

Chemical Resistance Guide of PVC Pipe

1st Edition



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ABOUT LEDES

Ledes is a leading global manufacturer designer of electrical conduit pipes and fittings. Ledes offers a complete line of electrical conduit and fittings, includes:

- **UL651 rigid PVC conduit, DB120 PVC conduit, UL1653 ENT, and fittings.**
- **CSA rigid PVC conduit, DB2/ES2 PVC conduit, ENT, and fittings.**
- **AS/NZS 2053 PVC conduit and fittings.**
- **Extremely UV resistant solar conduit and fittings.**
- **Low smoke halogen free conduit and fittings**

We honor environmentally friendly materials from all over the world, apply the most advanced production equipment and process technology, and customize manufacturing to meet the most requirement of specific global customers.

Chemical Resistance Guide of PVC Pipe

Introduction

PVC pipe, a staple in construction, plumbing, electrical, and industrial applications, often goes unnoticed despite its crucial role in fluid transport. Its widespread use stems not only from its affordability and durability but also from its remarkable resistance to a wide range of chemicals. This post delves into the chemical performance of PVC pipe, examining its resilience against various substances and highlighting its suitability for diverse applications.

PVC Pipe: A Chemical Resistance Champion

PVC, or Polyvinyl Chloride, possesses an inherent resistance to many chemicals due to its strong carbon-chlorine bonds within its molecular structure. This inherent resistance, combined with the smooth, non-porous surface of PVC pipe, makes it an ideal choice for transporting a variety of fluids, even in challenging environments.

PVC should not be used with esters, ketones, ethers and aromatic or chlorinated hydrocarbons because PVC will absorb these substances, and this will lead to a reduction in tensile strength.

Facing Chemical Challenges: What PVC Pipe Can Handle

PVC pipe demonstrates excellent resistance to a wide spectrum of chemicals, including:

- **Acids:** PVC pipe can withstand exposure to many inorganic acids, such as hydrochloric acid, sulfuric acid, and nitric acid, even at relatively high concentrations. This makes it suitable for industrial applications involving acidic solutions.
- **Alkalis:** While PVC's resistance to alkalis is generally lower than its acid resistance, it can still handle exposure to weak alkalis like sodium hydroxide and potassium hydroxide at moderate concentrations.
- **Salts:** PVC pipe exhibits good resistance to salt solutions, making it suitable for applications involving seawater, brine solutions, and de-icing salts.
- **Organic Solvents:** PVC pipe generally resists many organic solvents, such as alcohols, aliphatic hydrocarbons, and some ketones. However, it's crucial to note that certain solvents like aromatic hydrocarbons (e.g., benzene) and chlorinated

hydrocarbons can cause swelling or degradation. Compatibility should be carefully assessed for specific solvents.

- **Oils and Greases:** PVC pipe generally shows good resistance to oils and greases, making it suitable for applications involving lubrication or exposure to these substances.

Factors Influencing PVC Pipe's Chemical Resistance

While PVC pipe inherently possesses good chemical resistance, several factors can influence its performance:

- **PVC Formulation:** The specific formulation of the PVC used in the pipe, including additives like plasticizers, stabilizers, and fillers, can significantly impact its chemical resistance. Different formulations are tailored for specific applications and chemical exposures.
- **Temperature:** Elevated temperatures can reduce PVC's chemical resistance. It's crucial to consider the operating temperature range when selecting PVC pipe for chemical exposure.
- **Concentration and Duration of Exposure:** Higher chemical concentrations and prolonged exposure can lead to more aggressive attack and potential degradation. Always consult chemical compatibility charts for specific information.
- **Mechanical Stress:** The presence of mechanical stress, such as high pressure or constant vibration, can accelerate chemical attack, particularly in the presence of aggressive chemicals.

PVC Pipe Chemical Resistance Data Sheet

POLYVINYL CHLORIDE (PVC) CHEMICAL RESISTANCE DATA			
Chemical	Concentration	Corrosion Resistance	
		20°C(73°F)	60°C(140°F)
Hydrochloric acid	tc	Good	Good
Sulfuric acid	10%	Good	Good
	50%	Good	Good
	98%	Good	Weak
	Smoke	Weak	Weak
Nitric acid	25%	Good	Good
	50%	Medium	Weak
	75%	Weak	Weak
Hydrobromic acid	50%	Good	Good
	100%	Good	Good
Hydrocyanic acid	10%	Good	Good
Hydrofluoric acid	60%	Good	Medium
Aqua regia		Weak	Weak
Sulfite	30%	Good	Good
	50%	Good	Good
	98%	Good	Weak
Carbonate	100%	Good	Good
Borax	sat	Good	Good
Boric acid	sat	Weak	Good
Staphyl acid	20%	Good	Medium
	80%	Good	Weak
Phosphoric acid	50%	Good	Good
	95%	Good	Medium
Silicic acid	100%	Good	Good
Formic acid	100%	Good	Good
Acetic acid	10%	Good	Good
Monochloroacetic acid		Good	Good
Dichloroacetic acid	50%	Good	Good
	100%	Good	Medium
Trichloroacetic acid	50%	Good	Good

Chemical	Concentration	Corrosion Resistance	
		20°C(73°F)	60°C(140°F)
Propionic acid	50%	Good	Good
	100%	Good	Medium
Butyric acid	100%	Good	Medium
Citric acid	sat	Good	Good
Glacial acetic acid	96%	Good	Medium
Glyoxylic acid	50%	Good	Good
Oxalic acid	sat	Good	Good
Lactic acid	100%	Good	Good
Maleic acid	sat	Good	Good
High fatty acids containing 6 carbon atoms	100%	Good	Good
Oleic acid	100%	Good	Medium
Perchloric acid	20%	Good	Good
	50%	Good	Medium
	70%	Good	Weak

Chemical	Concentration	Corrosion Resistance	
		20°C(73°F)	60°C(140°F)
Phthalic acid	50%	Good	Good
Stearic acid	100%	Good	Medium
Succinic acid	50%	Good	Good
Amyl acetate	100%	Good	Good
Butyl acetate	100%	Good	Good
Ethyl acetate	100%	Medium	Weak
Dichloroethylene	100%	Weak	Weak
Dichlorobenzene	100%	Medium	Weak
Crude oil	100%	Good	Medium
Ketone		Good	Good
Acetone	100%	Good	Good
Propylene alcohol	96%	Good	Good

Chemical	Concentration	Corrosion Resistance	
		20°C(73°F)	60°C(140°F)
Benzyl alcohol	100%	Good	Good
Methanol	100%	Good	Good
Ethanol	96%	Good	Good
Ammonium hydroxide	tc	Good	Good
Sulfur dioxide	tc	Good	Good
Sulfur trioxide	100%	Weak	Weak
Aniline	100%	Good	Medium
Benzaldehyde	100%	Good	Medium
Benzene	100%	Medium	Medium
Ethylene glycol	100%	Good	Good
Glycerin	100%	Good	Good
Formaldehyde	40%	Good	Good
Cresol	90%	Good	Good
Toluene	100%	Medium	Weak
Xylene	100%	Medium	Weak
Phenol	tc	Good	Good
Ether	100%	Medium	Medium
Napthalene	100%	Good	Medium
Chlorobenzene	100%	Medium	Weak
Methylene chloride	100%	Weak	Weak
Chlorine	100%	Medium	Medium
Chlorine liquid	100%	Weak	Weak
Fluorine	100%	Weak	Weak
Bromine	100%	Weak	Weak
Oxygen	100%	Good	Medium
Ozone	100%	Medium	Weak
Sulfur	100%	Good	Good
Sodium hydroxide	50%	Good	Good
Phosphate (or) esters	sat	Good	Good
Nickel salts	sat	Good	Good
Copper salts	sat	Good	Good
Salts, chlorides	sat	Good	Good
Nitrates	sat	Good	Good

Applications Showcasing PVC Pipe's Chemical Prowess

PVC pipe's exceptional chemical resistance makes it a top choice for a wide range of applications:

- **Chemical Processing and Transport:** PVC pipe is extensively used in chemical plants for transporting corrosive chemicals, acids, and alkalis.
- **Water Treatment and Distribution:** Its resistance to chlorine and other water treatment chemicals makes PVC pipe ideal for water treatment plants and distribution systems.
- **Wastewater Management:** PVC pipe's resistance to sewage and chemicals makes it a reliable choice for sewer lines, drainage systems, and wastewater treatment facilities.
- **Irrigation Systems:** PVC pipe's durability and chemical resistance make it suitable for irrigation systems, handling fertilizers and other agricultural chemicals.
- **Industrial Applications:** PVC pipe finds use in various industries, including mining, plating, and manufacturing, for transporting chemicals and wastewater.

Conclusion: The Durable and Reliable Choice

PVC pipe's exceptional chemical resistance, combined with its durability, ease of installation, and cost-effectiveness, makes it an indispensable component in numerous applications. Understanding its chemical limitations and selecting the appropriate PVC formulation for specific chemical exposures ensures its long-term performance and reliability.

