Improper Use of Plumbing Fittings

Most modern plumbing designs consist of two main systems, the supply system and the drain waste, vent (DWV) system. The fire suppression/sprinkler systems would be considered a third system in many commercial and large residential buildings. The supply system provides water to the building's fixtures (sink, toilets, showers, etc.). The drain system transports used water and waste away from the building, generally to a sewer or septic system. Finally, the sprinkler system provides water at high pressure and high flow rates throughout the building. Some plumbing and fitting components are designed to be used with both the supply and DWV systems whereas fire protection system fittings are almost always unique. Due to the unique requirements of each system, many fittings are suitable for only one system or the other and cannot be interchanged. The improper selection and use of plumbing fittings can lead to failure of the fitting and substantial losses.

Water supply in a building is normally provided by either the municipal water system or a well and pump. In either situation, water enters the building at an elevated pressure, typically between 40 and 80 psi (pounds per square inch). In many municipal settings, this pressure is created by the water being stored high above ground in a water tower. The force of gravity creates pressure as the water flows down from the tower. In well-based systems, water is pumped into a pressurized storage tank. Some taller buildings may also require booster pumps to maintain adequate pressure at higher floors. Supply side water pressure is required to force the water throughout the building and to provide the flow rates needed for most applications (i.e., for the full spray of a shower). The presence of water pressure in the supply system requires that all the chosen components and fittings be properly rated to handle the pressure without failure. Additional considerations are also made for higher temperature performance (e.g., hot water supply lines can exceed the temperature rating of PVC), drinking water quality, and corrosion resistance).

On the other hand, the DWV system operates entirely on gravity flow. When water drains out of a fixture, it flows continuously downhill until it reaches the sewer or septic. Also included in the DWV system are the vent pipe(s). Venting is required to prevent suctioning effects which can pull water out of fixture traps, which are designed to capture a small amount of water in a U-shaped pipe. This captured water blocks unwanted gases and odors from the sewer reaching the inhabited spaces. The vent pipes are connected to the drain and waste pipes and typically proceed to the roof. DWV fittings do not need to withstand the same amount of pressure as the supply side fittings. Most are designed to only handle the pressure created by a ten-foot water column, slightly less than 5 psi. For instance, some DWV fittings are designed to be attached and secured with hose clamps, a method that is not suitable for higher pressures. Furthermore, drain elbow fittings have gentler curves to help direct the flow in the proper direction, and T-fittings are directional with the perpendicular leg being sloped in the direction of flow. Vent fittings may or may not use gentle curves. DWV fittings are also typically larger diameter than supply fittings to help reduce flowing friction and prevent clogs.

The misuse of plumbing fittings, particularly the use of DWV fittings in pressurized applications, is fairly uncommon in most conventional plumbing applications for one simple reason. Pressurized supply systems require smaller pipe sizes, typically under 1 inch, which are not readily available in DWV fittings. However, in non-traditional applications, especially when larger pipe sizes are needed, DWV fittings may

be incorrectly used in pressurized applications leading to fitting failure and subsequent water loss or personal injury. For instance, if one needs a 3-inch pipe and fittings for a pressurized system, they may mistakenly use non-pressure rated DWV components.

In one example, a construction contractor learned that the water main which had been installed to a newly constructed building was buried too shallow due to improper surveying. The building's fire suppression system was installed and operational as the building was being made ready for use. In order to keep those activities on-going, the decision was made to install a temporary water main to the fire suppression system while the permanent main could be remedied. Because it was necessary to purge air from the new main, the contractor needed to install a tee fitting and valve immediately prior to the fire suppression system. Unfortunately, the contractor installed a DWV tee fitting and valve inside of the fire suppression room. Several days later, during a weekend when no one was around, the tee fitting catastrophically failed. Before the damage was notice and the water turned off, several feet of water flooded the building and destroyed a newly installed elevator among other damages. A major financial loss was created by the improper use of a twenty-dollar DWV fitting in a pressurized application.

Another example of mis-used DWV components occurs frequently in so-called 'potato guns'. Potato guns consist of a potato forced down the length of a long tube with pressurized air or a low-energy explosion (such as igniting hair spray) then used to force the potato out of the tube at high velocity. Based on the typical sizes and unregulated nature of these devices, do-it-yourselfers tend to use non-pressure rated DWV components in these devices which inherently must operate at pressure. As users attempt to increase the performance of their guns and the subsequent need for higher pressures, failures are all too frequent and may result in injuries.

If you are investigating a case which involves failed plumbing fittings and are interested in engaging an expert witness to support your case, please contact us at Aither Forensic Engineering.

Aither Forensic Engineering
PO Box 158
Gambrills, MD 21054

(443) 302-9994
jkiddy@aitherforensics.com
www.aitherforensics.com