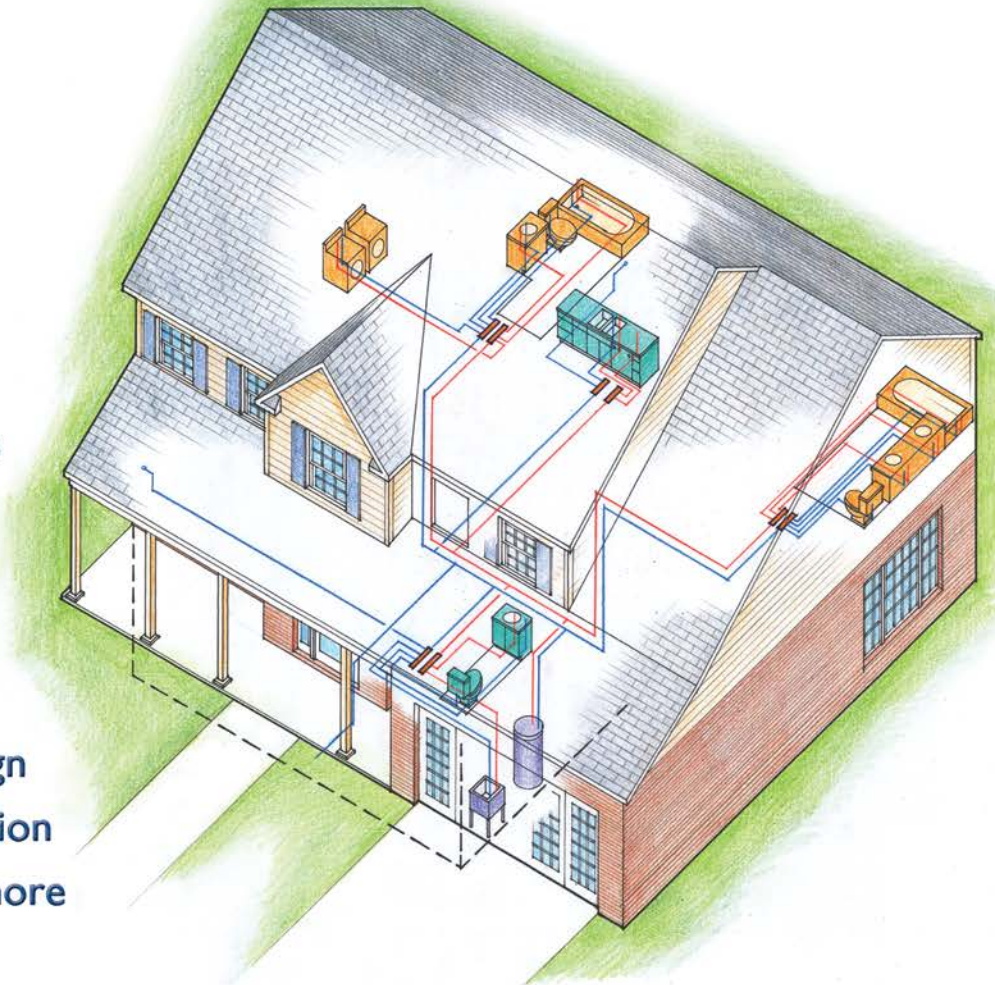


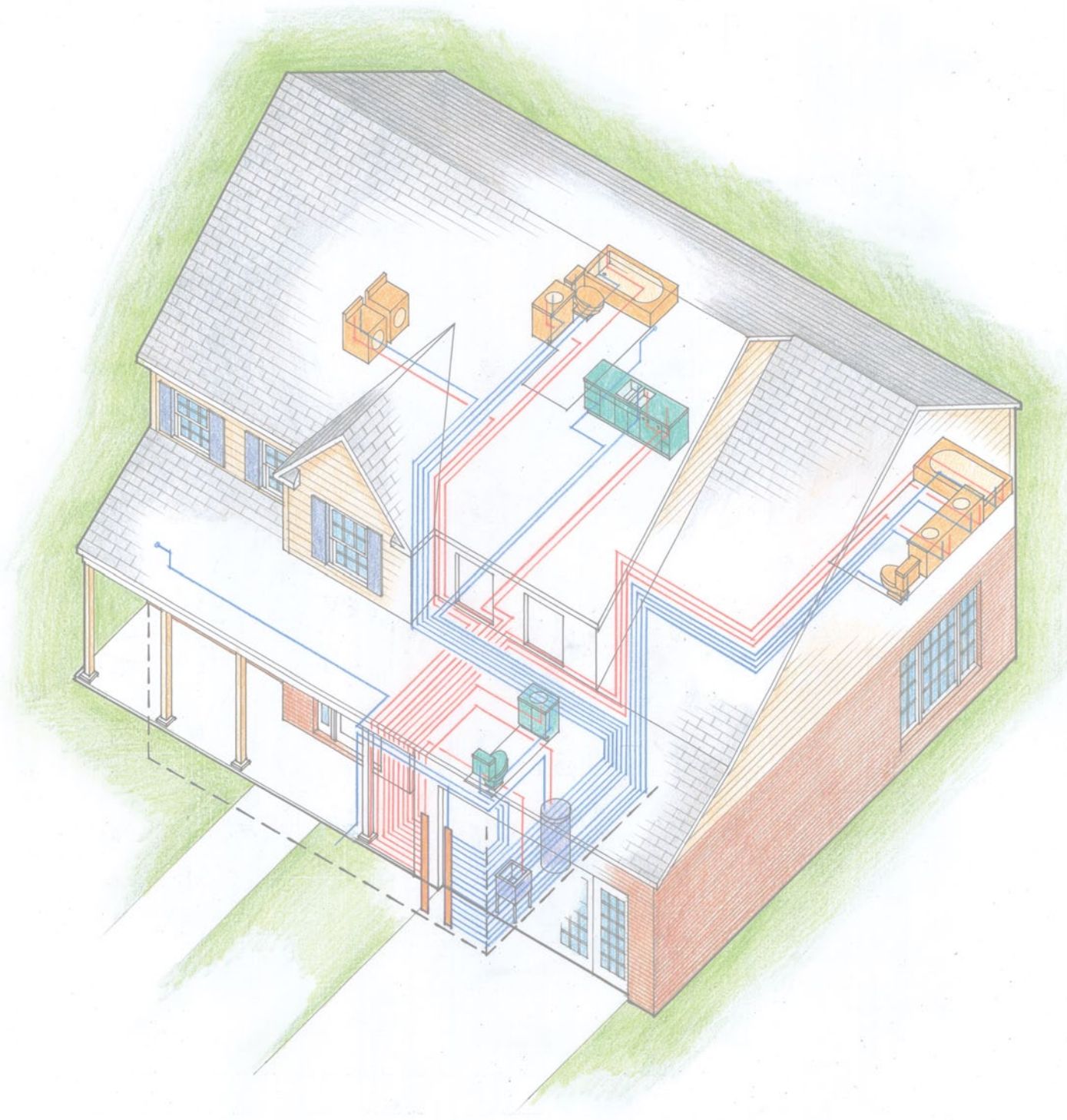
# DESIGN GUIDE

## Residential PEX Water Supply Plumbing Systems

Second Edition

Applications  
Advantages  
Material Properties  
Joining Methods  
Code Acceptance  
System Design  
Installation  
and more





# DESIGN GUIDE

## Residential PEX Water Supply Plumbing Systems

Second Edition

Prepared for



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## TYPES OF PEX PLUMBING SYSTEMS

The unique properties of PEX piping allow it to be configured in a number of different residential plumbing system designs. This section describes three layout options: trunk and branch, parallel pipe systems (parallel), and zone. By carefully choosing the right system for the application, the plumbing designer can produce a home that balances cost, installation time, environmental soundness, and performance.



### Trunk and Branch

For decades, trunk and branch (T&B) piping systems have been used by plumbers for potable water distribution using rigid plastic or metal pipe. Installation of PEX piping can be performed in a similar manner using a main trunk line to supply various branch take-offs to specific outlets. Typically the trunk line services numerous outlets while the branch line services generally one to three closely grouped outlets, such as in a bathroom. Installation of PEX piping in the T&B design follows the general design requirements established in plumbing codes.

As with rigid piping systems, use of tee and elbow fittings allows for the connection of branch take-offs from the main trunk. However, given the fact that PEX is available in long coils, the use of coupling fittings can be reduced or eliminated. Unlike rigid pipe systems, many elbow fittings can be eliminated in favor of sweep turns of the piping.

Specific features and advantages of the PEX trunk and branch design include:

- Simple system design conversion from rigid piping to flexible PEX piping
- Opportunities to reduce the number of fittings installed
- T&B systems will deliver hot water quicker during sequential flows
- T&B systems will generally supply one fixture at a higher pressure

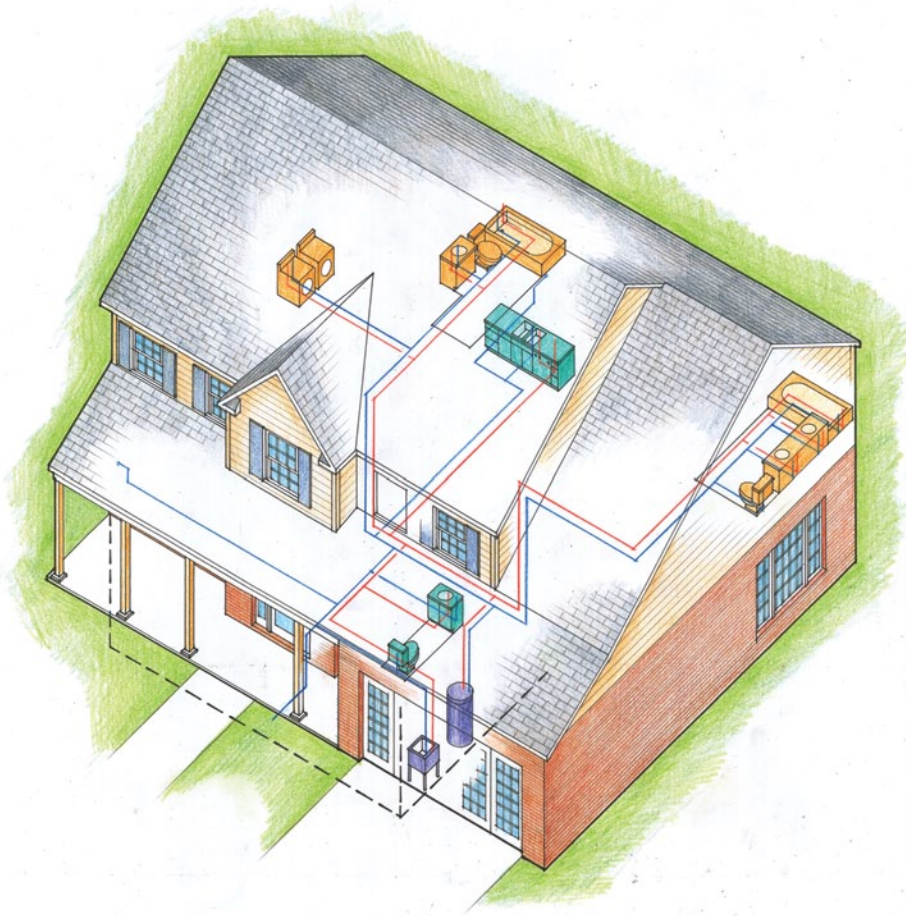


Figure 6.1 – PEX Pipes in a Trunk and Branch System Design

## Parallel

The unique features of PEX piping make it ideal for use in manifold-type system designs, commonly referred to as parallel plumbing systems. In this design, all fixtures are fed from dedicated piping that runs directly and unbroken from central manifolds. The hot water manifold should be located in close proximity to the hot water source to ensure fast and efficient delivery.

All outlets are individually fed from a common manifold or two central manifolds (hot and cold). Because inline fittings are eliminated, pressure losses along the line are reduced, allowing the piping size to be reduced for certain fixtures. Three-eighths-inch piping may be used for lower flow applications and 1/2-inch piping is recommended for higher flow applications.

The parallel system often has more evenly distributed pressure losses when flowing water to fixtures since all lines are fed from a common point, rather than adding multiple fixtures into the same pipe section. Smaller diameter pipe also results in quicker delivery of hot water from the water heater, although each line must be purged independently.

If the manifold is installed using valved outlets, many plumbing codes do not require a second valve at the fixture, speeding installation and adding convenience much like an electrical breaker panel.

Specific features and advantages of the PEX parallel design include:

- Easier piping runs to each fixture using smaller diameter piping
- Opportunity to eliminate all fittings between the manifold and the outlet
- Opportunity to have centrally located individual shut-offs housed at the manifold
- Quicker delivery of hot and cold water to the outlets
- A more stable pressure to each fixture when operating simultaneous fixtures

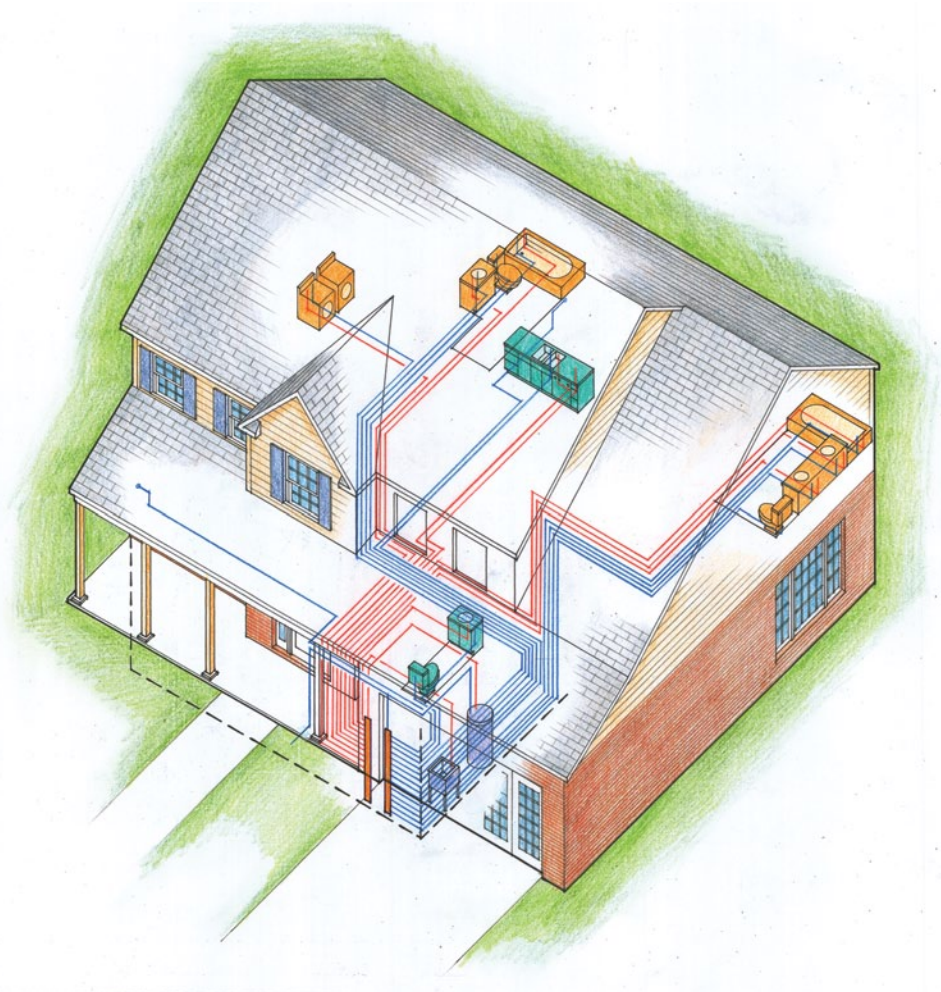


Figure 6.2 – PEX Pipes in a Parallel Design

### Zone (Zone and Multi-port Tee)

A third method for installing PEX piping combines elements of the first two systems and is typically referred to as a zone system design. The basic approach to this system is running hot and cold trunk lines to some convenient location in close proximity to multiple fixtures, such as for a bathroom group. At this point a smaller zone or multi-port Tee is installed on each trunk line. The zones or multi-port Tees can be flow-through or closed end. Individual branch lines are then run to each fixture. Manifolds with valves must be installed in accessible locations; manifolds without valves or multi-port Tees may be installed in enclosed spaces.

The zone system performs in a similar manner to the T&B system. However, it simplifies the installation due to the reduced number of fittings that are required.

Specific features and advantages of the PEX zone design include:

- Relatively simple system design conversion from rigid piping to flexible PEX piping
- Opportunities to reduce the number of fittings installed
- Quicker hot water delivery during sequential flows
- Opportunity to have centrally located individual shut-offs at each bathroom group

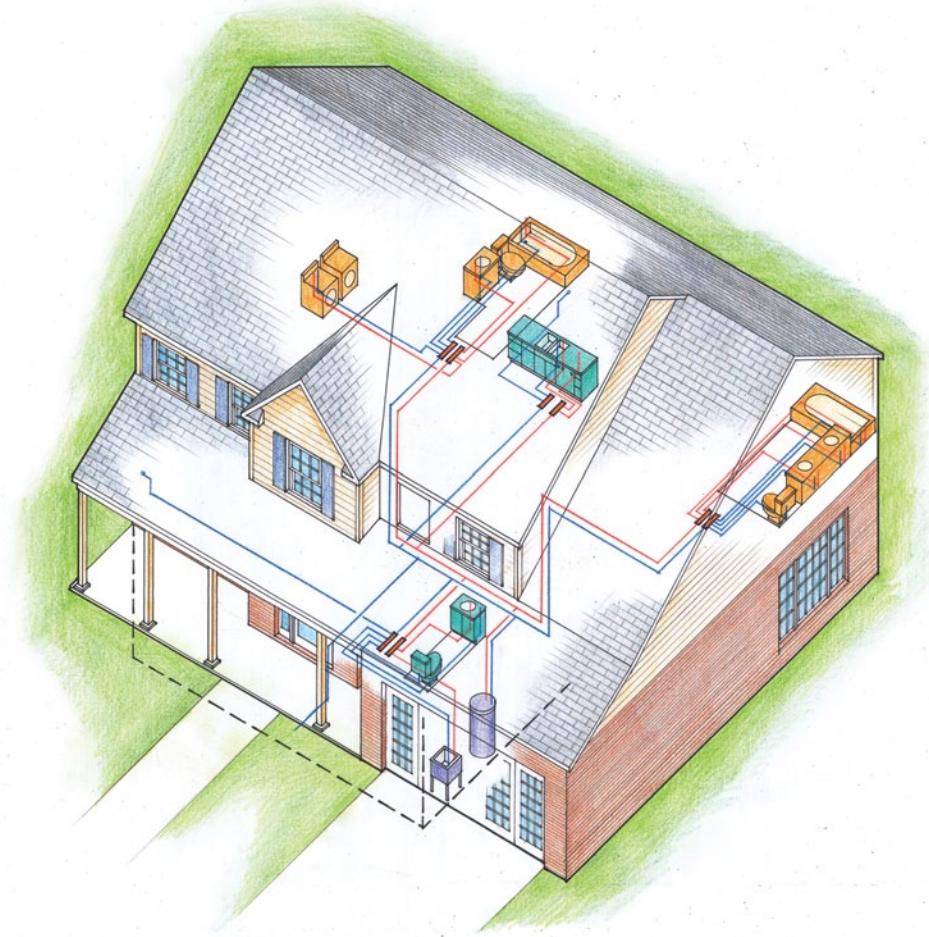


Figure 6.3 – PEX Pipes in a Zone Design



# GLOSSARY

**ASTM:** American Society for Testing and Materials

**Corrosion:** deterioration in metals caused by oxidation or chemical action

**Crosslinked polyethylene:** a polyethylene material which has undergone a change in molecular structure using a chemical or a physical process whereby the polymer chains are chemically linked. Crosslinking of polyethylene into PEX for pipes results in improved properties such as elevated temperature strength and performance, chemical resistance, and resistance to slow crack growth.

**Elasticity:** a measure of material stiffness or the ability of the material to stretch or deform temporarily under a load

**Fitting:** a device or connection that allows the PEX pipe to change direction or size, such as a tee, elbow, or coupling

**Fixture:** a device or appliance at the end of a water supply distribution pipe line. Example: lavatory, water closet, tub/shower, dishwasher

**IAPMO:** International Association of Plumbing and Mechanical Officials

**ICC:** International Code Council

**IPC:** International Plumbing Code

**IRC:** International Residential Code

**Joint:** the connection of the PEX pipe to a fitting, fixture, or manifold

**Manifold:** a device having a series of ports that are used to connect distribution lines for several fixtures

**NSPC:** National Standard Plumbing Code



**Outlet:** see fixture

**Parallel:** a plumbing design that utilizes a central manifold and distribution piping to each hot and cold water fixture

**pH:** a scale ranging from 0 to 14 that ranks how acidic or alkaline a liquid is; water with a pH below 7 is considered acidic and water with a pH above 7 is considered alkaline

**PPFA:** Plastic Pipe and Fittings Association

**PPI:** Plastics Pipe Institute

**Scaling:** process of mineral buildup on the interior of a pipe

**Test fixture:** the tub-shower unit farthest from the water source that was instrumented to measure flow rate, flowing pressure, and mixed water temperature in the lab tests

**Thermoplastic:** having the property of becoming soft when heated and hard when cooled

**Thermoset:** having the property of becoming permanently hard and rigid when heated or cured

**Trunk and branch:** a plumbing design that has a large main line that feeds smaller pipes to each fixture

**Ultraviolet:** high energy light waves found in sunlight that lead to the degradation of many plastics and materials (UV)

**UPC:** Uniform Plumbing Code

**Wait time:** the time it takes for hot water to be delivered to the Test Fixture; delivery time

**Water hammer:** a banging noise heard in a water pipe following an abrupt alteration of the flow with resultant pressure surges

**Zone:** a plumbing system that uses trunk lines from the water source to small manifolds at grouped fixtures, such as a bathroom; can be flow-through or closed end



