

Corzan® CPVC Use in Power Generation Plants



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**

CORZAN[®]
INDUSTRIAL SYSTEMS

The information contained herein is reliable based on current information but the advertiser makes no representations, guarantees or warranties, express or implied, including any implied warranties of merchantability or fitness for a particular purpose, or regarding the completeness, accuracy, or timeliness of any information. Always consult your pipe and/or fitting manufacturer for current recommendations.

Introduction

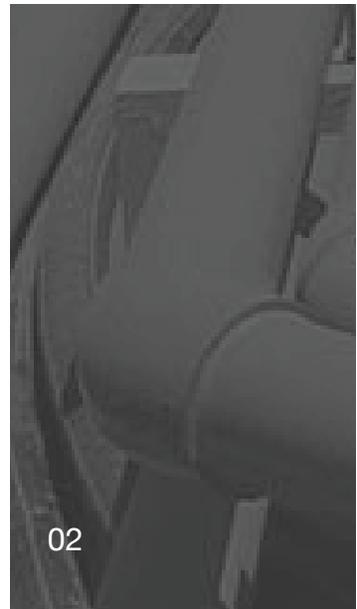
Power generation plants of all types—from gas turbine combined cycle to combined heat and power—all require the movement of large amounts of water, caustics and corrosives.

Unfortunately, due to the nature of the chemicals used and levels of heat and pressure involved, there are few pipe, ducting and liner material choices available that can provide long-term reliability.

That said, judiciously assessing these material options on a system-by-system basis can directly increase operational efficiency, minimize downtime and improve bottom-line performance.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



Material Options

Metal, specifically stainless steel and carbon steel, have been the power generation industry's go-to materials for years. They're inherently strong, and the industry as a whole is very familiar with their strengths—and, just as important, their weaknesses.

At the same time, some of metal's drawbacks end up costing power generation plants more in the long run. For example:

- Metal is susceptible to corrosion.
- Metal requires a laborious, time-intensive installation process.
- You often need hot work permits for welding.

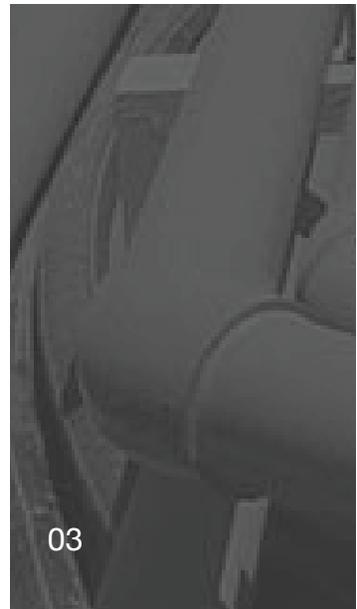
A Reliable Alternative

Corzan® CPVC (chlorinated polyvinyl chloride) has benefited power plants of all types. This technology, which was invented by Lubrizol nearly 60 years ago, has redefined where and how plastics can be used in industrial environments.

Through decades of use, CPVC has proven capable of standing up to the unique challenges of the power generation industry.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



Why Corzan CPVC for Power Generation?

Corzan CPVC is a specialized, high-performance thermoplastic designed for use in aggressive industrial environments, including power plant systems. Unlike other thermoplastics (i.e. PVC), Corzan CPVC stands up to heat and pressure while offering superior resistance to corrosives and caustics. In addition, its lightweight and easy joining process can generate substantial installation savings.

Specifically, Corzan CPVC can:

- Eliminate internal and external corrosion concerns.
- Reduce installation time and costs.
- Lower life-cycle costs, as well as maintenance and corrosion monitoring.
- Provide excellent hydraulic capabilities.
- Minimize total system costs with stable material prices.
- Limit delays because parts are widely available.

In addition, Corzan® piping is available in diameters up to 24 inches to satisfy most power plant requirements.

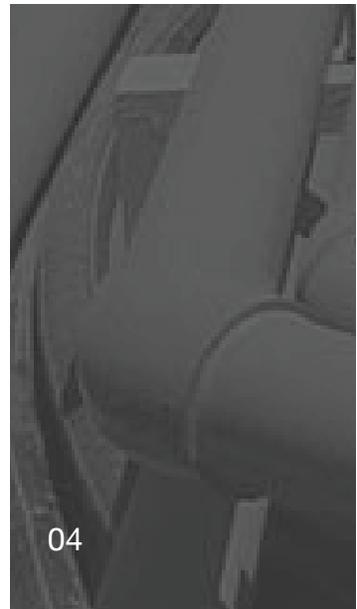
Corzan CPVC Stands Up to the Most Aggressive Chemicals

Corzan CPVC provides superior, long-term resistance to corrosive chemicals, seawater and demineralized water, even at high temperatures. In fact, CPVC pipes and fittings effectively stand up to most acids, bases and salts. It can also reliably handle the aggressive chemicals commonly encountered in power generation plants, including:

- Hypochlorite
- Caustic soda
- Sulfuric acid



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



- Sodium sulfite
- Ferrous chloride
- Ferric chloride
- Hydrogen sulfide
- Alum

Installation

From an installation perspective, Corzan CPVC offers significant opportunities over metals. All metal piping requires a complex welding process, which includes:

- A designated welding area.
- Costly hot work permits.
- An experienced, certified welder.
- Weld x-rays.

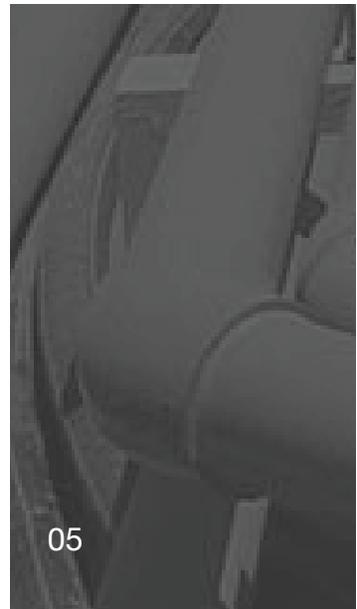
It's a long, labor-intensive process that can prove costly for power plants. In addition, metal is heavy, which complicates moving the material around a plant and securing it in place.

Conversely, CPVC is lightweight, allowing it to be easily moved around a facility, often without specialized machinery. It can also be easily joined using two primary methods:

- **Solvent Cement:** Solvent cement can be applied anywhere without heat or flame. It molecularly fuses the CPVC material together, creating a strong joint. New plant construction or large system updates benefit most from solvent cement installations.
- **Mechanical Coupling:** Mechanical couplings can join CPVC to CPVC or CPVC to any other piping material, including metal. This method is great for immediate piping repairs where timely replacement can limit the cost of system downtime.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



When specifying a mechanical coupling, it is important to assess the gasket material to ensure it is compatible with the CPVC material and fluids being transferred. An improper gasket selection can weaken the system and lead to leaks.

Where Can Corzan CPVC Be Used in Power Plants?

CPVC is used by all types of power generation plants, including nuclear, coal combined cycle and CHP plants. The material has a proven track record of providing reliable piping, ducting and liners that mitigate corrosion issues and prolong the life of a system.

Existing power plants often turn to CPVC for emergency repairs because the piping is readily available and can be installed and tested quickly using mechanical couplings.

New power plants and plants looking to upgrade or replace existing systems rely on Corzan CPVC because of its low installation costs and long-term, corrosion-free capabilities.

System Specific Applications

Corzan CPVC surpasses other materials from a performance and cost standpoint in the following applications:

- Underground cooling water loops.
- Cooling tower risers and headers.
- Boiler feed systems.
- Condensate return water systems.



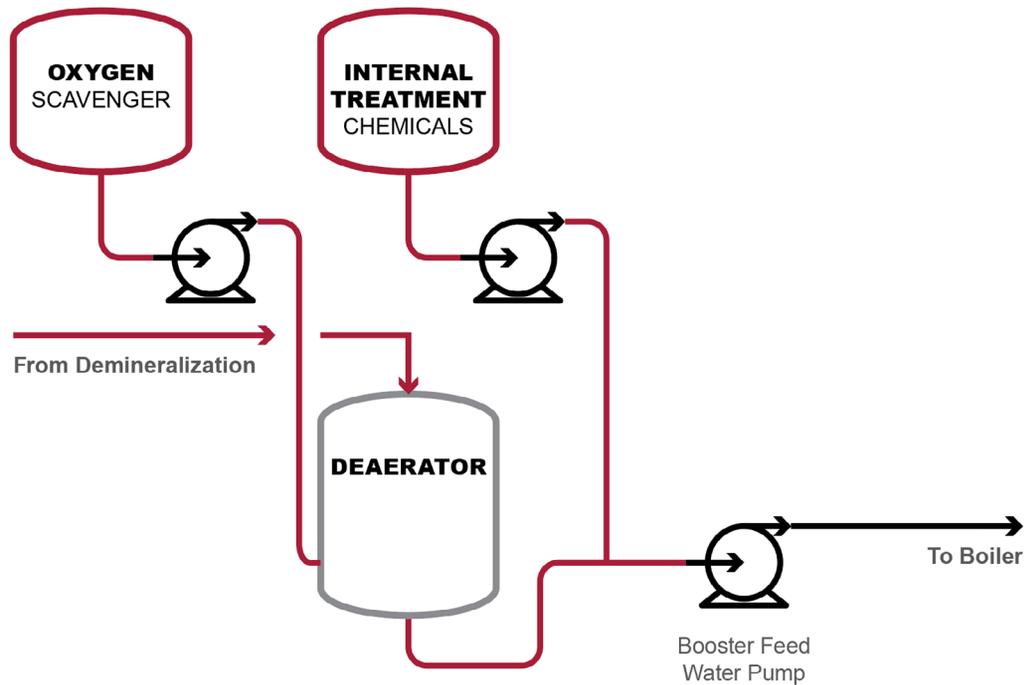
Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**

- Flue gas desulfurization systems.
- Environmental systems (for coal-fired steam plants).
- Wastewater treatment facilities.

Following are three specific instances within a power plant where Corzan CPVC can generate value both in the short and long term.

Boiler Feed Water Systems

Boiler feed water systems treat and transport water to the boiler, which in turn creates the steam that turns the generator turbines. To ensure the long-term reliability of the turbine blades, the feed water must be ultra-pure. Otherwise, corrosion and scale can weaken the blades.



The above diagram shows a boiler feed water treatment system. The red indicates where Corzan CPVC pipes, fittings and liners can be used to improve the life and effectiveness of the system.

Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**

Proper boiler feed water treatment involves effective and reliable delivery of chemicals to remove corrosive substances, balance pH levels, and limit the conductivity of boiler water.

Specific treatment chemicals are introduced into the feed water at strategic points. Some of these treatment chemicals include:

- **Oxygen Scavengers:** Sulfite-based oxygen scavengers remove any trace of oxygen that remains after the water has passed through the deaerator. Oxygen is a catalyst for corrosion.
- **Scale Inhibitors:** Phosphates are introduced into the boiler feed water stream to bind to the calcium ions and keep them from binding to metal parts, which can lead to scaling.

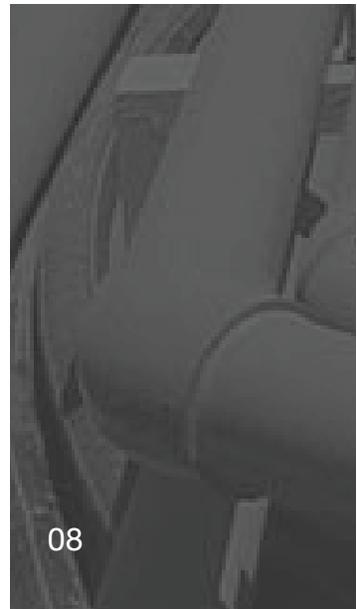
The material used for the tank liners and piping in which treatment chemicals are stored and delivered is a very important consideration. Chemically treated water threatens the strength, flow rate and pressure of these systems without the proper material because:

- Sulfites in high concentrations can be corrosive to many common types of metallic materials.
- Acid phosphate solutions can also be corrosive to metallic feed systems.
- Orthophosphate treatments can produce deposits in the feed line.

CPVC's nonmetallic construction eliminates corrosion and scaling concerns, as well as any chance of re-introducing metal to the feed water stream after treatment.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



Cooling Water Loop Circulation

Cooling water loops play an essential role in the power production process. After turning the generator turbines, steam must be cooled to convert it back to a liquid. In addition, this cooling process helps to limit heat transfer to the surrounding environment, satisfying regulations and improving plant efficiency.

In many power plants, this is done by passing the steam across pipes circulating colder water within in a flue, stack or condenser. These cooling systems are either:

- **Once-through systems**, which pull in water from a nearby water source, circulate it through the steam, and then pump the water back into the water source a few degrees warmer.
- **Wet-recirculating (closed-loop) systems**, which recirculate the cooling water. The steam-heated water is cooled by exposing it directly to ambient air, often blowing against the water flow. In larger plants (10+ MW), this process occurs in a cooling tower that can be up to a kilometer away. In small plants, the water is fed through a chiller system.

Where Piping Material Matters

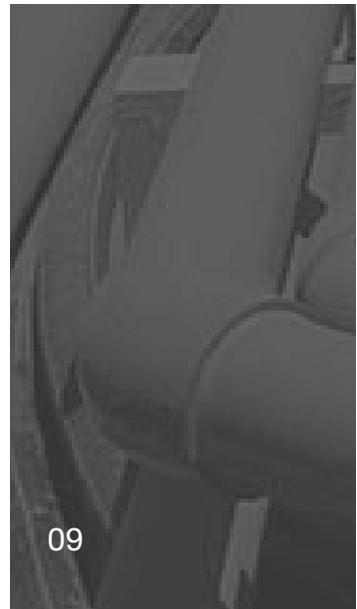
Installation

In both cooling systems, the weight of the piping material and ease of installation can have significant impact on installation cost and maintenance. Metal piping is six times as heavy as Corzan CPVC, and in almost all scenarios, requires hot joint welding. Installing these piping systems over long distances or through a building can require significant time investment from highly skilled labor, which can escalate installation costs.

Corzan CPVC's light weight and solvent cement welding process makes



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



it easy for fewer installers to lay and join the piping system, without specialized equipment or extensive training. All tools and materials for either solvent welding or mechanical couplings can be obtained locally.

Water Source

Power plants draw water from the nearest body of water, which along the ocean coast is likely salt water. Salt is highly corrosive to metal piping, limiting its lifespan or requiring an expensive coating. On the other hand, Corzan CPVC does not react to the salt water, ensuring a longer life span with little required maintenance.

Biofilm Removal

Water pulled from nearby sources will often include microbial contamination, which can build up within cooling lines and towers. This biofilm accumulates through microbial slimes, which are masses of microscopic organisms and their waste products. This slime reduces heat transfer efficiency, as the slime can serve as an insulator.

The smooth internal surface of CPVC pipe and fittings provides fewer footholds for bacteria to attach and multiply. CPVC is also resistant to the waste products of bacteria, which can cause corrosion in metal.

Wet Scrubbers

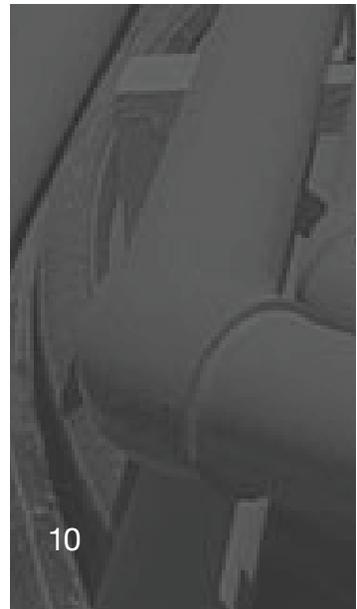
A scrubber is a system that cleans or purifies air by removing gasses, particulates, or otherwise harmful compounds from a system's emissions.

Power plants require scrubbers and combustion vents to remove particulates from the generator or boiler. For example, coal power plants rely on scrubbers to remove sulfur dioxide emissions from exhaust gas.

In any scrubber that handles corrosive compounds, Corzan CPVC is a viable choice for tank lining, drain piping, and more. Wet scrubbers in



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



particular, which use continuous sprays of neutralizing fluids to control harmful emissions, benefit from the chemical compatibility of Corzan CPVC to improve the performance and overall lifespan of the scrubber.

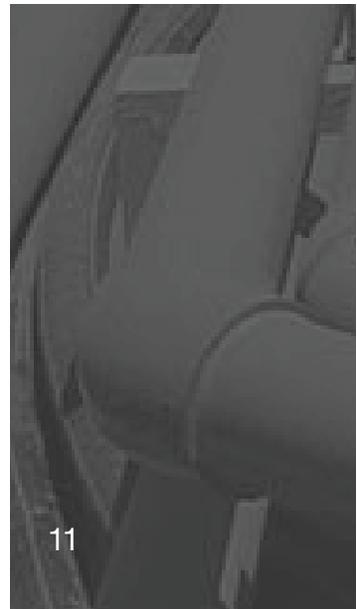
The neutralizing fluids in wet scrubbers are usually lime-based or sodium hydroxide caustic fluids, which can be corrosive to materials like stainless steel. The neutralizers can form condensation on the inside wall of the metal scrubber's tank, which causes pitting corrosion over time. Corzan CPVC, however, can stand up to these harmful chemicals with limited degradation.

CPVC Scrubber Applications

- **The venting duct:** The gasses being carried to the scrubber can be corrosive, so metals and other materials may not withstand constant exposure.
- **Chemical delivery:** Often, the liquid neutralizer is itself a corrosive chemical and requires a resistant pipe to deliver it to the tank. Examples of scrubbers with this specification include caustic scrubbers and sulfuric acid scrubbers.
- **The scrubber tank:** The inside of the tank is commonly a corrosive environment due to the chemicals being sprayed into the gas stream, as well as the gas stream itself. This is where pitting corrosion becomes an issue for materials such as stainless steel.
- **Drain piping:** Finally, once the neutralizer and the gas stream mix and a new compound falls to the bottom of the tank, it can be corrosive in nature. In this case, CPVC pipes and fittings are a strong choice for the drain piping.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



Is Corzan CPVC Right for your Power Plant?

As with all materials, quality matters. While some of the advantages covered in this guide are inherent to all CPVC materials, the quality of the CPVC's engineering determines the range of chemicals, heat and pressure it can withstand.

Corzan Industrial Systems has a long, proven history of reliable service to power generation plants. Our material provides an excellent balance of properties to improve reliability and user confidence. It also reduces capital and life-cycle costs, and, most importantly, allows power generation plants to stay operational and more productive.

To determine if Corzan CPVC is right for your power plant or a specific system within, please [schedule a free consultation with our technical support team](#). They can provide a free process suitability review and offer a transparent assessment of whether our material can satisfy your plant's needs.



Where Can
CPVC Be Used to
**Optimize Plant
Performance
and Reliability?**



CPVC Use in Power Generation Plants



Please contact us about any caustic and corrosive applications you may have.

www.Corzan.com



The information contained herein is reliable based on current information but the advertiser makes no representations, guarantees or warranties, express or implied, including any implied warranties of merchantability or fitness for a particular purpose, or regarding the completeness, accuracy, or timeliness of any information. Always consult your pipe and/or fitting manufacturer for current recommendations.