

PB'S TROUBLED PAST

The industry blames plastic plumbing's early failures on poor installation, but some experts question the material itself

by Wendy Talarico

Officials at U.S. Brass may tell you, as their advertisements say, that polybutylene (PB) tubing is the greatest thing since sliced bread. But some plumbers, builders, and code officials who've seen and experienced problems with the plastic plumbing systems will tell you something different.

Comments are spoken cautiously because of a raft of lawsuits, past and pending. "It's the siege mentality," explains one spokesman at Shell Chemical Co., which manufactures the polymer from which extruders make PB pipe. "Everybody's a little skittish," he says.

The history of PB systems reads like that of a kid in and out of trouble. There is evidence of questionable field research, poor installation instructions, and optimistic warranties. Problems still occur with fittings, most notably those made of polyacetal, a material

that once dominated the market. Questions also linger about the durability of the pipe itself.

Still, some plumbing contractors, after years of use, stand by the product and continue to install it.

Residential Uses

PB is one of four types of plastic pipe suitable for use with potable water. The others are polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), and polyethylene (PE). Mobil Chemical Co. developed the PB polymer in the mid-1960s. From that time until Shell acquired the technology in 1977, PB was used primarily in commercial construction and mobile homes. By the early 1980s, Shell was promoting PB pipe for use in cold-water service from the curb line and for

residential interior systems.

Cold-water service piping is usually found in two ratings: 160 psi at 73°F and 250 psi at 73°F. Interior tubing carries a rating of 100 psi at 180°F.

The most popular interior sizes are 1/2 inch and 3/4 inch. Manifold or "home-run" systems (see "Home-Run Holds Promise," page 41) use 1/2 or 3/8-inch tubing. Cold-water service sizes are avail-

able from 3/4 inch to 2 inches, with 1 inch the most popular. Three types of fittings are available in a variety of materials. Insert fittings are made

of copper or brass. Heat-fusion fittings are made of PB. Compression fittings may be made from Noryl, a polymer made by GE Plastics, or Udel, also a polymer, made by Amoco Chemical Co. Manifolds that distribute water to individual interior lines in a home-run system are made of polybutylene, Noryl, or copper.

As for the amount of PB tubing actually in use, two extruders, Vanguard Plastics and U.S. Brass, claim PB has 8% of the national new home market. Figures on the number of existing dwellings with PB tubing range from 2.5 million to 6.5 million, depending on whether mobile homes and hotel/motel installations are included. Promoters of the tubing say it is becoming the material of choice for replumb projects.

The bulk of the installations are in the Southeast, where about 35% of the new-home market is PB. Generally you'll find it any place that has experienced heavy development in the past ten years, including California, where the state code does not allow PB, but some local codes do. (The California-based International Association of Plumbing and Mechanical Officials — IAPMO — which writes the Universal Plumbing Code accepted in most Western states, has rescinded its acceptance of PB. It cites failures nationwide as the reason. The Federal Trade Commission is investigating allegations that IAPMO's decision on PB and other plastic pipe is actually a restraint of trade, taken in response to pressure from plumbers' unions.)

PB's Pros

One advantage of PB over copper is ease of installation. The semi-rigid tubing can be snaked or fished through hard-to-get-at places. Manifold systems limit the number of fittings to two per line, reducing the potential for leaks. If the pipe does freeze, chances are it will not burst, since the plastic expands and contracts with the water (1 inch per 100 feet of tubing per 10°F temperature change). One important advantage is a 25-year warranty that accompanies some brands. In addition, the tubing is lightweight, free of air-hammer noise, and resistant to scale.

PB tubing is cheaper than copper, but the increasingly popular home-run systems use more tubing, so installed costs per home are about the same. Many plumbers say PB takes as long to install

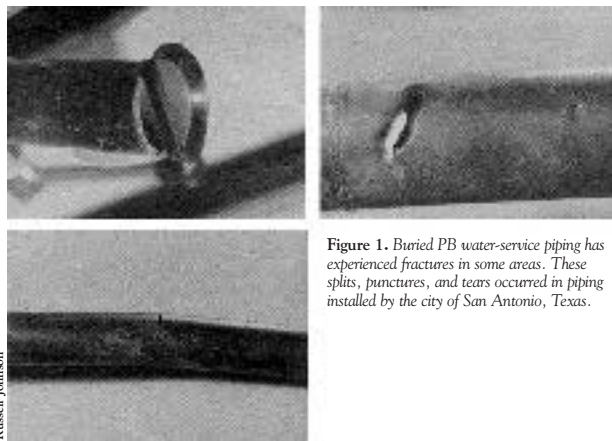


Figure 1. Buried PB water-service piping has experienced fractures in some areas. These splits, punctures, and tears occurred in piping installed by the city of San Antonio, Texas.

and sometimes longer if the crew is not familiar with it.

The Weakest Link

If a plumbing system is only as strong as its weakest fitting, PB systems which use acetal joints may be at risk. According to courtroom testimony offered by Alexander Chudnovsky, Ph.D., a scientist at the University of Illinois, acetal fittings are stressed by the pressure needed to secure the crimp rings. Tightening the rings can cause the fittings to crack, leaving the material susceptible to degradation by chlorine and other chemicals in water. Although warranted for 25 years, some of the fittings have been failing within three to five years, he says.

Substituting copper and brass for the acetal fittings leads to different problems, according to testimony by Salvatore Stivala, Ph.D., a chemical engineer and professor of chemistry at the Stevens Institute of Technology, in Hoboken, N.J. He says that copper and brass accelerate the rate of oxidation in polyolefins, the family of polymers that includes polybutylene. Oxidized PB becomes brittle, making it prone to cracking and stress fractures, he says. Other problems result from PB's tendency to expand differently than copper and brass. Something as basic as hot

water running through the plastic tubing and metal fittings will cause different expansion rates, exerting pressure on the connections. Ultimately, leaks may result, says Stivala.

The incidence of failure among Celcon and Delrin, two brands of acetal fittings, is widely documented. Problems with Celcon fittings, manufactured from an acetal copolymer produced by Hoechst-Celanese Corp., were first detected in the early 1980s. Delrin fittings, made from an acetal homopolymer produced by E.I. DuPont de Nemours and Co., Inc., were not introduced until the mid-1980s. Problems with Delrin are just beginning to appear. Acetal fittings were used in manufactured housing, until this spring. Estimates of the number of site-built houses with acetal fittings range from 500,000 to 3 million.

Jim Moriarty, a Houston attorney who has represented about 2,000 homeowners who claimed problems with fittings, says about 20,000 homes have been the subject of litigation. The number of out-of-court settlements can't be determined, but several builders told JLC they couldn't discuss the product because their own settlements bar them from doing so—a common practice in civil law.

Moriarty is one of several lawyers who say manufacturers and distributors have

not done enough to warn contractors of problems with the fittings. He says tradespeople are footing the bill for faulty products. "If you have a leak, or even lots of leaks, you don't say to yourself, 'I'm suing for fraud,'" Moriarty says. "You figure something went wrong and you fix it. These companies have left a trail of plumbers and contractors from one end of the country to the other paying out of their pockets for something that isn't their fault."

Not all plumbers agree. Gilbert Nelson, president of Nelson Mechanical Contractors, in Pensacola, Fla., is a contractor who initially had trouble with acetal fittings but still uses PB systems. In fact, he praises extruders and manufacturers for their promptness in solving the troubles he had with fittings.

Buried Problems

Russell Johnson, a Texas attorney, represents four municipalities that are experiencing widespread fractures of cold-water service piping from the curb to the house (see Figure 1). One of his clients, the Medford, Ore., Water Commission, is replacing 5,000 PB service lines with copper less than ten years after the PB was installed. Another, the San Antonio, Texas, City Water Board, received a \$28 million out-of-court settlement in 1987 from Shell along with pipe manufacturers, fitters, and wholesalers.

In a position paper, Shell blames such problems on "improper installation of fittings, inadequate backfill support for the pipe, and excessive bending of the pipe." It also says pipe samples "analyzed by leading experts in the field of polymer oxidation" showed no evidence of oxidative failure.

Testimony offered by Dr. Stivala at the San Antonio hearings, however, states that while some of the problems can be blamed on installation, the pipe is still subject to attack by oxygen in the water. Problems, he says, may occur within just three or four years—a statement that conflicts with claims by some extruders that the systems will last 50 years.

Some of the problems with cold-water service start with the installation. Julius Ballanco, senior staff engineer for Building Officials & Code Administrators International (BOCA), warns: "PB has a high rate of expansion and contraction. On a hot day the blue pipe will absorb heat from the sun. Then, once it's laid, it's buried. That lowers the temperature and the pipe shrinks, say maybe 8 inches. If the fittings are tight and the dirt is packed around it, the pipe has no place to go." Cracks may form and, over time, cause failure, he says.

Manufacturers recommend laying the pipe with sufficient slack (snaking) to avoid such problems. But even so, surrounding soil may prevent necessary movement. This is not a problem indoors, since temperatures are fairly constant and the tubing has room to move inside the studs. Yet all of the tubing will fracture if frozen and thawed more than about ten times, Ballanco says.

Instructions Blamed

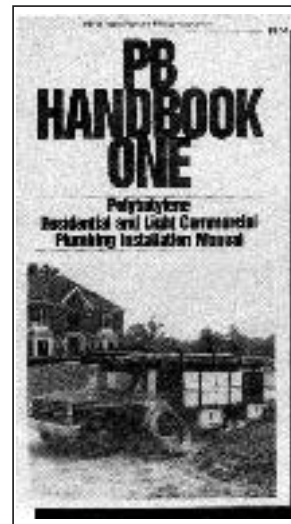
Chuck Walker, manager of PB marketing for Shell, says most of the problems, including the cold-water service fractures, can be blamed on poor installation. Most installation problems, however, resulted from inadequate and often incorrect training and instruction materials, according to many involved, including representatives from Shell.

The Washington, D.C., Suburban Sanitary District has documented about

3,000 cases of cold-water piping that has sheared off at foundation walls. The stresses and strains of settling dirt and foundations (see Figure 2) were too much for the PB tubing, says George Rose, an administrator for the Montgomery County, Md., Office of Consumer Affairs.

The Suburban Sanitary District reports: "No manufacturer's published instructions were located that detailed specific precautions at stress points, where PB is far less tolerant of abuse than copper." The report says the manufacturers' original installation guidelines "were developed based on desktop and laboratory analysis, more so than actual job-site research."

However, the training has improved. Nowadays, many field reps, trade orga-



PB Handbook One, from the Plastic Pipe and Fittings Association, is the first industry-sanctioned guide to PB installation. An updated version will be out soon.

nizations, and manufacturers are providing good instruction. And in 1988, the Plastic Pipe and Fittings Association issued PB Handbook One, the first industry-sanctioned PB installation guide (available from Plastic Pipe and Fittings Association, 800 Roosevelt Road, Building C, Suite 20, Glen Ellyn, IL 60137; 708/858-6540). The guide covers many of the key problem areas and will be available in an updated version this summer.

Learning Curve

From spokesmen for Shell to a sales rep for Vanguard, PB proponents say the systems' past woes are no different from those of any new product. "General Motors recalls new cars, don't they?" asks Keith Swinehart, chairman of the board at Vanguard.

In some cases, Vanguard has offered to re-plumb homes with faulty fittings. For builders and contractors who do have trouble with PB systems, spokesmen at Vanguard Plastics and U.S. Brass (manufacturers of Qest) suggest users contact the appropriate manufacturers at 800 numbers they provide (Vanguard: 800/851-5039; U.S. Brass: 800/356-3496).

In the meantime builders and contractors who use PB will have to keep their fingers crossed. Until the industry demonstrates that the problems have been eliminated, questions about durability and liability are likely to persist. ■

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Figure 2. In many PB water-service systems, piping has been damaged due to earth settlement (top). Problems include shearing of the tubing at the foundation wall. To prevent such failures, model codes recommend you use a rigid PVC sleeve from the foundation across the footing trench and onto undisturbed soil for a distance of 2 feet (bottom).

Russell Johnson

Wash. Suburban Sanitary District