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JANUARY 2019 | \$4.95

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The Scourge of Yellow Brass in Plumbing Fittings

Is zinc in the brass fittings too much of a good thing?



Ken Kasdan

Modern plumbing systems for potable water are generally comprised of either copper or Pex tubing, with copper pipes still being the top-of-the-line accepted standard and Pex now promoted as more durable and easier to install. Pex is now a building code-approved plumbing line, with each brand having their own International Code Council-approved report. Properly installed, the lines and fittings of different manufacturing systems are not interchangeable. Pex has been promoted by its various manufacturers as being so robust they can't even test it to failure, as one manufacturer claims. It is easy to install as it's both somewhat flexible and does not require a skilled plumber to solder the joints with a torch.

But Pex is also notorious for failures of the system, and it's not the plastic pipe, but rather the multiple fittings holding the system together. The culprit is the use of yellow brass as the alloy from which the fittings are made. The problem with yellow brass is it tends to corrode when exposed to water. Not a good thing for plumbing! Some water more than others. No yellow brass fittings are acceptable, yet some are still on the market.

The key problem is dezincification of the metal alloy. These Pex systems can be found in multiple locations in plumbing systems in single-family homes, detached, multi-family apartments or condominiums, as well as high-rise structures. Yellow brass is also likely a major component of valves and other plumbing assemblies in high-rise buildings.

In addition to Pex, the fittings on the plastic water supply lines connecting to washers, sinks, tubs and toilets have historically been made of yellow brass.



A PEX, yellow brass fitting, attaching the PEX tubing to a copper water line. The fitting is badly dezincified, with a substantial meringue deposit inside the fitting, as well as on the barbs which lie between the fitting and PEX tub.

Even if you see a plastic coupling or nut, under it generally is a yellow brass assembly. Likely it is corroding.

What is dezincification of yellow brass? It's simply the process of dealloying, with the basic metals separating themselves from the designed alloy. The zinc gets dissolved and depleted, leaving behind a weak, copper-rich porous fitting.

Generally, yellow brass is any alloy of copper and zinc where the zinc content is higher than 15 percent. Typically in Pex plumbing fittings, it has been as high as 35 percent zinc and 65 percent copper. With the implementation of federal standards to require no lead in plumbing lines, fittings have been modified. Most manufacturers have reduced the zinc to 18 percent, some much higher. One water line connector manufacturer took out the lead, resulting in an even higher percentage of zinc.

Dezincification occurs when excessive proportions of zinc are used—anything greater than 15 percent is unacceptable. The higher the zinc content, the greater the susceptibility to dezincification. Rather than this article delving into the atomic structure of the metal, and an analysis of alpha and beta brass particles in the duplex brass, what happens is the zinc dissolves out of the metal alloy, leaving behind a porous network of a weak, copper-rich alloy. As it corrodes it often generates a meringue, which is white, often with a greenish tint. The remaining brass then takes on a reddish tint.

The meringue forms outside the fitting as leaks start. It's a sure sign of dezincification. The meringue is not only an indication of a weakening fitting, but also in many circumstances the meringue forms inside the fitting itself, obstructing the waterway and

compromising the internal moving parts. Meringue is not always formed but is common.

So, why use more zinc? Because it's cheaper than copper. The spot price for copper on the London Metal Exchange as of December 2018 was \$2.78 per pound, while zinc was at \$1.21. The more copper the plumbing fitting manufacturers replace with zinc, the more money they save. A United States penny is in fact 98 percent zinc with a copper coating.

Dezincification of yellow brass is not new and has been known to be an inappropriate plumbing alloy for more than 75 years. Rarely was it used since the 1960s, but for reasons not fully understood, the awareness of the failures of yellow brass seem to have been lost to the industry. Many imported products integrating yellow brass and U.S. manufacturers have specified it. Pex manufacturers often considered themselves plastic pipe suppliers and not metallurgists, and used yellow brass.

Either the entire fitting may be yel-



A PEX fitting with the copper water line removed showing corrosion on the barbs and significant deterioration of the fitting itself.

low brass and dezincification causing leaks or water flow restrictions, or the internal components can and will dezincify, restricting proper operation of the valves.

The only way to remedy the dezincification problem is to remove and replace the yellow brass components, either the fitting or valve itself, or internal yellow brass components if they can be accessed for service.

The takeaway: Owners should consider having an experienced plumber or mechanical engineer inspect the system and look for telltale signs of yellow brass corrosion. Experienced experts generally know where yellow brass is likely to have been used. Builders, contractors and manufacturers can often be held liable for manufacturing and installing defective products, and an experienced attorney can often assist in obtaining a recovery. Here on the island, tens of millions of dollars have been recovered for owners to replace defective yellow brass.

Ken Kasdan is considered one of the nation's leading construction defect authorities. He regularly speaks at national conventions of attorneys, insurers and claims professionals. He has practiced law for over 40 years. He is the senior partner with Kasdan LippSmith LLLC, a fully staffed firm with its primary office in Oahu. He is director of client relations. Reach him at 369-8393 or at kllaw@hawaii.com.

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