

NOT ALL CPVC PIPING SYSTEMS PERFORM THE SAME

Newly Developed CPVC Piping Systems are Pressure Rated 25% Higher than Traditional CPVC Systems

Since its introduction to the market in 1959 by The Lubrizol Corporation, chlorinated polyvinyl chloride (better known as CPVC) has proven to be an attractive alternative to traditional industrial metallic piping systems in a wide variety of chemical process environments. Because it is inert to most mineral acids, bases, salts and aliphatic hydrocarbons, it offers a more reliable, long-term performance than many other materials, including metals and most non-metallic alternatives. In addition to its corrosion resistance, CPVC also offers high impact resistance and heat distortion temperature (HDT), making it ideal even in harsh application conditions. The end result for industrial plants choosing CPVC is longer industrial piping service life, lower maintenance costs and reduced downtime.

The distinct advantages of CPVC industrial piping result from the material's unique molecular structure. CPVC is a PVC homopolymer that has been subjected to a chlorination reaction. In PVC, a chlorine atom occupies 25 percent of the bonding sites on the backbone, while the remaining sites are filled by hydrogen. CPVC differs from PVC in that approximately 40 percent of the bonding sites on the backbone are filled with strategically placed chlorine atoms, while the remaining 60 percent of available sites are filled with hydrogen. The chlorine atoms surrounding the carbon backbone of CPVC are large atoms which protect the chain from attack. Literally, access to the CPVC carbon chain is restricted by the chlorine on the molecule and, thus, the backbone is protected.

The same chemical properties that provide CPVC with its superior chemical resistance are also responsible for its high HDT. These properties are also what make CPVC industrial pipe and fittings suitable in a wide array of industrial applications, including use in the following process industries: chemical processing, pulp and paper, metal treating, chlor-alkali, fertilizer, mineral processing, wastewater treatment, semiconductor and power generation. Wherever corrosion resistance and mechanical strength are primary considerations, CPVC should be considered.

What's the Difference?

Although CPVC as an industrial piping material has a long proven history, not all CPVC industrial piping systems perform equally. While some of the bottom-line benefits provided by CPVC are common regardless of manufacturer (including lightweight, ease of installation, low thermal conductivity, etc.), CPVC compounds are often differentiated by the level of performance they provide.

CPVC compounds are made with base resins having different molecular weights and varying chlorine contents, as well as different additives that can affect chemical resistance and long-term performance. In the same way that two different types of industrial metallic pipe will likely perform differently, it is safe to assume that two CPVC industrial pipes made from different compounds will yield different performance results. For this reason, it's important to check with your industrial piping supplier to determine the type of tests that have been conducted on that specific CPVC compound.

Lubrizol and its customers, for example, have tested hundreds of different chemicals to determine the chemical resistance with its industrial Corzan® pipe and fittings. To provide added peace of mind for installers choosing Corzan piping systems, Lubrizol has developed a Corzan industrial pipe and fitting chemical resistance program, which list the chemicals solutions that can be used with Corzan piping systems, ensuring a successful system.

Similarly, different manufacturers have undergone different types of tests regarding to minimum burst pressure requirements, dimensional tolerances, residual stress requirements, drop impact requirements and fusion property testing. It is not appropriate to assume that the test results from one CPVC compound will parallel the expected results for a different compound.

The Corzan® HP Pipe and Fitting Advantage

In addition, some leading manufacturers, such as Lubrizol, have invested heavily in R&D to produce proprietary technologies that extend the traditional boundaries of standard CPVC performance. In 2010, Lubrizol introduced to market Corzan HP pipe and fittings. Corzan HP pipe has been tested and certified by NSF International as having a pressure rating that's 25 percent higher than standard CPVC at 180 °F (82 C). Another point of differentiation worth noting in CPVC systems is the fittings. A higher pressure-rated pipe means little if the fittings cannot take the pressure, as the overall system is only as strong as its weakest point.

Lubrizol is dedicated to developing advanced fittings that add strength and dependability to the entire system, and when properly installed, are, in fact, the strongest point of the system. Through extensive research, development and work with third-party testing entities, today, Corzan HP fittings are the first and only fittings pressure rated in accordance with ASTM D2837 and PPI TR-3 with Hydrostatic Design Basis (HDB) of 4000 psi at 72 F and 1000 psi at 180 F as listed in PPI TR-4.

Cell class rating is also something worth investigating when specifying a particular CPVC piping product. Standard CPVC has a cell class rating of 23447, as defined by ASTM D1784. There is also a higher rating, which Corzan meets—24448. Products meeting this rating provide three times the impact strength of standard CPVC, resulting in fewer breaks and fractures, a lower scrap rate and easier cutting. The higher cell class also means a higher HDT—230 F (110 C) versus 212 F (100 C) for standard CPVC. This translates into a lower probability of sagging or bending. Corzan HP pipe compound is certified by NSF International to meet 24448.

The Value of Third-Party Certification

Corzan HP piping systems are the first to meet ASTM F441 material classification 4120-06. A pipe that meets ASTM F441 material classification 4120-06 will have a pressure/temperature rating of 100 psi at 180 F (82 C). By achieving the 4120-06 classification, Corzan HP pipe and fittings deliver 25 percent more strength for greater reliability under pressure.

Prior to this classification, Corzan HP pipe and fittings were certified to the requirements of NSF SE 8459. As is the case with all certifications by NSF, SE Specifications are based on highly stringent testing that is conducted over a period of time. Only products that consistently perform to the established standards are given the SE Specification. In the case of SE 8459, specifically, pipe must meet or exceed the 24448 cell class when tested according to ASTM D1784 and have an HDB of 4000 psi at room temperature and 1250 psi at 180 F.

In addition, the CPVC material used in the production of the fittings must meet or exceed a 23447 cell class and have an HDB of 4000 psi at room temperature and 1000 psi at 180 F. Only Corzan HP pipe and fittings have met these stringent requirements, which means the only way to ensure a fully pressure-rated system is to use Corzan HP fittings in combination with Corzan HP piping.

Other Considerations

Although most of this article is dedicated to explaining the chemical and physical differences between various CPVC compounds, it is also worth noting that there are critical considerations beyond the

specific product properties that can affect the long-term performance of an industrial piping system. The reputation and longevity of the manufacturer should also be taken into consideration, as well as the availability of technical support and service. Lubrizol and the manufacturers of Corzan HP systems, offer comprehensive engineering services, including the ability to perform chemical resistance testing for specific applications. Corzan Industrial Systems have been proven to perform reliably for more than 50 years of demanding industrial use. The company also offers a Quality Assurance Program to ensure consistent performance and a uniform property profile.

Conclusion

Compared to other industrial piping alternatives—metallic and non-metallic—CPVC offers a number of benefits that should be taken into consideration when installing a new line or upgrading/repairing an existing system. CPVC has proven, through years of use and extensive testing, that it possesses the chemical resistance and mechanical strength necessary to endure a wide array of harsh industrial environments. However, it must be noted that the actual performance and endurance will likely vary depending on the exact CPVC compound.

As this article demonstrated, there are many factors which affect overall performance and reliability. Fortunately for specifiers and installers, there are industry standards and certifications in place to help differentiate products based on objective, scientific results. For those industry professionals looking for the added confidence that comes from a piping system that meets the highest overall standards and requirements, there is only one system on the market today that provides the durability of a fully pressure-rated system—the Corzan HP piping system.

For more information on Corzan HP Industrial Systems, visit corzancpvc.com or call 1-216-447-7397.