Long-Term Integrity Of Piping Systems For Safety Performance

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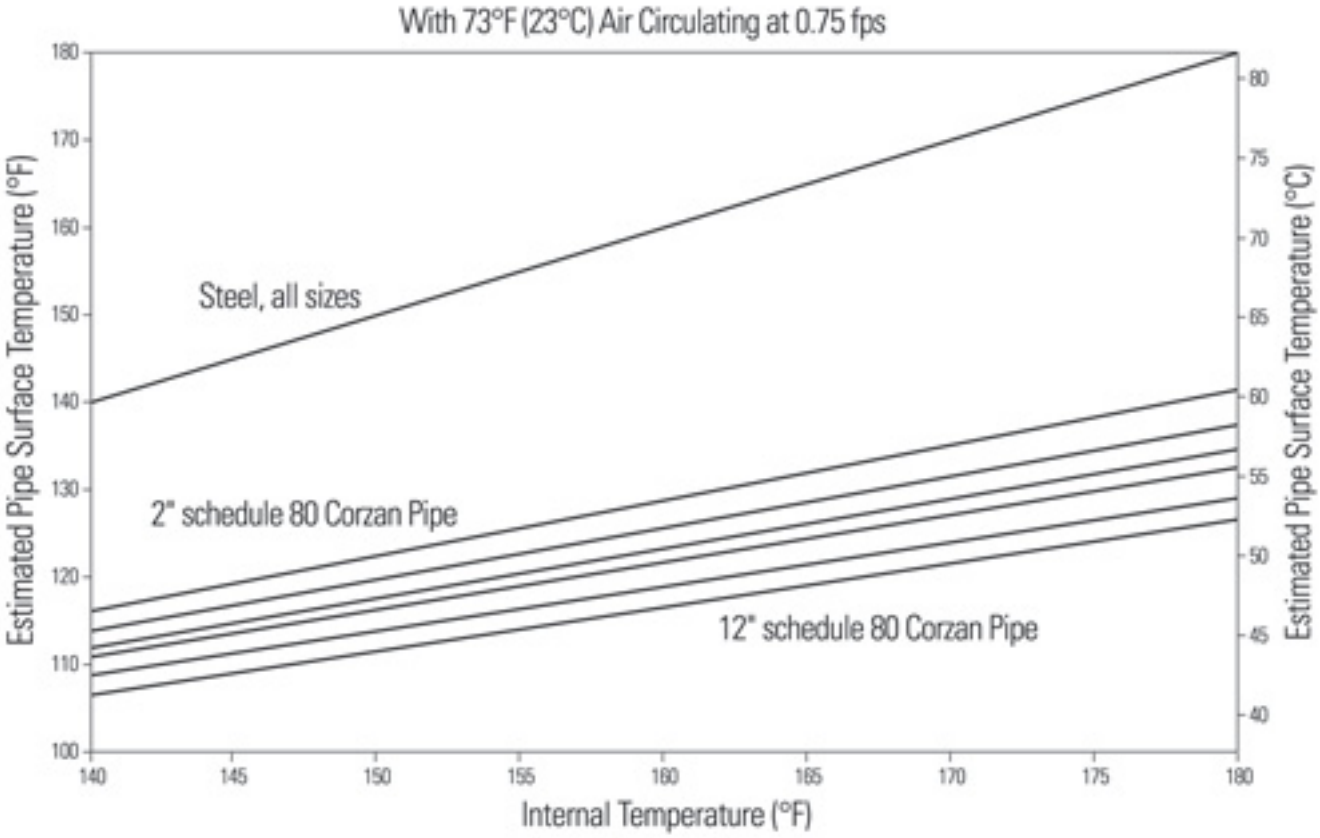

A plant’s overall safety record is determined by many things. Most manufacturers invest heavily in education and crisis-response programs designed to minimize worker injuries. As safety personnel look to identify those areas of the plant most likely to represent a safety hazard, it’s important not to overlook some of the basics. Take the plant’s piping system, for instance.

Many plants continue to transport materials in metallic piping systems. While metal has dominated the piping industry for many years, its use is coming under more scrutiny in recent years as companies seek to identify more cost-effective, reliable alternatives that contribute to a stronger plant safety record.

Regardless of the volatility of the liquid being transported through the piping system, metal pipe and fittings are vulnerable to a number of safety risks. Starting with installation, metal piping presents two primary safety hazards. The most serious is the fire risk associated with the open flame of the welding torch required to install a metallic piping system. Due to the inherent fire risks associated with welding, a metal pipe installation requires a hot work permit, which requires a time-intensive approval process.

A second safety concern during the installation process relates to the weight of metal piping. As a heavier material (relative to most non-metallic piping), metal creates the added risk of worker strains and sprains during installation. The added weight creates the additional need for heavy machinery on the job site, which can create its own safety concerns.

Once a metal piping line is up and running, a significant safety concern stems from its burn potential. Metal is a tremendous conductor, which means it transmits heat easily from the interior to the exterior of the pipe. Depending on the temperature of the fluid being conveyed, the potential for burns must be mitigated with the addition of insulation around the pipe. The conductivity of metal not only represents a safety concern, but also a cost concern, since the addition of insulation increases the overall cost of any piping project in the form of increased labor and material costs.

By far the greatest ongoing safety concern associated with a metallic piping system, however, is the risk of leaks and premature failures as a result of corrosion. Many chemicals encountered in the process industry aggressively corrode most metal equipment, resulting in process leaks, flow restrictions and, ultimately, premature failure. Not only are such leaks and failures costly, but they represent a safety hazard to plant workers.

A Safe Alternative To Metal

If these have been cause for concern, it might be effective to choose an appropriate non-metallic piping material. Chlorinated polyvinyl chloride (CPVC) offers a unique combination of benefits that make it a viable alternative with regard to safety performance.

Starting with the installation process, CPVC is sometimes preferred because it is light weight—roughly 1/8 the weight of comparably sized steel pipe. Not only does its lightweight design minimize the risk of worker injuries, but it typically eliminates the need for heavy equipment which can present additional safety risks.

CPVC also completely eliminates the fire risk of welding pipe. Instead, CPVC systems can be installed by solvent cementing, flanging or threading. Any piping modifications or pipe repairs can also be made quickly, easily, and safely without the need for a welder or lifting device to hoist equipment into place. This also means avoiding the hassle and delays of requesting a hot work permit.

Solvent cementing, which is by far the most common installation method used for CPVC industrial piping systems, creates a highly reliable joint by chemically fusing the pipe to the fitting. When installed correctly, a solvent cemented CPVC joint actually becomes the strongest part of the entire system—offering more durability than either the pipe or fitting alone. This contrasts sharply with metallic systems and other plastic piping materials for which the joint is often the most vulnerable and likely to be the source of initial leaks.

Once installation is complete, CPVC offers many additional safety advantages—starting with highly reliable performance. CPVC stands up to many of the same aggressive chemicals that corrode steel, and it does so in very extreme temperature environments. In fact, CPVC is pressure rated for up to 200 degrees F.

CPVC systems are chemically inert to most mineral acids, bases and salts, as well as aliphatic hydrocarbons. In addition, these systems are not subject to galvanic corrosion. And, not only are they immune to internal corrosion but also to external corrosion caused by salts or other corrosive elements that may be in the soil or air. Such durability and corrosion resistance make the material ideally suited, with minimized safety concerns, for a number of process industries, including chemical, pulp and paper, metal treating, chlor-alkali, fertilizers, mining, wastewater treatment and semiconductors. That's not to say that CPVC is applicable for all applications. Like metal, it also has its limitations and areas where it cannot be used safely. For example, CPVC is not recommended for use with most polar organic materials, including various solvents.

Since CPVC is a natural insulator with low thermal conductivity, it remains safe to touch (even with high internal fluid temperatures) and minimizes the risk of burn injuries. As an added benefit, it reduces the need for additional insulation to protect workers from burn injuries.

Another safety attribute of CPVC pipe and fittings is their outstanding flame and smoke characteristics. With flash ignition temperatures of up to 900 degrees F, CPVC is low on the combustibility chart—a positive indicator when considering that many other ordinary combustibles, such as wood, can ignite at 500 degrees F or less. The flash ignition temperature is the lowest temperature at which combustible gas can be ignited by a small, external flame, which means the higher the number, the less chance of combustibility.

In addition, CPVC will not sustain burning. Once the ignition source has been extinguished, CPVC will stop burning—a critical safety consideration that positions CPVC favorably over some other plastics, such as ABS, polypropylene and polyethylene—all of which may continue to burn even after the source of the flame has been extinguished.

Conclusion

There are many criteria for choosing the material for a plant's piping system. CPVC is quickly becoming another viable material option for a wide array of industrial applications because it offers a reliable, cost-effective, easy-to-install alternative. And most important to safety-conscious specifiers is the fact that it offers a number of attractive safety attributes.

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