Update on Plastic Plumbing

Plumbers still prefer copper for pressure piping, but plastic has its place

by Richard E. White

In the plumbing and piping industry, as in many others, the leading contractors and engineers pay attention to new products and techniques, and innovative applications of "ordinary" materials. They are eager to produce superior jobs or do the same job less expensively. One example of successful innovation is the widespread use of plastic materials for plumbing drainage, waste, and vent piping.

While plastic drainage piping has become standard practice in most communities, few plumbers have rushed out to use plastic for water-supply piping. Residential plumbing contractors—in our area, at least—seem reluctant to accept plastic pressure piping. Codes are not the problem, as there appear to be no general code barriers.

Many Options

Part of the problem is simply the large range of available products. Few contractors know which of the many choices is the best to use in a particular application. While there are hundreds of types of plastic pipe, only four are in use for potable-water applications: PVC, CPVC, PE, and PB.

PVC (polyvinyl chloride) is available in straight 20-foot lengths in various wall thicknesses, with compatible fittings. It is used for cold-water distribution and, in some locales, for water service. The same raw material is also used to make DWV pipes and fittings.

CPVC (chlorinated polyvinyl chloride) is available in straight 20-foot lengths, with compatible fittings. It is used for hot- and cold-water distribution, and sometimes water service. CPVC is produced in various colors to aid in distinguishing the formulation and intended application. One manufacturer, for example, makes pressure piping rated 100 psig and 180°F in tan or buff, and pipe for 160 psig, 73.4°F, in blue.

Because PVC and CPVC are rigid enough to remain round under moderate loading, they can be used with fitting sockets. This is important because, since the fittings are the female part of the joint, no restriction is created in the flow path as happens with insert fittings.

PE (polyethylene) is available in coils of various lengths, with compatible fittings. It is used for water service, irrigation piping, and supply pipes from submersible pumps. The fittings are of the insert type. They are often made of nylon, but galvanized steel is popular, and some rigid plastics are also used.

PB (polybutylene) is available in coils of various lengths, and in 20-foot straight lengths, with compatible fittings. It is used for hot- and cold-water distribution and water service. PE and PB are flexible materials that are easily pushed out of round by moderate forces, so most fittings are insert types with some type of clamp. The straight-pipe PB can be used with socket fittings, with the advantages cited above for PVC and CPVC.

Weak Joints

We discussed plastic pressure piping with a representative of a major manufacturer. His version of the problem was one that we commonly hear: the joint—and not just transition joints (from metal to plastic) but joints in general. His company is putting considerable time and money into developing the ideal joint system but, to date, there have been no breakthroughs.

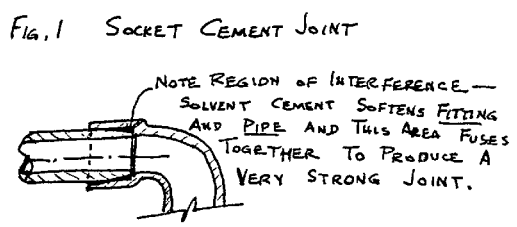
Consider the joints that are available:

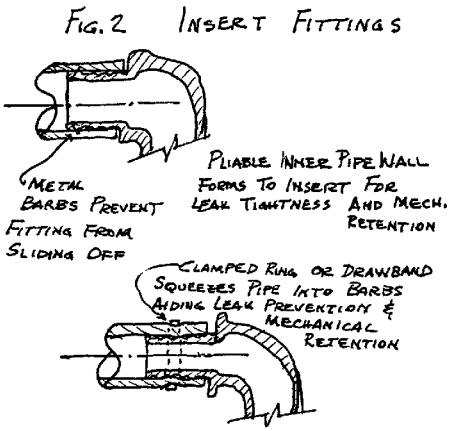
Socket Cement: In some ways, this is the best joining system. The fitting material is the same as the pipe, there is no reduction in cross-sectional area of the flow path and, after it has cured, the joint is very strong.

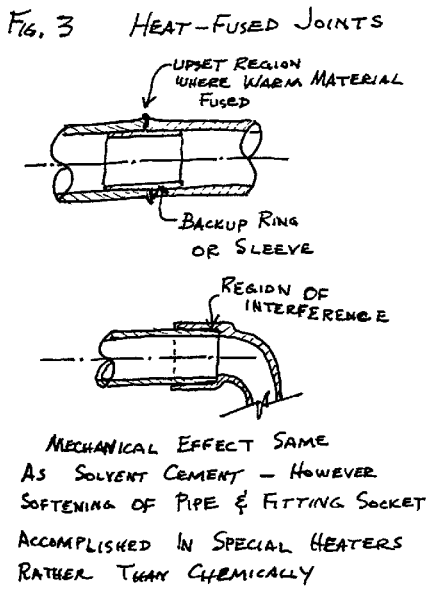
There are, however, several drawbacks the joint is applicable only to rigid plastics such as PVC and rigid PB; once made, it cannot be changed, the joint cannot be disassembled, and the total curing time may be as much as 24 hours before full pressure can be applied.

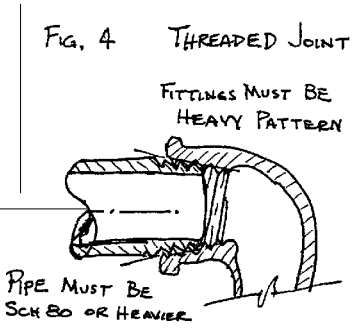
In addition, solvent cements must be worked quickly, the ambient temperature must be within fairly narrow limits, and the solvent chemicals may be hazardous—both during installation and possibly afterward as a contaminant in the water (see below).

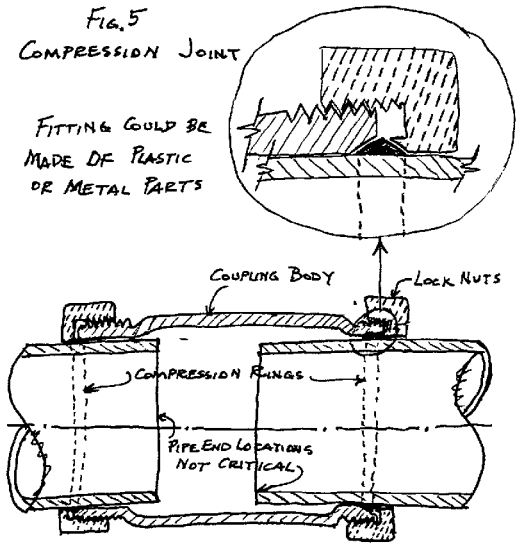
Insert Fittings: These joints are quick and easy to assemble. With some materials, insert fittings install with no external clamps. For other pipe materials, they use a mechanical clamping

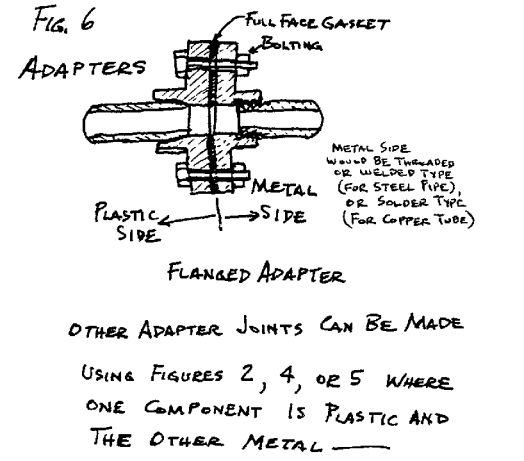












ring set with a large squeeze tool (PB) or drawn up with a worm-gear drawband (PE). Some softer materials use O-rings for seals with metal barbs that prevent the fitting from sliding off the pipe end. These fittings are rapidly assembled and disassembled—when necessary—and tolerate wide ambient-temperature changes. They are not yet entirely reliable, however.

Heat-Fused: This joint requires special tooling, considerable training, and is applicable only to PB. The joints are strong and reliable but they cannot be disassembled. This joining method has been used only on major installations because of the need for special tooling and training.

Threaded: Plastic materials that are stable in shape can be threaded if Schedule 80 dimensions are used. Such joints can be disassembled, but they need special tools and skills. Also, they are not totally reliable Threaded fittings are applicable to only one plastic (PVC) in this group. Also, Schedule 80 weights are more costly than the Schedule 40 material typically used.

Compression: Compression-style fittings are handy. They don't require precisely measured pipe lengths, are quick to assemble, and can be reused Plastic compression fittings are made for metal pipe, PVC pipe (of NPS dimensions), and rigid PB.

When joining steel pipe to steel pipe in larger diameters, we have found that plastic compression fittings will eventually leak if the pipe contents undergo 40- to 50-degree temperature variations. Plastic-to-plastic PB fittings, on the other hand, appear to be reliable. This joint seems to be the best choice for residential PB applications in ½- to ¾-inch sizes, although these fittings are expensive compared to socket cement or insert types.

Transition Fittings (Adapters)

In almost all plastic plumbing systems, sooner or later you have to tie into steel or copper. The successful transition from plastic to metal requires that the materials in contact have compatible temperature coefficients. Since plastics expand and contract roughly ten times as much as metals, most contractors who have used plastics extensively have had leaks at adapters. We believe this area—the transition from metal to plastic—is the weakest aspect of the use of plastic piping for pressure purposes.

In a commercial water-source heat-pump system that we installed, we had to change, after 15 years, all adapter fittings from threaded to flanged at all plastic-to-metal joints (sizes ranged from ½-inch to 2-inch). The failure was precipitated by the circulating water temperature dropping about 20 degrees below the usual minimum working temperature. The job was originally done with male adapters, and the trauma caused the plastic threads to shrink away from their metal counterparts. This, of course, resulted in numerous leaks that did not reseal when the water temperature returned to normal.

A Matter of Perception?

In discussing plastic piping for residential water service, we found that contractors in our area perceive many drawbacks, but no clear-cut cost benefits. Besides joint difficulties, they expect to need more hangers, and anticipate a generally less-attractive job.

Another, potentially more serious, problem is not generally recognized by contractors: plastic piping suitable for hot-water distribution is rated for a maximum of 100 psig working pressure and 180°F working temperature, but water heaters are rated for 150 psig working pressure. So pressure/temperature relief valves are set to discharge at 150 psig or 210°F.

The differences between the plastic-pipe working values and the relief-valve discharge values suggest a potential for catastrophic failure due to high pressure or temperature. The pipe, presumably, could fail before the relief valve discharged. We have been unable to get a guarantee from the manufacturers of plastic piping that this will not be a problem.

Most plastics will burn in a fire and be consumed by fire. Most will give off hazardous fumes if combustion is not complete. But these statements are true of furniture, carpeting, drapes and paneling.

Red Herrings

Some allegations about plastics are technically correct but exaggerated. One of these concerns flammability

Most plastics will burn in a fire and be consumed by fire. Most will give off hazardous fumes if combustion is not complete. But these statements are true of furniture, carpeting, drapes, wood floors, paneling, and so on.

It is also alleged that the solvents or certain components of the cements from joints will leach into the water as it passes through the joint. These arguments seem to be based on meager or trivial evidence.

While we have read reports in the magazines about cost savings with plastic, all the contractors we interviewed believe there is no significant cost difference in the typical residential job.

For industrial process piping or commercial heat-transfer piping, where larger pipe sizes are used, cost savings are definite factors in both material and labor. There are also many special-purpose systems where plastic pipe is the superior product for drainage: in a photo darkroom, radiant slabs, and situations where electrolytic corrosion is a problem. Many plastics are engineered with impressive characteristics, but these are not economical for residential use.

The residential contractors we interviewed believe copper will produce a superior job over plastic, at no cost penalty. This seems to sum up the plastic industry's problem: to convince contractors that they can produce a quality job at significant savings by changing their present practice. ■

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