool. The block or die bar of the compression-type flaring tool shown in Figure 5-4 swings open to allow insertion of the copper tubing and, when closed and tightened by means of wing nuts, holds the tubing securely in position. You can also use a ratchet-style flaring tool. See Figure 5-5.
- 4) Centre the die over the open end of the tubing and turn the handle to force the die down onto tubing to form the flare.

Figure 5-6 shows a properly made flare.

Figure 5-4
Compression-type flaring tool

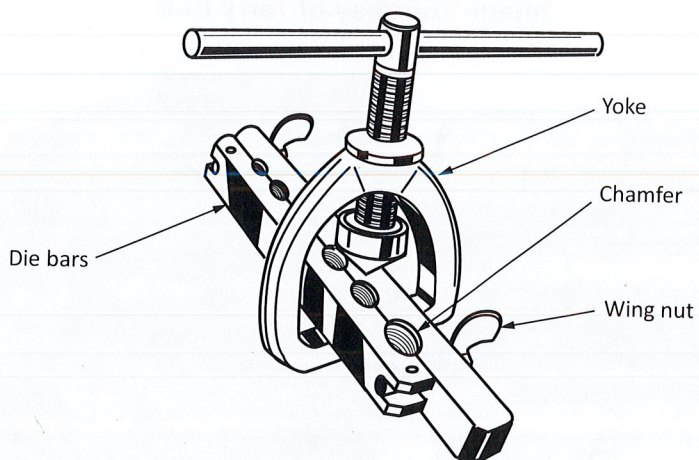


Figure 5-5
Ratchet-style flaring tool
Image courtesy of Terry Bell

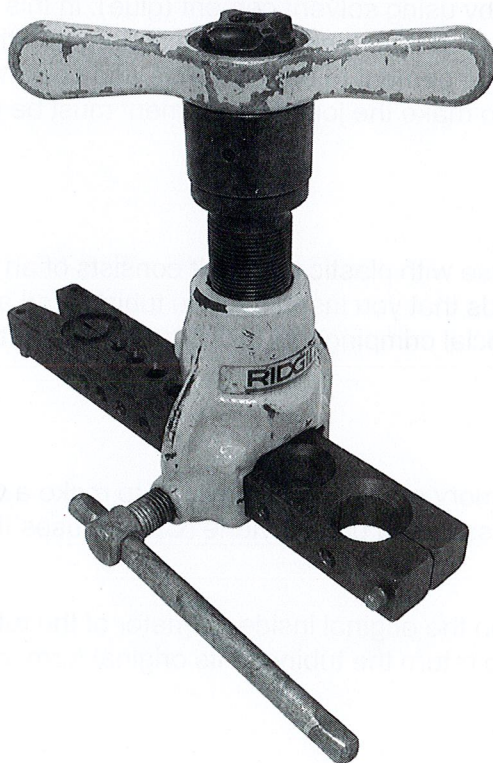
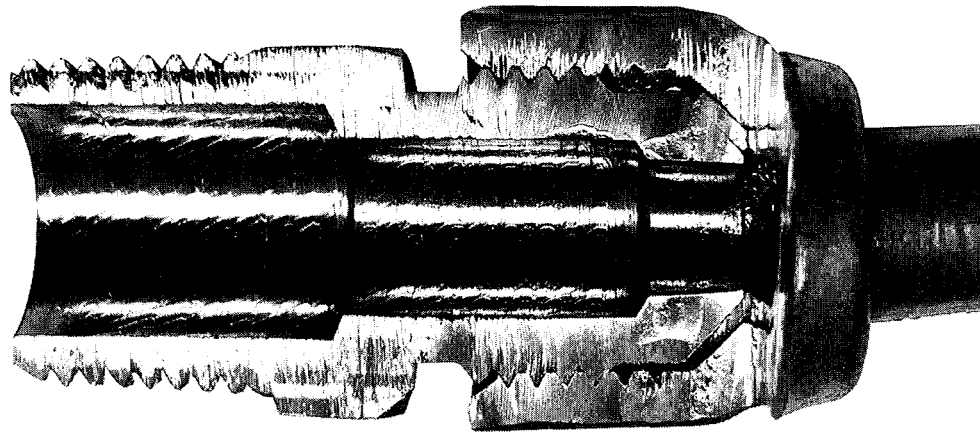


Figure 5-6
Properly made flare
Image courtesy of Terry Bell



Solvent-welded joints

Some plastic pipes are joined by using solvent cement (glue). In this method, the joint consists of a pipe end and a socket fitting. The piping end must be square and the pipe and socket fitting must be clean and dry. Apply the cement to both the pipe and socket, and push the pipe into the socket with a twisting motion to make the joint. The cement must be suitable for the type of pipe being used.

Crimped joints

This type of joint is what you use with plastic tubing. It consists of an insert fitting with raised grooves (barb type) on the ends that you insert into the tubing, and a crimp ring that you place over the tubing. You use a special crimping tool sized for that diameter of tubing to compress the ring.

Expansion joints

This type of joint uses the memory effect of polyethylene to make a water-tight seal and is typically used with PEX-a, cross-linked polyethylene (Uponor uses this manufacturer and joining method).

The fitting is slightly larger than the original inside diameter of the tubing, so the memory effect will cause the material to try to return the tubing to its original form, providing a continuous, water-tight seal.

It works as follows:

- 1) Cut the tubing square, and then place a polyethylene collar over the end of the tubing.
- 2) Place a special tool in the end of the tube, and expand the tubing and collar.
- 3) Remove the tool and insert the fitting into the tubing.
- 4) The tubing immediately tries to return to its original diameter, in effect shrinking itself around the fitting to create a water-tight seal.

The collar provides extra strength at the joint. It is also colour coded to provide identification of hot and cold-water lines.

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Applications and joints

Table 5-1 shows the common applications and joints that gas technicians/fitters use for copper and plastic pipe and tubing.

Table 5-1
Applications and suitable joints

Pipe tube	Applica- tions		Suitable joints						
	Hot water	Cold water	Threaded	Solder	Flare	Compression	Solvent weld	Crimp	Cold flare
Type K copper	✓	✓		✓	✓	✓			
Type L copper	✓	✓		✓	✓	✓			
Type M copper	✓	✓		✓	✓	✓			
PVC		✓	✓				✓		
CPVC	✓	✓					✓		
Poly B	✓	✓				✓		✓	
PEX		✓				✓			✓
PE-AL-PE		✓				✓			
PEX-AL-PEX	✓	✓				✓			
PP-R	✓	✓				✓			

Assignment Questions – Chapter 5

- 1) What are the three most common materials used for water distribution piping?
 - a) Cast iron, copper, plastic
 - b) Copper, galvanized steel, asbestos cement pipe
 - c) Galvanized steel, plastic, cast iron
 - d) Copper, galvanized steel, plastic

- 2) What is the colour code for Type K copper?
 - a) Blue
 - b) Green
 - c) Yellow
- 3) May polybutylene be used on both hot and cold-water distribution lines?
 - a) Yes
 - b) No
- 4) What is the melting temperature of hard solders?
 - a) Above 1 000°F
 - b) Above 750°F
 - c) Above 500°F
 - d) Above 250°F
- 5) Can the solvent cement specified for use with one type of plastic pipe be used with another type of plastic pipe?
 - a) Yes
 - b) Yes, as long as it has a complete bead.
 - c) No
- 6) Match the different types of pipe and tubing with the appropriate description.

a) Colour coded blue, available in coils or rigid lengths:	Type M Copper
b) Series 80, 100, 125, 160, 200 – may be used for cold water only:	PEX-AL-PEX
c) (Polypropylene) may be used for hot and cold-water distribution:	Type K Copper
d) (Chlorinated) may be used for hot and cold-water distribution:	Steel
e) Colour coded green, available in coils or rigid lengths:	PVC
f) Cross-linked, may be used for hot and cold-water distribution:	PP-R
g) Welded and seamless galvanized, may be used in industrial applications:	Type L Copper
h) Colour coded red, available in coils or rigid lengths – only rigid lengths can be used for water:	CPVC