

Industrial Revolution

The design of every home requires compromises among different and often competing goals: comfort, convenience, durability, energy consumption, maintenance, construction costs, appearance, strength, community acceptance, and resale value. Often consumers and developers make the trade-offs among these goals with incomplete information, increasing the risks and slowing the adoption of innovative products and processes.

This slow diffusion negatively affects productivity, quality, performance, and value.

This department of Cityscape presents, in graphic form, a few promising technological improvements to the U.S. housing stock. If you have an idea for a future department feature, send your diagram or photograph and a few well-chosen words to dana.b.bres@hud.gov.

Plumbing Manifolds: Circuit Breakers for Water

Dana Bres, U.S. Department of Housing and Urban Development

Over time, the status quo for distributing water in homes has been the use of pipes in decreasing sizes that branch out to water-using appliances in the home. The plumbing manifold, which acts like a circuit breaker for water, is a viable alternative to the status quo. The manifold saves money and natural resources.

The Status Quo

The typical American home uses a series of copper pipes of decreasing size to distribute water from the building point of entrance, branching off to service water-using appliances in each room. These copper pipes are larger (typically 3/4-inch or 1-inch diameter) where water service enters the home and then become smaller as the “branches” lead toward appliances. Some homes have polyvinyl chloride (PVC) water piping as an alternative to copper. In most homes, the plumbing system is installed using sections of rigid pipe cut to length and then joined with fittings using solder or solvent. About one-half of new homes use copper pipe.

Some disadvantages of the status quo for piping in homes are as follows:

- On a recent field evaluation in Lincoln, Nebraska, installing a copper plumbing system in a modest home required 36 labor hours (4.5 labor days).
- Leaks can occur during installation and later. Each fitting and connection must perform without fail. This performance is particularly important because most of the fittings and connections will be hidden behind walls and in ceiling spaces; repairs later will be both burdensome and costly.
- Energy and water are wasted when hot water is used. The water that flows from the tap while you wait for hot water is water that was once hot (requiring energy) and is now wasted as it runs down the drain. In addition to the environmental impacts, wasted water costs include the energy to heat the water, the cost of purchasing it, and the cost of disposing of it.

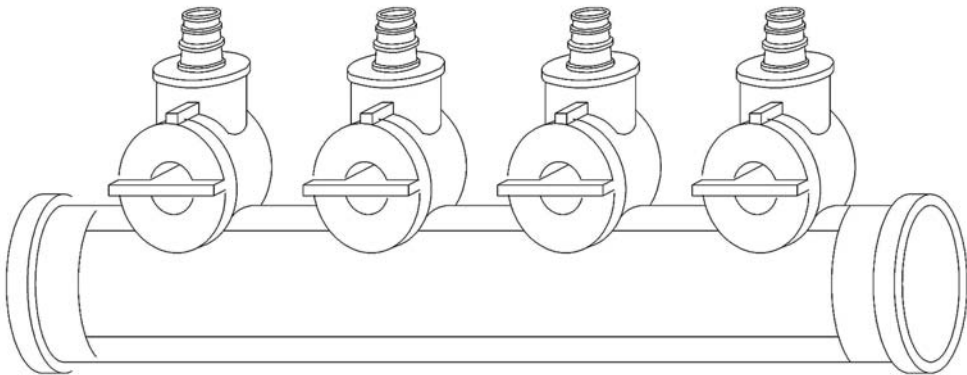
- Jobsite security has become a concern. As the cost of copper has increased, so have reports of jobsite theft, in which installed copper pipe is removed from homes under construction. In addition to losing the copper pipe, builders lose the labor associated with the installation and may have to repair other damage from the theft.

The Plumbing Manifold

Use of a plumbing manifold with flexible, cross-linked polyethylene (PEX) pipes provides a viable alternative to the rigid pipe discussed previously. With a manifold, the larger home water supply lines (both hot and cold) provide water to the manifold, which resembles an electrical circuit breaker in function. Most manifolds are about four inches wide and 12 to 18 inches tall and are wall-mounted near the water heater. Manifolds typically have a series of valves for each tube leaving the manifold (see exhibit 1). From the manifold, individual PEX water lines are run to each appliance in the home, through a separate control valve. Such systems have been described as using a “hub and spoke” approach.

Exhibit 1

Plumbing Manifolds



Some advantages of the manifold approach include the following:

- Cost of construction is reduced because significantly less labor is associated with the installation. The PEX tubing is installed from a large roll that allows for continuous sections with no connections or fittings in the walls or ceilings. In identical units in the Lincoln, Nebraska evaluation, PEX required about 20 labor hours, a savings of 2 labor days compared with the installation of copper pipes. If the Lincoln project comparison were done today, the cost savings would be even higher because the cost of copper has increased fourfold since 2003.
- Frequency and cost of maintenance are reduced because all the fittings are at accessible locations, the flexible tubes are naturally resistant to vibration, and the tubes possess some capacity to expand if the water freezes.

- Energy usage is reduced because the diameter of the PEX lines is smaller, which means less water must be flushed from the lines before hot water is delivered to the tap. Reducing the water waste saves energy, water, and the costs of the energy, water, and wastewater. Considering all costs, switching from 1/2-inch copper pipe to 3/8-inch PEX is estimated to reduce the water, wastewater, and energy costs by about 50 percent for those hot water-using appliances. (There would be no savings for the cold water system because the water is ready to use when the tap is opened.)

Other potential uses for manifolds and PEX piping could include applications in large homes or other buildings. For example, a larger, single cold water supply line could provide water to a remote bath and a tankless water heater. Plumbing manifold and PEX piping can reduce both the wait for and waste of hot water.

Manufacturers

A number of manufactures produce plumbing manifolds. The choices of which manifold to use will be based on local availability, cost, and familiarity of the system by the installers.

Sources

ToolBase TechSpecs: Home-Run Plumbing Systems.

http://www.toolbase.org/pdf/techinv/homerunplumbingsystems_techspeg.pdf.

PATH Field Evaluation: Evaluation of Residential Water Distribution Piping Installation.

http://www.toolbase.org/pdf/fieldevaluations/brighton_plumbingreporttask1.pdf.

Additional Information

The PATH (Partnership for Advancing Technology in Housing) Technology Inventory on the [toolbase.org](http://www.toolbase.org) website provides information on the use and sources of plumbing manifolds and PEX piping.