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Breaking Under Pressure: Failures Associated with Pressurized CPVC Water Piping

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The use of CPVC piping for water supply systems has gained widespread usage over the years since its introduction. It offers numerous advantages over other materials, including ease of installation. However, mistakes in installation have led to some costly failures in this material.

CPVC (chlorinated polyvinyl chloride) pipe has become widely used throughout homes and other structures. It can be used for both cold and hot water supply lines, unlike its cheaper cousin, PVC pipe, which can be used only for cold water applications. The use of CPVC has been embraced by both the DIY'er (do it yourselfer) and the professional plumber. The material is lightweight, strong, flexible, non-reactive, inexpensive, and can be installed with the use of common hand tools. In short, it is nearly an ideal material. There are, however, some precautions that must be taken for the successful installation.

Strict adherence to the manufacturer's instructions is critical for any type of plastic material used for pressure piping. The failures we have analyzed have often resulted from design or installation problems. For example:

USE OF EXCESSIVE GLUE

The primer and glue used for joining CPVC pipe to its fittings are actually solvents that softens or plasticize the material, causing it to fuse together. A properly made joint will normally be stronger than the pipe itself. Most manufacturers will specify that the solvent be applied heavier to the pipe than to the inside of the fitting. When pushing the pipe into the fitting, the excess solvent on the pipe will be pushed away from the fitting. Excess solvent applied inside the fitting will tend to stay inside the fitting or the pipe. The excess solvent inside the joint can pool and soften the pipe or fitting. Unless allowed to harden over an extended curing time, the softened area can blow out like a balloon and rupture when pressure is applied. If the problem is discovered during testing, the damage can be minimized. A more significant problem can occur when the final blowout occurs at a later time when it may not be detected until significant water damage has resulted.

NO ALLOWANCE FOR EXPANSION

CPVC has a greater thermal coefficient of expansion than other materials a plumber has traditionally used. In other words, it will expand more when used in a hot water application than other materials, such as copper. If this characteristic is not considered in the design and installation, disastrous results can ensue. CPVC expands 4.7 inches per 100 feet for every 100 degree Fahrenheit rise in temperature. In a multi-story building where long runs of piping are common, it is especially important to allow for this expansion. Every straight run of pipe must be provided with a properly sized and supported expansion loop. The expansion loop will absorb the deflection resulting from thermal expansion of the pipe. In the absence of the expansion loop, the expansion of the pipe will stress the fittings to the point of failure.

IMPROPER FITTINGS

When joining CPVC to a different material, it is necessary to use the appropriate transition fitting, particularly on the hot water supply. The difference in thermal expansion of different materials must be accommodated. To connect a CPVC hot water supply to a copper fitting or a metal valve, a transition fitting with an elastomeric seal, usually a rubber O-ring, is required. Unfortunately, cheaper fittings are available for other uses, such as cold water lines, that are mistakenly used, even by experienced professional plumbers.

Strict adherence to codes and manufacturer's recommendations will generally result in a very satisfactory end product. Shortcuts often result in catastrophic, costly damage to property and a major inconvenience for the property owner. Engineers at The Warren Group are experienced with these losses and are happy to consult with you.