Is your current seismic bracing solution helping — or harming — your CPVC fire sprinkler system?

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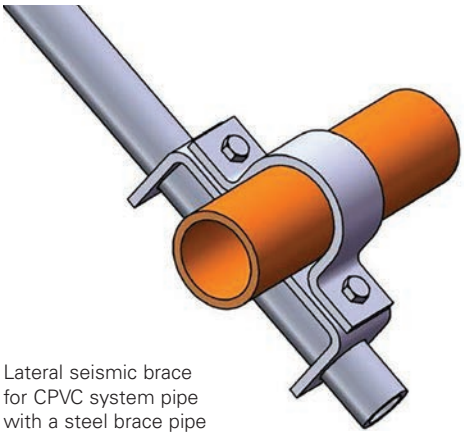
The problem

As a critical life safety system, fire sprinklers are relied upon to protect both people and property. In earthquake regions — where fires are frequently the most damaging consequence of Mother Nature's tremors — a well-designed and properly installed seismic bracing system is an essential component to any fire sprinkler system.

However, changing pipe material preference among some segments is sparking new concerns for the industry. As CPVC pipe becomes an increasingly attractive alternative to (IPS) steel, the traditional seismic bracing systems used to hang and hold these sprinkler pipes fail to accommodate the unique differences of CPVC. In fact, traditional seismic braces available on the market may be putting fire sprinkler systems at risk of failure, rather than safeguarding them as intended. Yet with properly designed seismic bracing, CPVC can be confidently deployed in applications across the industry.



Lateral seismic brace for CPVC system pipe with a steel brace pipe

What's changed?

In recent years, some portions of the fire sprinkler industry have begun to transition from steel to CPVC pipe, a move that reflects a number of advantages. One of the driving forces behind the evolution to plastic is the ability to reduce the overall size of the system pipe, resulting in less friction loss when water moves through the pipe. Both smaller and lighter than steel, CPVC pipe also occupies less room within tightly constrained applications where space is at a premium. Furthermore, plastic is more economical than steel, and is not vulnerable to fluctuating tariffs and other pricing uncertainties.

Yet for all of its benefits, the shift to plastic also presents a number of challenges when it comes to seismic bracing. The properties of CPVC vary dramatically from steel, prompting a need for critical changes to bracing solutions. If proper actions are not taken to accommodate plastic's unique specifications, sprinkler pipes can be significantly damaged — potentially leading to impairment and even catastrophic failure of critical fire systems.

While its critical to comply with code requirements, you also need to consider the impact of the use CPVC versus steel in seismic bracing applications. That's why it is essential to include seismic bracing solutions that are specifically designed for CPVC.

Assessing the differences of CPVC vs steel

Although less expensive and more efficient than steel pipe, plastic is vulnerable to cracking and degrading. Its propensity to fracture can stem from a variety of different sources, including:

- **Compression** is one of the most common threats to CPVC pipe failure. There are a number of factors that can cause pipes to compress, including utilizing the wrong type of clamp, clamping pipes too tightly, and allowing CPVC pipe to make contact with other pipes. All of these measures place significant stress on CPVC, making ultimate failure likely.

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- **Contact with oils.** Plastic is not compatible with many of the oils, plasticizers, glycols and other residues routinely found on steel brace pipes. As a result, when CPVC pipes come into contact with other pipes harboring these materials, it can lead to degradation and failure.

- **Environmental stress cracking (ESC)**. Typically occurring slowly over a period of time, ESC is caused when a susceptible material such as CPVC pipe experiences stress or makes contact with the variety of incompatible chemicals described above. While most failures tend to manifest as slow leaks, they can also result in catastrophic breaks.

- **Thermal cycling**. During thermal expansion, CPVC pipe expands and contracts five times more than steel for the same change in temperature. Because the majority of existing sprinkler braces do not allow for this type of expansion, it places significant stress on plastic, often resulting in failures, decreased water flow rates, and gouging, "egging" or scrapping of pipes.

In the past, these issues were never cause for concern because metal pipes represented the industry standard. Yet this trend is changing. In 2017, an estimated 10 percent of fire sprinkler pipe deployments were CPVC. Less than two years later, that number had more than doubled, with CPVC comprising more than 20 percent of installations. While more prominent in certain segments such as residential and lighter duty, CPVC can continue to grow as a viable pipe option if seismic bracing solutions simultaneously evolve.

One of the primary problems with traditional seismic bracing solutions currently available on the market is that they attach to pipes by clamping down on them, causing them to go out-of-round and creating a significant risk for compression. In addition, these braces allow CPVC pipes to make contact with other pipes, opening the door to interaction with potentially hazardous chemicals and oils. While these practices pose no threat to metal pipes, they place tremendous stress on CPVC.

Failing to take into account the specific requirements of CPVC pipe can have devastating consequences. Even the smallest hairline cracks can lead to failure of fire sprinkler pipes during an earthquake. Cracks can also cause leaks, with even the smallest threatening to severely impact performance since extremely pressurized water is delivered through the pipes. As a result, it is imperative for manufacturers to develop new seismic braces that are specifically designed to mitigate the special variances of plastic.

Allows for stress free expansion because the CPVC pipe is not compressed.

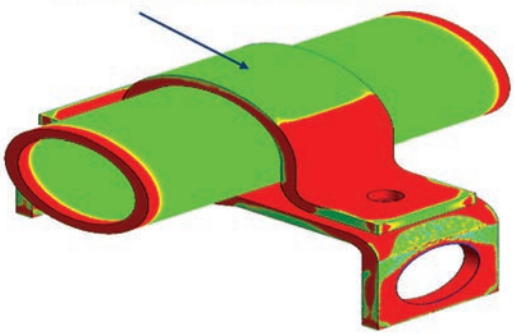

Fig. 3000 sway brace attachment for CPVC and steel fire sprinkler systems

How to remedy the potential liabilities of CPVC

The Eaton® TOLCO Fig. 3000 Brace safely and completely mitigates the disparities of CPVC. Unlike competitive offerings, the Fig. 3000's patented "gap and barrier" design prevents compression by resting between the brace member and the CPVC pipe.

In addition, with a pipe-to-system offset, the Fig. 3000 ensures that CPVC won't make contact with other pipes, thereby averting possible transfer of harmful residues. Conversely, other brace options in the market can place CPVC pipe in direct contact with other pipes, likely resulting in the transfer of incompatible oils.

By allowing for expansion, the Fig. 3000 prevents stress on CPVC even during temperature changes.

UL Listed as a sway brace for CPVC and IPS pipe ranging from 1" to 3", the Fig. 3000 is used in conjunction with a Fig. 900 series fitting and joined together with bracing pipe per NFPA 13 guidelines, forming a complete sway brace assembly.

Conclusion

In regions where earthquakes are a possibility, fire sprinklers systems require highly reliable seismic bracing. With increasing interest in CPVC as a material for these systems, it is critical that those relying on seismic bracing take into account the unique differences of plastic pipe compared to steel. Failure to do so puts fire sprinkler systems at risk of failure and poor performance.

For more than 60 years, Eaton has supported the fire protection industry with its innovative TOLCO seismic bracing products that are trusted worldwide to help combat damage from earthquakes. With exceptional quality and design, the Fig. 3000 is one of the products currently available that safely addresses the distinctive differences of CPVC pipes.

For more information, visit Eaton.com/fire-protection

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