PEX:
An Alternative to Copper Pipe

Cross-linked polyethylene is tough and flexible, and you don't need a torch to install it

BY DAVE LOVESKY

Remember when all drainpipes were made of cast iron? These days, a tour of most basements reveals that iron pipe is gone, and in its place, you'll find black (or white) plastic: PVC. In the not-so-distant future, a similar change may affect residential plumbing: Cross-linked polyethylene pipe, also known as PEX, is beginning to replace copper for the household water supply. Until a few years ago, PEX was used primarily as tubing in radiant-floor heating systems, but its popularity as a substitute for copper water-supply pipe is growing.

The biggest reason is that although PEX is as expensive as copper, PEX installs quickly; an entire house can be plumbed in a day or two, meaning big labor savings. Unlike non-cross-linked plastics, PEX won't soften when subjected to heat or fail when exposed to chlorine and other waterborne chemicals. Non-cross-linked polybutylene was first used in the 1970s for radiant-floor systems until it began to rupture under exposure to chlorine; it caused more than a few new concrete slabs to be jackhammered to pieces. Introduced to the European market first, the improved PEX has undergone 30 years of accelerated testing and has yet to fail under normal conditions.



CONNECTING PEX

1. CUT THE TUBING
No matter which proprietary connection is used, it's important to trim the tubing square so that the fitting has a proper seal.





2. ASSEMBLE THE PARTS
In this example, a Stadler-Viega compression sleeve is slipped over the tubing end, and the fitting is inserted into the tubing.



3. SEAL THE JOINT
Stadler-Viega's tool compresses the sleeve, which locks the tubing onto the fitting.

Drawings: Dan Thornton

What is PEX? It's a high-density polyethylene whose molecules have been chained together by one of three processes: chemical (peroxide treatment during extrusion); silane (hot-water treatment after extrusion); or electron beam (tubing irradiated after extrusion). In Europe, the methods are called PEX A, B and C, respectively. Although all three types are certified by the ASTM (American Society for Testing and Materials) for use in residential plumbing, I prefer to use tubing formed with the chemical or electron-beam methods. In my opinion, the silane method isn't strong enough.

Plotting the route from the supply to the faucet

As in a radiant-heat system, PEX plumbing is run from multioutlet brass or copper manifolds (photo right) that distribute hot or cold water. To plan pipe runs, you need to be aware of design criteria and must choose one of three installation methods (drawing right).The first is the home run, which uses one line to serve each fixture. The second method is known as branching, which uses larger pipe to supply smaller feeds. The third method is a hybrid and takes advantage of both the other methods.

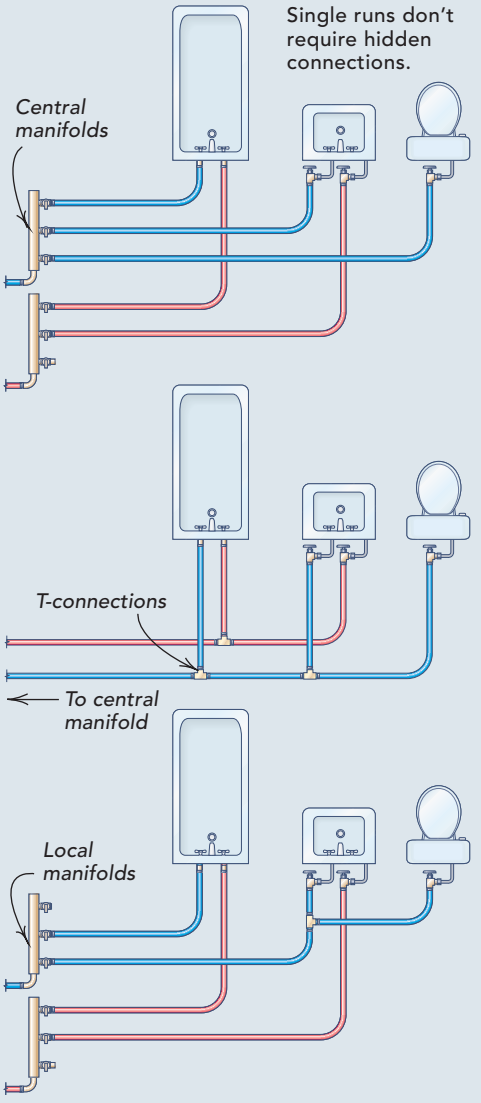
The house's layout and the customer's budget determine what type of system my company uses. Generally, for a 2½-bath, two-story house, we install a hybrid system with a remote manifold, home-run the showers to ensure consistent pressure and combine the runs for paired fixtures such as toilets and sinks.

Know the system requirements before you buy supplies

Pressure drop and fixture flow-rate requirements are major design issues for residential water lines. In any system, the water pressure depends on the flow rate from the source,

MORE THAN ONE WAY TO PLUMB A SYSTEM

Whether the tubing is copper or PEX, the system should be designed efficiently so that a minimum amount of pipe and fittings (and the labor needed to install them) can adequately supply a house's water needs.



A home run is a straight shot
Running one tube from the manifold to any fixture without interruptions is known as a home run. Although it uses more tubing, this simple method requires fittings only at each end and is therefore less labor intensive.

The branch method is less efficient
The branch method uses less tubing, but requires more fittings and more labor. The tubing size must vary according to the load that it carries, and the system is subject to pressure loss if several fixtures on a branch are used at once. Connections are inaccessible within walls.

Hybrid method is most popular
Combining the best aspects of both methods, the hybrid uses fewer fittings and less tubing, and is typically run from several manifold locations. Higher-flow fixtures need a home-run supply to ensure uninterrupted pressure. Intermittently used fixtures such as sinks and toilets can be branched.



Manifolds distribute the supply. *As in radiant-heating systems, brass or copper manifolds commonly form the supply point for PEX systems. The main advantage of manifolds is that individual lines can be isolated and controlled.*

PROS

- Quick, relatively foolproof installation.
- Nontoxic. Installation requires no solvent cements and less flux and solder that could potentially contaminate water.
- Fewer connections, especially those hidden behind walls.
- Equalized pressure drops that minimize hot or cold water surges.
- Minimal water-hammer noise.
- Greater tolerance to freezing than copper.
- Easily repaired.

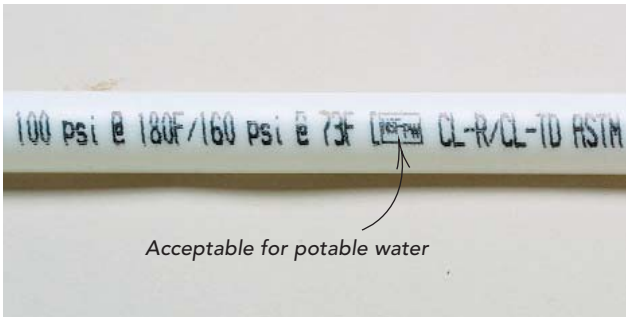
CONS

- Begins to break down after 30 to 90 days (depending on the manufacturer) of direct exposure to ultraviolet light.
- Can't be piped directly to a gas or oil water heater.
- Must be kept away from flues, hot-air vents and recessed lights. Can't be installed within 6 in. of a gas vent or within 12 in. of a recessed light.
- Will degrade when exposed to solvent- or petroleum-based products.

TUBING, TOOLS AND FITTINGS

Available in different colors and diameters ranging from ¼ in. to 1½ in., PEX tubing that's rated for residential water supplies should be marked accordingly.





Acceptable for potable water

Proprietary tools for fittings

Each PEX manufacturer has designed fittings and tubing to be joined in one of four mutually exclusive ways; one maker's parts or tools won't work with another's. While proprietary tools can be expensive, distributors sometimes rent or loan the tools.



Crimped copper ring: A common method uses a crimped copper ring whose size must be checked with a go/no-go gauge. The crimping tool must be adjusted for a perfect crimp. Watts Radiant; Zurn (Qestpex); Vanguard. Tool cost: $150 to $250 per tubing size.





Ratcheting clamp: A stainless-steel clamp tightened with a ratcheting tool; not used extensively. RTI Systems. Tool cost: $160.





Stainless-steel sleeve: Newer press method. Tools are factory-calibrated for each tube diameter; installers don't need to check the press. Stadler-Viega. Tool cost: $229 per tubing size.





Expanding tube: Tool temporarily stretches the tube's inner diameter to accept the fitting. The shrinking tube and reinforcing ring seal the connection. Labor intensive. Wirsbo. Tool cost: $300.



whether a well or a city water line. Gravity and pipe diameter reduce water flow to a fixture; the correct pipe diameter should overcome both obstacles and supply the necessary amount. Because of all the variables involved, sizing pipe is a somewhat complicated subject. For more information, consult the pipe manufacturers' pressure-drop charts or the appropriate plumbing codebook.

Another factor is that PEX tubing expands and contracts in length under normal usage, so estimates should allow an extra ⅛ in. per ft. of tubing. Although some tubing manufacturers recommend that installers make a tubing loop in a stud bay to account for movement, I've found that allowing a bit of slack in a tubing run takes care of the problem. When in doubt, I follow the manufacturer's specs.

A good mechanical connection is the key to a leak-free system

Before running any PEX tubing, install all manifolds and stubs in position. Some manufacturers have manifold systems that don't require solder; if you solder, do it first, or the heat from a torch will reduce the tubing to a sloppy mess. I like to work with another person; one of us feeds and the other pulls the tubing (photo left, facing page). A word of caution: Although the tubing is flexible, it can kink. Most kinks can be repaired by carefully applying heat from a hair dryer or heat gun; the heated tubing will return to its original shape as it cools. If the tubing is punctured, you have to replace the run or cut out the damaged section and install a coupling.

Leave extra length, 12 in. or so, at each end to allow for final trimming. When running the tubing, attach the run at each floor (just before or after the tubing passes through the wall plate) before carrying it to the next; horizontal runs should be supported every 32 in. (photo top center, facing page); vertical runs, every 48 in. Nailed or screwed to the framing, tubing clips should support but not constrict tubing. Runs that pass through steel studs or through wood studs with sharp edges should be protected with nylon grommets (photo bottom right, facing page) available from most distributors. Nail plates should be used wherever tubing passes close to the edge of studs. I keep bends to the recommended radius (equal to 8 times the tubing diameter) and use elbow supports (photo center right, facing page) to reduce stress on the tubing if there's a bend close to a fixture or a wall penetration.



An extra pair of hands prevents kinks. *Although PEX can be pulled like wire, it can kink or even be punctured. It's a good idea to have help when pulling the flexible tubing.*



Clips support horizontal runs. *To keep the tubing in place, plastic or metal clips must be secured every 32 in., or closer for straight exposed runs. It's important that the clips don't constrict or crush the tubing.*





Plastic elbows support tighter bends. *Tubing bent to a tighter than recommended radius or bent adjacent to a wall or floor penetration can be supported with plastic pipe supports.*





Nylon grommets protect the tubing. *Available from most distributors, grommets are cheap insurance for tubing that passes through sharp-edged steel or wood studs.*



Joining tubing to fittings is relatively easy, but the details depend on the type of system used (drawings p. 85). Once you've established where to cut (I hold the tubing next to the fitting and register the cut with the cutters), make the cut as square as possible (top photo, p. 84). Next, slide the clamping device onto the tubing (center photo, p. 84); then insert the fitting into the tubing, making sure that the tube end is snug against the fitting body. The clamping device is positioned according to specifications and is tightened with the appropriate tool (bottom photo, p. 84). (Wirsbo's system is a bit different. Its tool temporarily expands the tubing's diameter; the fitting is inserted into the tubing, which shrinks back to its original size, sealing the connection; bottom photo, facing page.)

Once the system is complete, it can be charged with 100 psi compressed air or water to check for leaks.

Tools and fittings must come from the same source

Dozens of companies manufacture and distribute their own fittings, the tubing and the method of sealing the fitting/tubing joint as proprietary systems (sidebar facing page), meaning that one company's parts or methods won't work with another's. Most of these assembly methods employ malleable steel or copper rings that are crimped onto the tubing.

The actual differences between the systems can be significant. The important thing to remember is that you should find and work with a reputable manufacturer that has been in business for a while and will stand by its product in the future. □

Dave Lovesky runs C & N Mechanical Inc. in Bloomfield, Connecticut. Photos by Charles Bickford.

FOR MORE ABOUT PEX

Here's a partial list of PEX distributors and manufacturers. For more information, check your local Yellow Pages.

Consolidated Plumbing Industries
(865) 690-1558
www.durapex.com
Crimp rings

Hubbard Enterprises
(800) 321-0316
www.holdrite.com
Inserts and clips

Plastic Pipe and Fittings Association
(630) 858-6540
www.ppfahome.org

RTI Systems
www.rtisystems.com
(800) 784-0234
Ratcheting clamps

Stadler-Viega
(800) 370-3122
www.stadlerviega.com
Press-sleeve system

Vanguard Piping Systems Inc.
(800) 775-5039
www.vanguardpipe.com
Crimp rings

Watts Radiant
(800) 276-2419
www.wattsradiant.com
Crimp rings

Wirsbo
(800) 321-4739
www.wirsbo.com
Expanding-sleeve system

Zurn Plumbing Products
(903) 886-2580
www.zurn.com
Crimp rings