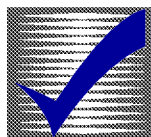




HOW-TO BOOKLET #3013

COPPER PIPE



TOOL & MATERIAL CHECKLIST

- Copper Pipe and/or Flexible Copper Tubing
- Propane Torch
- Flare Block
- Solder Flux
- Non-Corrosive Solder
- Pliers
- Water Bucket
- Tube Cutter
- Steel Wool
- Tape Measure
- Gloves
- Pipe Adaptors

Read This Entire How-To Booklet for Specific Tools and Materials Not Noted in the Basics Listed Above.

Rigid copper pipe and flexible copper tubing are not inexpensive, but the quality and application of the products may be worth the price to a homeowner. Both products can be used for hot and cold water supply, drain, waste, and vent systems, and for heating and cooling applications. With adaptors, the pipes can be connected to existing copper, plastic, and galvanized steel pipe runs.

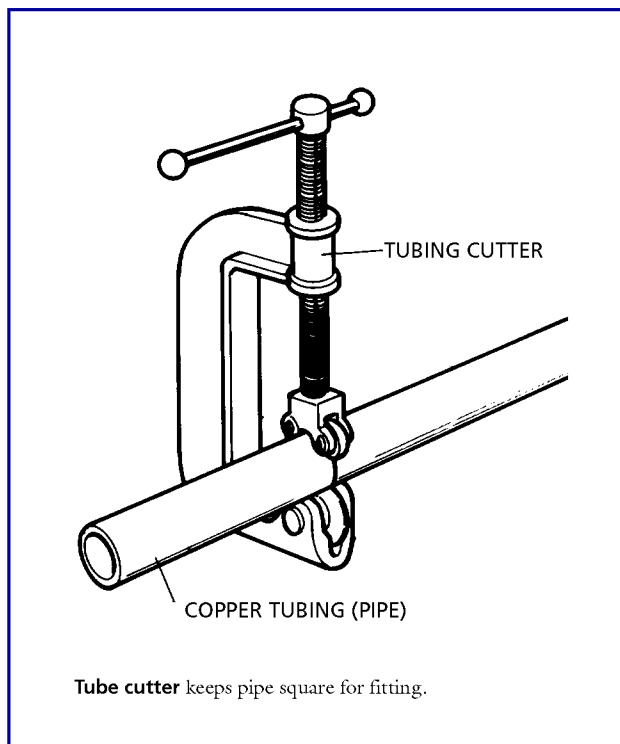
Copper when compared to galvanized steel pipe is lightweight, readily available, easy-to-fabricate, strong, noncorrosive, and resistant to very high temperatures. If you have hot water (hydronic) heating, you can make repairs with copper pipe.

CAUTION:

Copper pipe sometimes is assembled with solder, which requires high heat from a propane torch (as detailed below). Be extremely careful with the torch; plan your project so the flame and heat is kept away from flammable building materials. It is strongly recommended that a bucket of water or a fire extinguisher be handy when working with the propane torch. Heed all warnings provided by manufacturers on torch use.

TYPES OF COPPER PIPE

Copper pipe is available in 10- and 20-foot lengths and in three weights: Type M is thin wall; Type L has a medium-thick wall; Type K has a thick wall. Unless otherwise specified by local code, Type M is sufficiently strong for the water supply system in your home.



Copper pipe is always 1/8-inch larger than the nominal size. Example: 1/2-inch pipe measures 5/8-inch. outside diameter. The actual inside diameter varies with the thickness of the pipe wall. The thicker the wall, the smaller the inside diameter of the pipe.

In the 10- and 20-foot lengths, Types K, L, and M are available in “drawn temper,” which is the rigid form of pipe. In the plumbing trades, this usually is referred to as “hard” tubing because it’s rigid. The three types of tubing are also made in annealed (soft) temper in almost all the same sizes as the hard tubing and in the same lengths. However, the soft tubing comes packaged in rolls rather than in straight lengths as hard pipe.

For your shopping information, rigid or hard copper pipe usually is termed “pipe” in home center stores and building material outlets. If you want flexible copper tubing, ask for it as “flexible.”

Hard temper Type M or soft temper Type L is recommended for underground water services, although local codes may call for the thick-walled Type K for this service. Type M usually is recommended for the water supply system in your home, as mentioned above.

Another class of copper pipe, called DWV (for drain, waste, vent) is available only as rigid pipe in larger sizes.

As the name implies, this pipe is used for drain, waste, and vent lines in the drainage system in your home.

Pipes in sizes of 3/8-, 1/2-, 3/4-, and 1-inch are suitable for home water supply systems. The 1-1/4-, 1-1/2-, 3-, and 4-inch sizes are for DWV.

Still another class of copper tubing, designated ACR, is for air conditioning and refrigeration field service. ACR is designated by the actual outside diameter, as opposed to other types of copper pipe. It is available in uncharged lengths of 20 feet in draw (hard) temper and 50 feet in soft temper.

JOINING COPPER PIPE/TUBING

Copper pipe and tubing can be joined in three different ways: with solder (sweating); with compression nuts; by flaring. The steps for each system are detailed below:

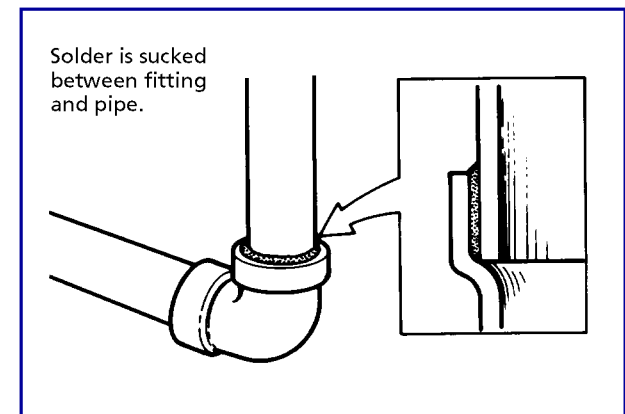
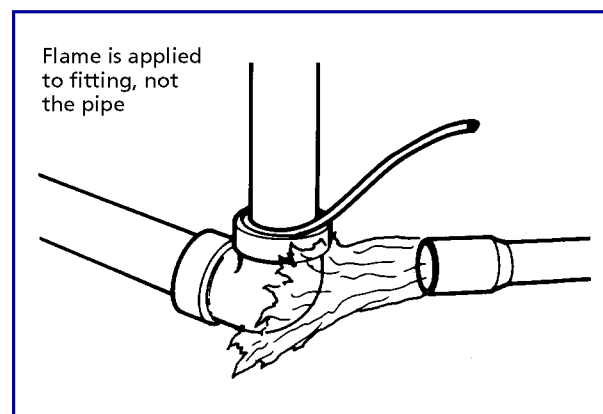
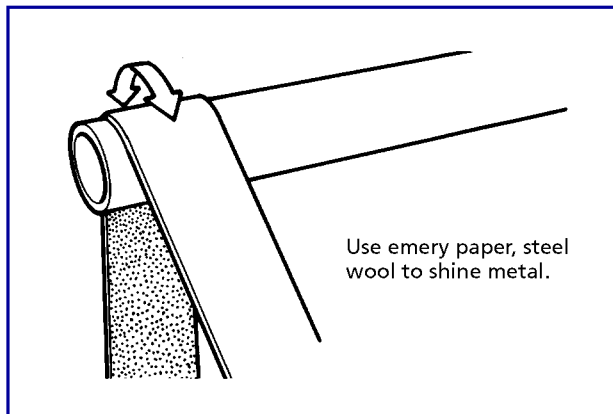
Solder (Sweat) Joined. Measure and mark the length of pipe needed. Measure twice, cut once.

- 1 With a tube cutter, cut the pipe to length. You can also use a hacksaw and miter box to cut the material, but a tube cutter is recommended because it cuts the pipe perfectly square so it fits tightly against a tiny “shoulder” inside the pipe fittings. A hacksaw in a miter box also produces true cuts, but the metal residue on the pipe after the cut has

been made must be removed with a cone or triangular reamer. The tube cutter has a built-in reamer for this job, although the tube cutter usually leaves a clean cut.

- 2 If necessary, remove the burrs left by the cutting operation.
- 3 “Dry fit” the fitting onto the pipe. Does the end of the pipe fit squarely against the shoulder in the fitting? If not, recut the pipe.
- 4 Make all necessary cuts in the complete pipe run and assemble the run dry. Make any adjustments at this time.
- 5 With steel wool, shine the end of each pipe where it will go into the fitting so the copper is as bright as a new penny coin. Do not touch the shined metal with your fingers. Your fingers leave grease on the pipe and any grease tends to prevent the solder from sticking properly.
- 6 Coat the shiny ends of the pipe with paste soldering flux. Use a flux brush for this and make sure that the pipe at the end where it goes into the fitting is completely covered with a thin layer of paste flux.

NOTE: Rigid copper pipe is assembled with sweat-soldered fittings using “soft” solder. Solder used to be a combination of tin and lead.



However, codes have been recently changed to eliminate lead from the solder formula. Under “grandfather” code “extensions” tin and lead solder may still be sold in stores where you buy materials. Be sure to check the store concerning any code restrictions on tin/lead solder in your area.

Also: Solder generally is used in wire form, but paste-type solders also are available. They consist of finely ground solder in a suspension of paste flux. If you use this product, (do not use acid-core solder with copper pipe) there are four rules to follow:

- 1 Wire solder should be applied in addition to the paste. The wire helps fill voids and aids in displacing the flux, and if it is not used you may have nicely tinned surfaces with a poor joint resulting from a lack of continuous solder bond.
- 2 The paste solder must be thoroughly mixed if it has been standing in the container for more than a short time. The heavy solder has a tendency to settle to the bottom of the can, and taking material from the upper portion of the container will result in a mixture that is mostly flux and little solder.
- 3 Do not depend on the flux to clean the end of the pipe. Use steel wool.
- 4 Remove any excess flux. Only enough flux should be used to lightly coat the areas to be joined with solder. Use a flux brush or the end of a piece of wire solder to apply flux to the copper pipe.
- 5 Slip the fittings onto the pipe and make sure that the pipe is tightly set against the shoulder in the fittings. If the fittings do not have shoulders, the pipe should go into the fitting about 1/2 inch.
- 6 With a propane torch, heat the fitting—not the pipe. Touch the solder to the joint between the fitting and pipe from time-to-time while heating the fitting. When the fitting is hot enough the solder, touched to the joint, will by capillary action be pulled back into the joint.

If you look closely you can see this action. When the joint is full of solder, the solder will automatically form a tiny bead around the joint. At this point the joint is soldered or sweated.

You do not have to run the wire solder around the joint. Just hold the solder at one point and let the capillary action do the work.

- 9 Let the joint cool by itself; don’t dip it in water, since sudden cold sometimes causes the joint to crack. It takes only a few minutes for the metal to become cool enough to move, if it has to be moved.

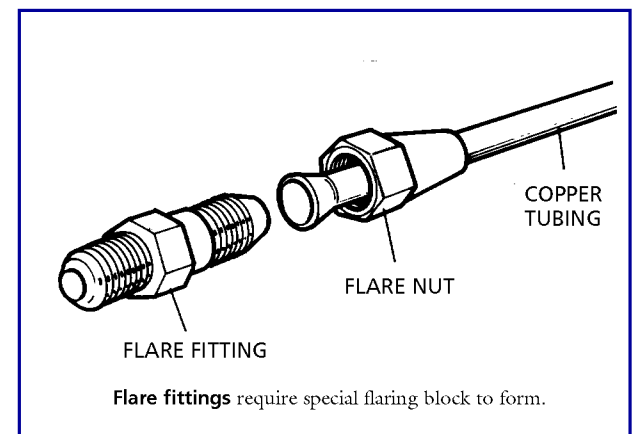
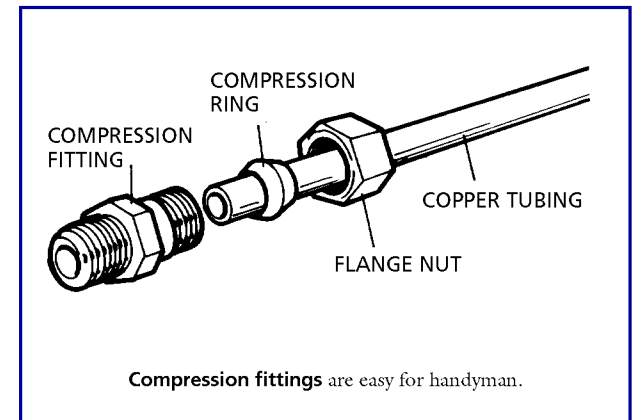
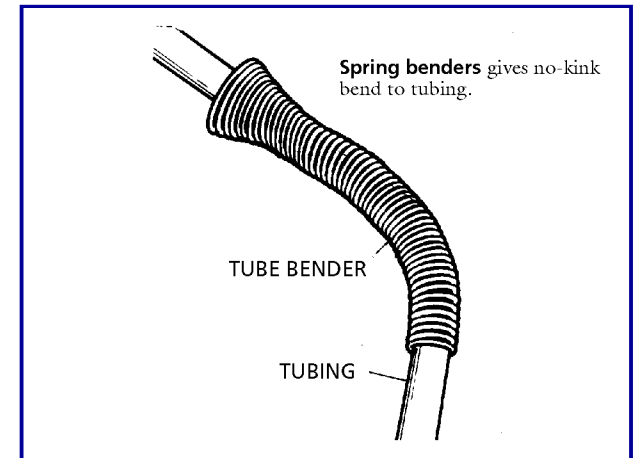
- 10 Complete each joint as detailed

SPECIAL NOTES: Copper pipe can not be properly sweated with water in the pipe. The water from any installed pipe should be drained. If there is still moisture in the pipe when you start to sweat the joint, use this trick: Stuff a wad of fresh bread into the pipe. The bread will absorb the water. Then sweat the joint. The heat will turn the bread into “burnt toast,” which will flush out of the pipe when the water is turned back on.

If, when the water is turned on you have leaky joints, turn off the water and drain the pipe as best as you can. Then heat the leaking joint at the fitting and pull it apart after the solder has melted.

Use pliers for this and wear heavy gloves. The pipe will be very hot. Now, heat the pipe and wipe away any solder with a cloth. Again wear gloves and be careful. The pipe should be hot but not cherry red; just enough heat to melt the solder. After wiping, the pipe should have a thin coating of solder on it. Do the same with the inside of the fitting. Be careful. The fitting also should have a thin coating of solder on it. This is called “tinning.”

Apply new flux to the pipe and fitting, and slip the pipe and fitting together. Heat the fitting with the torch and touch the joint with solder until you see the tiny bead appear at the joint. The pipe should be perfectly joined.



If you are soldering valves (faucets) to copper pipe, disassemble the valves. The heat can damage washers in the valves.

A regular propane torch will handle pipe and tubing up to about 1 to 1-1/4-inches in diameter. Over this size, use a Mapp gas torch or an oxyacetylene torch that you can either buy or rent. These tools supply the necessary heat for the larger sizes of pipes.

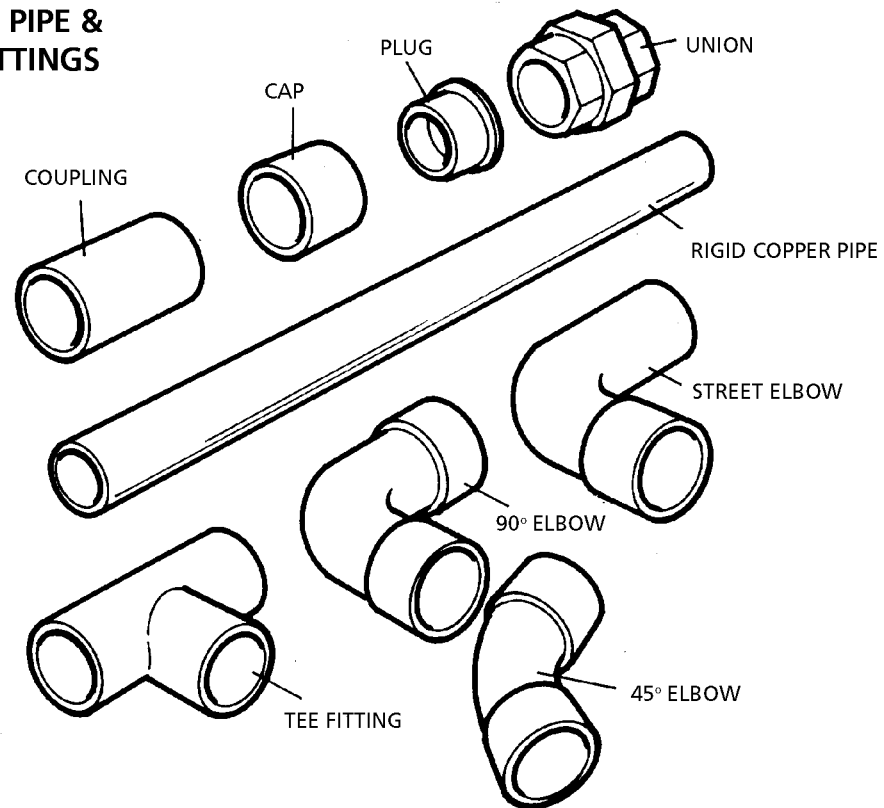
Compression Nuts. The easiest way for most do-it-yourselfers to assemble copper tubing (and some smaller sizes of rigid copper pipe) is with compression nuts. The nuts consist of rings which go onto the pipe like a ring on your finger after the nut has been slipped onto the pipe. There are two nuts and two little compression rings to each joint. When the nuts and rings are in position, you simply screw the nuts together. The compression provided by the threads pulls the joint together, forming it. You then tighten the nuts with adjustable wrenches to complete the union.

But before assembly, measure (twice) the pipe and cut it square.

Flare Blocks. Copper tubing also can be assembled by flaring the end of it in a flaring block. The block, via pressure from a turned-down “wedge,” flares the end of the pipe to match the fitting it joins. Some working tips:

- 8 Cut the tubing to size and square and debur it.
- 8 Position and lock it in the flaring block a tad low in the block, AFTER you slip on the connector.
- 8 Turn down the flaring tool or wedge so it starts the flare at the end of the tubing.
- 8 Reposition the tubing in the block so the top edge of the tubing is flush with the surrounding surface of the flaring block.
- 8 Turn down the flaring tool to complete the flare. The flare has to be perfectly formed in order to produce a water-tight connection.

RIGID COPPER PIPE & STANDARD FITTINGS



If you attempt to make the flare all at once, you can “bell” the flare. Once you get the hang of using the block, you can flare tubing in one operation. Until then take tiny bites for better flaring results.

PIPE ADAPTORS

Copper pipe and tubing can be connected to plastic pipe. Because plastic is inert and does not react with any metal, no problems occur when mixing plastic and copper in a water supply or drain system. You also can buy adaptors to join steel and copper pipe.

For plastic, the fittings are attached to the plastic with plastic pipe cement after the fitting has been cleaned with plastic pipe cleaner. One end of the plastic fitting is threaded and it is turned into a threaded fitting that has been soldered to the copper pipe.

Valves and other plastic fittings that have compression nuts at the ends can also be used on copper pipe—such as steel. Just cut out a section of the pipe to allow insertion of the fitting, and then put it on line and tighten the nuts. You may have to retighten the nuts about three times over several days in order to prevent leaks and still not stress and break the plastic fittings.