MATERIAL FAILURES OF PLASTIC PLUMBING FIXTURES AND PIPING

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By Don Waltz

There are many subrogation opportunities related to water losses arising from material failures of plastic plumbing fixtures and piping. More of these claims can be expected. A greater number of these losses will occur[1] in the future given the modern use of less expensive plastic components for plumbing fixtures and piping, and the increased marketing of plumbing fixtures for installation by ordinary lay users. Generally, these losses are caused by poor product design, inadequate testing and/or improper installation.

Improper Installation

Two significant problems arise from the use of plastic components for simple plumbing fixtures and piping. First, often these components have to be tightened to the extreme during installation to prevent leakage. However, these plastic components are susceptible to damage if improperly tightened or overly tightened. For example, the tightening of the plastic nut at the inlet portion of the waterline to a toilet valve can crack if over tightened. Over time, this crack can expand until the nut fails, and leakage occurs. What makes these items particularly susceptible to failure is that today, they are often installed by the insured owner himself or his employees rather than a professional plumber. Moreover, the instructions for such plastic plumbing kits are often sketchy, at best. Given these factors, losses caused by plastic plumbing components sold directly to the consumer through hardware superstores and the like are fertile

[1] Most water loss incidents involve little or no damage. If the owner is present at the time the leakage occurs, the damage may be minimal, and may not even be reported to the carrier. Therefore, when a large loss does occur, and is caused by a particular component, it is likely that many such failures have occurred that were never reported.

ground for claims against manufacturers if the design of the product makes it susceptible to damage under normal use.

Stress Corrosion Failures and Incompatibility with Water Supplies

Often, losses occur when one of the "poly" plastics used to make a plastic fixture or pipe is exposed to some sort of environmental chemical. Polyethylene, polypropylene, polybutelene, are all of very similar chemical compositions. Often, the manufacturer may not have tested the effect of various environmental chemicals on these plastics.

One common source of failures in plastic plumbing components is environmental stress cracking in the "poly" plastics. Environmental stress cracking in these types of plastics has been known for approximately two decades. In 1981, R. A. Bruback of Dow Chemical published a paper in Polymer Magazine detailing the kinetics of environmental stress cracking in high-density propylene. Environmental stress cracking, otherwise known as ESC, can occur when the plastic is notched, or somehow damaged during installation. Another form of ESC involves a dry pore/craze structure that is formed under stress. Either one of these integrity failures can allow an outside agent to enter the material. The outside agent can be something as innocuous as water. However, it is extremely rare for plastic plumbing fixtures and components to come in contact with pure water. On the contrary, public water supplies contain chemical treatments to purify the water. Even low concentrations of these chemicals can accelerate this deterioration.

One such chemical is chlorine. Public water supplies commonly use chlorine as a disinfectant. This is added before it leaves the water treatment facilities. High levels are added at the facility because such levels are expected to diminish as the water reaches the consumer. Therefore, high levels can be found closer to the facility. Another common chemical which can accelerate the degradation of plastics is ferric chloride, which is used as a coagulant. Ferric

chloride is used during water treatment, but traces of this substance also come through to the final end-user of the product. In addition, galvanized piping and brass plumbing components can be sources of zinc. Zinc can combine with naturally occurring chlorides to form zinc chloride which can also damage plastic plumbing fixtures and piping.

All of these chemicals commonly found in public water supplies can greatly accelerate the deterioration of plastics. In addition, the environment of the plastic component is often one containing soaps, detergents, oils, or liquid bleaches. These aggressive agents, known as oxidants, appreciably reduce the stress at which cracks will form. Therefore, environmental stress cracking in plastics is a common failure, and should be accounted for by the manufacturer in the design of the product. If the manufacturer has performed inadequate testing on the components, then the manufacturer is liable under product liability theories.

One common cause of environmental stress cracking is a combination of over-tightening of the fixture coupled with environmental agents which increase the susceptibility of the plastic to stress cracks. For example, a toilet valve is connected to a toilet using a plastic nut which connects the incoming water line of the piping to the toilet valve. This plastic nut serves to secure the base of the toilet valve to the toilet tank. These nuts are often installed by the consumer. Often, it is difficult for the consumer to tighten the nut to the point that leaks will not occur. Therefore, the consumer often over-tightens the nut which creates extreme stress on the outermost threads of the nut. At this stress point, the pore/craze structure discussed above can occur. When it does, water is allowed to seep into the material and accelerate the stress cracking process. The greater amount of chemical oxidants in the water supply, the more quickly the stress cracking can occur. Eventually, the nut cracks and creates an unexpected leak. If there is no one present to recognize the leak, the leak can continue unabated and cause severe damage.

Another example concerns a filter housing which is used to contain chemicals intended to purify the water. Such filter housings typically contain a top piece and then a bottom base screws onto the top piece, and holds the chemical. These housings can be susceptible to environmental stress cracking. If the base of the housing is over-tightened, that creates a stress condition on the threads of the bottom component. In addition, the filter housing, by its design, is intended to hold chemicals which can greatly accelerate environmental stress cracking. Under these circumstances, it is easy to see how environmental stress cracking can occur, and again, serious damages can occur if leakage occurs and if this leakage occurs which is unnoticed and continues unabated.

The most well known problem arising from the use of plastic plumbing was the Polybutelene Piping litigation. Polybutelene is a form of plastic resin that was used extensively in the manufacture of water supply piping from 1978 until 1995. It was believed to be the "pipe of the future" and is also believed to have been installed in at least 6 million homes. The primary problem with the polybutelene piping pertains to its incompatibility with some water supplies. Specifically, oxidants in public water supplies, such as chlorine, are believed to react with the polybutelene piping and cause them to become brittle. Micro fractures result, and the basic structural integrity of the system is reduced. The piping system then becomes weak and may fail without warning, causing damage to the building. The greater the amount of oxidants in the water, the more likely these failures are to occur.

Another common failure mode that can occur is simple deterioration of the plastic due to hydrolytic degradation. Many plastic plumbing fixtures are made of what is known as "acetyl" plastic. Acetyl plastics deteriorate due to hydrolytic degradation. Put simply, the tensile strength of the plastics is lowered when constantly exposed to water. This deterioration is accelerated by exposure to chemicals in water.

Water losses caused by the failure of plumbing fixtures made of plastics are a fertile ground of subrogation. Often, manufacturers do not conduct adequate long-term testing to determine the affect of waterborne chemicals on plastic plumbing fixtures prior to marketing them. If they do not do such testing, and the fixture fails as a result of exposure to typical water supplies, then there certainly is a viable claim against the manufacturer for providing a defective product.

Stress Concentrations

Other failures of plastic components can occur, regardless of environmental water. These primarily occur where "stress concentrations" occur. A stress concentration occurs when a greater degree of stress is imposed on that portion of the plumbing fixture than is imposed on the remainder of the fixture. Often, the plastic portions of the fixture are not designed to withstand such stress concentrations and the component breaks. There are so many different types of stress concentrations that can occur, that it is impossible to deal with such failures in more than general terms. However, in any failure of a plastic plumbing fixture, the fact that the portion of the plumbing fixture which failed might have been "overstressed" must be considered. Often, these losses can result in viable product liability claims against the manufacturer.

Investigation

For these types of claims, there would be an immediate tendency to retain a plumbing expert to investigate the cause of the loss. That is often unnecessary. By their nature, losses caused by water leakage are easier to investigate than other claims involving fire, etc. Normally, the plumbing fixture or piping were the leakage occurred is still intact and available. Therefore, there is often no need to hire a "cause and origin" investigator to determine the cause of the loss. Rather, the important thing is to properly document the evidence at the scene, and then have the

fixture or piping examined by a materials scientist. The expert you choose should specialize in materials, but should also have some basic background in chemistry, or availability to a chemist/consultant. A material scientist can often determine whether the failure was caused by overstressing during tightening, some form of trauma, or some form of incompatibility between environmental water and the materials of which the fixture or piping is made.

Early investigation of plumbing failures is extremely important. The failed components are often very small. For example, a small piece of plastic found in the bottom of a toilet tank after a water loss can be very significant. Many times, the insured may attempt to or actually perform repairs themselves and will not understand that preserving evidence is important. It is therefore incumbent upon the claims adjuster to have an early investigation of the incident performed so that all relevant evidence is preserved. All potential responsible parties should be placed on early notice of the loss. They should be given the opportunity to examine the fixture in a condition that is as close as possible to that which existed at the time of the loss. If possible, investigators for all sides should reach agreement on what evidence should be preserved from the scene. It is very important to preserve all components of the plumbing fixture involved, not just the failed component.

Responsible Parties

The following are the primarily responsible parties who should be placed on notice of a plumbing fixture/piping loss.

1. The Installer – The installer is the first person to look to in any plumbing fixture losses. It may be that the installer made installation errors. Moreover, the installer may be deemed the "seller" of the component wherein he could be held liable for any defects in the component, regardless of fault.

2. Suppliers – Claims against wholesalers and retailers should be considered. If the product was sold to the insured for installation, it may be a type of product that should not be sold to the general public. Also, although product warnings typically come from manufacturers, sometimes warnings concerning compatibility/environmental issues should come from the retailer or wholesaler.

3. Manufacturers – Most claims arising from plastic plumbing fixture/pipe failures will be asserted against the manufacturer. These claims can include: improper selection of materials; failure to properly test materials over long term conditions; failing to properly consider and test materials for various environmental conditions and chemical exposures; and designing the components with insufficient strength.

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