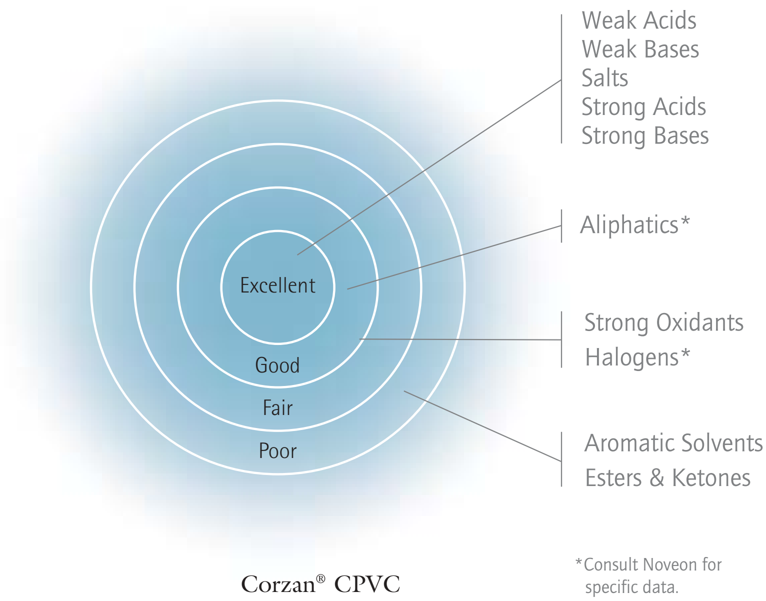
CORZAN™
INDUSTRIAL SYSTEMS

Chemical Resistance Data

noveon
The Specialty Chemicals Innovator™

Corzan™ Industrial Systems

One of the key advantages of Corzan® CPVC is its excellent resistance to a broad range of corrosive environments. By replacing traditional materials with Corzan® CPVC, engineers can extend equipment service life and reduce maintenance, while minimizing process life-cycle costs. This technical report is intended to provide engineers and end-users with guidance as to the suitability of Corzan® industrial piping systems in corrosive applications. In general, Corzan® CPVC is inert to most mineral acids, bases, salts, and aliphatic hydrocarbons, and compares favorably to other non-metals in these chemical environments. Specific use conditions must also be considered since these will determine the chemical resistance of any thermoplastic piping system. Variables that can affect chemical resistance include chemical concentration, temperature, pressure, external stress, and final product quality. Since the number of possible use conditions is so large, the final decision regarding material suitability often must be based on in-service testing. The information contained in this report was developed to include conditions that are most often encountered in industry. CPVC samples were immersed in the particular reagent for at least 90 days at 73°F (23°C) and 180°F (82°C). Changes in weight and tensile strength for each sample were reviewed in conjunction with field experience and information gathered from various sources to develop recommendations shown. Note that these recommendations are based on specific use conditions and may not apply to all situations. For this reason, the final decision regarding material suitability must rest with the end-user. The notes following the chemical resistance chart list specific areas where caution must be used when considering Corzan® CPVC. Additional chemical resistance data will become available as testing of Corzan® CPVC continues. Consult with your product supplier or Noveon for the latest Corzan® CPVC chemical resistance information.



Corzan® CPVC
Chemical Resistance

N.B. Information presented within this report is based on test data and field experience of CPVC manufactured by Noveon and is not intended to reflect the properties found with other suppliers of CPVC materials. To determine if your supplier is using Corzan CPVC, call the Corzan Marketing Department at 888-234-2436.

Chemical Compatibility Case Study

An excellent example of an industrial system's performance in a demanding process application is an installation at Kodak's state-of-the-art lithographic plate manufacturing facility in Colorado. At this facility Kodak manufactures more than 8,000 varieties of lithographic offset printing plates in dimensions up to ten feet long.

To manufacture the plates, large coils of aluminum are unrolled, and one side of the aluminum sheet is chemically treated to provide a grained surface, which is then coated with a light-sensitive photopolymer. After this coating step, the aluminum is cut to the appropriate dimensions and packaged.

The Kodak Story

Prior to the construction of the plate manufacturing facility in 1990, Jim Loomis, Senior Plate Manufacturing Engineer, was faced with many important design decisions. Not only would the piping material have to meet Kodak's high quality standards, but it would have to safely handle the aggressive chemicals used in the plate etching process at temperatures up to 180°F (82°C).

Some of the chemicals used in the process are:

- Caustic Etching Solution
- 30% Nitric Acid
- 50% Sodium Hydroxide

In addition, Jim wanted to specify the system in a single material for design efficiency and quality assurance. The system also had to be available in iron pipe sizes from 1" (25mm) up to 12" (300mm), including a wide variety of piping, fittings and valves.

After a comprehensive materials study, one material, CPVC, was specified for the entire system. Resistance to a variety of harsh chemicals at high temperatures, as well as mechanical strength up to 180°F (82°C) were all key elements in specification decision. Jim was also extremely pleased with the economically-priced process piping and components available from a team of quality manufacturers.

If your next project includes corrosive chemicals, high temperatures, or a wide range of service conditions, think of Corzan Industrial Systems first.

TABLE I – Chemical Resistance of Corzan® CPVC

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Acetaldehyde	N	N
Acetic Acid, up to 10%	R	180
Acetic Acid, greater than 10%	C	C
Acetic Acid, Glacial	N	N
Acetic Anhydride	N	N
Acetone, up to 5%	R	180
Acetone, greater than 5%	C	C
Acetone, pure	N	N
Acetyl Nitrile	N	N
Acrylic Acid	N	N
Acrylonitrile	N	N
Adipic Acid, sat'd in water	R	200
Alcohols	C	C
Allyl Alcohol	C	C
Allyl Chloride	N	N
Alum, all varieties	R	200
Aluminum Acetate	R	200
Aluminum Chloride	R	200
Aluminum Fluoride	R	200
Aluminum Hydroxide	R	200
Aluminum Nitrate	R	200
Aluminum Sulfate	R	200
Amines	N	N
Ammonia	N	N
Ammonium Acetate	R	200
Ammonium Benzoate	R	200
Ammonium Bifluoride	R	200
Ammonium Carbonate	R	200
Ammonium Chloride	R	200
Ammonium Citrate	R	200
Ammonium Dichromate	R	200
Ammonium Fluoride	R	200
Ammonium Hydroxide, 28%	N	N
Ammonium Hydroxide, 10%	N	N
Ammonium Hydroxide, 3%	C	N
Ammonium Nitrate	R	200
Ammonium Persulfate	R	–
Ammonium Phosphate	R	C
Ammonium Sulfamate	R	200
Ammonium Sulfate	R	200
Ammonium Sulfide	R	200
Ammonium Thiocyanate	R	200
Ammonium Tartrate	R	200
Amyl Acetate	N	N
Amyl Alcohol	C	C
Amyl Chloride	N	N
Aniline	N	N
Antimony Trichloride	R	200
Aqua Regia	R	N
Aromatic Hydrocarbons	N	N
Arsenic Acid	R	–
Barium Carbonate	R	200
Barium Chloride	R	200
Barium Hydroxide	R	200
Barium Nitrate	R	200
Barium Sulfate	R	200
Barium Sulfide	R	200
Beer	R	200
Beet Sugar Liquors	R	200
Benzaldehyde	N	N

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Benzene	N	N
Benzoic Acid, sat'd in water	R	N
Benzyl Alcohol	N	N
Benzyl Chloride	N	N
Bismuth Carbonate	R	200
Black Liquor	R	200
Bleach, household (5% Cl)	R	200
Bleach, industrial (15% Cl)	R	200
Borax	R	200
Boric Acid	R	200
Brine Acid	R	200
Bromine	N	N
Bromine, aqueous, sat'd	R	200
Bromobenzene	N	N
Bromotoluene	N	N
Butanol	C	C
Butyl Acetate	N	N
Butyl Carbitol	N	N
Butyl Cellosolve	N	N
Butyric Acid, up to 1%	R	180
Butyric Acid, greater than 1%	C	C
Butyric Acid, pure	N	N
Cadmium Acetate	R	200
Cadmium Chloride	R	200
Cadmium Sulfate	R	200
Calcium Acetate	R	200
Calcium Bisulfide	R	200
Calcium Bisulfite	R	200
Calcium Carbonate	R	200
Calcium Chlorate	R	200
Calcium Chloride	R	200
Calcium Hydroxide	R	200
Calcium Hypochlorite	R	200
Calcium Nitrate	R	200
Calcium Oxide	R	200
Calcium Sulfate	R	200
Cane Sugar Liquors	R	200
Caprolactam	N	N
Caprolactone	N	N
Carbitol	N	N
Carbon Dioxide	R	200
Carbon Disulfide	N	N
Carbon Monoxide	R	200
Carbon Tetrachloride	N	N
Carbonic Acid	R	200
Castor Oil	C	C
Caustic Potash	R	180
Caustic Soda	R	180
Cellosolve, all types	N	N
Chloric Acid	R	180
Chlorinated Solvents	N	N
Chlorinated water, (hypochlorite)	R	200
Chlorine, dry gas	N	N
Chlorine, liquid	N	N
Chlorine, trace in air	R	200
Chlorine, wet gas	N	N
Chlorine dioxide, aqueous, sat'd	R	200
Chlorine water, sat'd	R	200

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Chlorobenzene	N	N
Chloroform	N	N
Chromic Acid, 40% (conc.)	R	180
Chromium Nitrate	R	200
Citric Acid	R	200
Citrus Oils	N	N
Coconut Oil	N	N
Copper Acetate	R	200
Copper Carbonate	R	200
Copper Chloride	R	200
Copper Cyanide	R	200
Copper Fluoride	R	200
Copper Nitrate	R	200
Copper Sulfate	R	200
Corn Oil	N	N
Corn Syrup	R	200
Cottonseed Oil	N	N
Creosote	N	N
Cresol	N	N
Crotonaldehyde	N	N
Cumene	N	N
Cupric Fluoride	R	200
Cupric Sulfate	R	200
Cuprous Chloride	R	200
Cyclohexane	N	N
Cyclohexanol	N	N
Cyclohexanone	N	N
Detergents	C	C
Dextrin	R	200
Dextrose	R	200
Dibutyl Phthalate	N	N
Dibutyl Ethyl Phthalate	N	N
Dichlorobenzene	N	N
Dichloroethylene	N	N
Diethylamine	N	N
Diethyl Ether	N	N
Dill Oil	N	N
Dimethylformamide	N	N
Disodium Phosphate	R	200
Distilled Water	R	200
EDTA, Tetrasodium –	R	200
Esters	N	N
Ethanol, up to 5%	R	180
Ethanol, greater than 5%	C	C
Ethers	N	N
Ethyl Acetate	N	N
Ethyl Acrylate	N	N
Ethyl Benzene	N	N
Ethyl Chloride	N	N
Ethyl Ether	N	N
Ethylene Bromide	N	N
Ethylene Chloride	N	N
Ethylene Diamine	N	N
Ethylene Glycol, up to 50%	R	180
Ethylene Glycol, greater than 50%	C	C
Ethylene Oxide	N	N
Ferric Chloride	R	200
Ferric Hydroxide	R	200
Ferric Nitrate	R	200

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Ferric Sulfate	R	200
Ferrous Chloride	R	200
Ferrous Hydroxide	R	200
Ferrous Sulfate	R	200
Fluorine gas	N	N
Fluosilicic Acid, 30%	R	180
Formaldehyde	N	N
Formic Acid, up to 25%	R	180
Formic Acid, greater than 25%	C	N
Freons	C	C
Fructose	R	200
Gasoline	N	N
Glucose	R	200
Glycerine	R	200
Glycol Ethers	N	N
Green Liquor	R	200
Halocarbon Oils	N	N
Heptane	C	–
Hydrazine	N	N
Hydrochloric Acid	R	180
Hydrochloric Acid, 36% (conc.)	R	180
Hydrofluoric Acid, 3%	R	–
Hydrofluoric Acid, 48%	C	C
Hydrofluosilicic Acid, 30%	R	180
Hydrogen Peroxide, 50%	R	–
Hydrogen Sulfide, Aqueous	R	180
Hypochlorous Acid	R	180
Isopropanol	C	C
Ketones	N	N
Kraft Liquors	R	200
Lactic Acid, 25%	R	200
Lactic Acid, 85% (Full strength)	R	C
Lead Acetate	R	200
Lead Chloride	R	200
Lead Nitrate	R	200
Lead Sulfate	R	200
Lemon Oil	N	N
Limonene	N	N
Linseed Oil	N	N
Lithium Chloride	R	200
Lithium Sulfate	R	200
Lubricating Oil, ASTM 1, 2, 3	R	–
Magnesium Carbonate	R	200
Magnesium Chloride	R	200
Magnesium Citrate	R	200
Magnesium Fluoride	R	200
Magnesium Hydroxide	R	200
Magnesium Salts, inorganic	R	200
Magnesium Nitrate	R	200
Magnesium Oxide	R	200
Magnesium Sulfate	R	200
Maleic Acid, 50%	R	180
Manganese Sulfate	R	200
Mercuric Chloride	R	200
Mercuric Cyanide	R	200
Mercuric Sulfate	R	200
Mercurous Nitrate	R	200
Mercury	R	180
Methane Sulfonic Acid	R	180

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Methanol, up to 10%	R	180
Methanol, greater than 10%	C	C
Methanol, pure	N	N
Methyl Cellosolve	N	N
Methyl Chloride	N	N
Methyl Ethyl Ketone	N	N
Methyl Formate	N	N
Methyl Isobutyl Ketone	N	N
Methyl Methacrylate	N	N
Methylamine	N	N
Methylene Chloride	N	N
Mineral Oil	R	–
Monoethanolamine	N	N
Motor Oil	R	–
Muriatic Acid	R	180
Naphthalene	N	N
Nickel Acetate	R	200
Nickel Chloride	R	200
Nickel Nitrate	R	200
Nickel Sulfate	R	200
Nitric Acid, up to 25%	R	150
Nitric Acid, 25-35%	R	130
Nitric Acid, 70%	R	105
Nitrobenzene	N	N
1-Octanol	C	N
Oils, edible	N	N
Oils, Sour Crude	N	N
Oleum	N	N
Olive Oil	N	N
Oxalic Acid, Sat'd	R	170
Oxygen	R	180
Ozonized water	R	200
Palm Oil	N	N
Paraffin	R	180
Peanut Oil	N	N
Perchloric Acid, 10%	R	–
Phenylhydrazine	N	N
Phosphoric Acid	R	180
Phosphorus Trichloride	N	N
Picric Acid	N	N
Pine Oil	N	N
Plating Solutions	R	180
Polyethylene Glycol	N	N
Potash	R	200
Potassium Acetate	R	200
Potassium Bicarbonate	R	200
Potassium Bichromate	R	200
Potassium Bisulfate	R	200
Potassium Borate	R	200
Potassium Bromate	R	200
Potassium Bromide	R	200
Potassium Carbonate	R	200
Potassium Chlorate	R	200
Potassium Chloride	R	200
Potassium Chromate	R	200
Potassium Cyanate	R	200
Potassium Cyanide	R	200
Potassium Dichromate	R	200
Potassium Ferricyanide	R	200
Potassium Ferrocyanide	R	200

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Potassium Fluoride	R	200
Potassium Hydroxide	R	200
Potassium Hypochlorite	R	200
Potassium Iodide	R	200
Potassium Nitrate	R	200
Potassium Perborate	R	180
Potassium Perchlorate, sat'd	R	180
Potassium Permanganate, sat'd	R	180
Potassium Persulfate, sat'd	R	–
Potassium Phosphate	R	200
Potassium Sulfate	R	200
Potassium Sulfide	R	200
Potassium Sulfite	R	200
Potassium Tripolyphosphate	R	200
Propanol, up to 0.5%	R	180
Propanol, greater than 0.5%	C	C
Propionic Acid, up to 2%	R	180
Propionic Acid, greater than 2%	C	C
Propionic Acid, pure	N	N
Propylene Dichloride	N	N
Propylene Glycol, up to 25%	R	180
Propylene Glycol, greater than 25%	C	C
Propylene Oxide	N	N
Pyridine	N	N
Sea Water	R	200
Silicic Acid	R	–
Silicone Oil	R	–
Silver Chloride	R	200
Silver Cyanide	R	200
Silver Nitrate	R	200
Silver Sulfate	R	200
Soaps	R	200
Sodium Acetate	R	200
Sodium Aluminate	R	200
Sodium Arsenate	R	200
Sodium Benzoate	R	200
Sodium Bicarbonate	R	200
Sodium Bichromate	R	200
Sodium Bisulfate	R	200
Sodium Bisulfite	R	200
Sodium Borate	R	200
Sodium Bromide	R	200
Sodium Carbonate	R	200
Sodium Chlorate	R	200
Sodium Chloride	R	200
Sodium Chlorite	R	200
Sodium Chromate	R	200
Sodium Cyanide	R	200
Sodium Dichromate	R	200
Sodium Ferricyanide	R	200
Sodium Ferrocyanide	R	200
Sodium Fluoride	R	200
Sodium Formate	R	200
Sodium Hydroxide	R	180
Sodium Hypobromite	R	200
Sodium Hypochlorite	R	200
Sodium Iodide	R	200
Sodium Metaphosphate	R	200

Reagent	Temperature 73°F (23°C)	Max. Temp. (°F)
Sodium Nitrate	R	200
Sodium Nitrite	R	200
Sodium Perborate	R	180
Sodium Perchlorate	R	180
Sodium Phosphate	R	200
Sodium Silicate	R	200
Sodium Sulfate	R	200
Sodium Sulfide	R	200
Sodium Sulfite	R	200
Sodium Thiosulfate	R	200
Sodium Tripolyphosphate	R	200
Soybean Oil	N	N
Stannic Chloride	R	200
Stannous Chloride	R	200
Stannous Sulfate	R	200
Starch	R	200
Stearic Acid	R	–
Strontium Chloride	R	200
Styrene	N	N
Sugar	R	200
Sulfamic Acid	R	180
Sulfur	R	–
Sulfuric Acid, (see page 7)		
Sulfuric Acid, Fuming	N	N
Sulfuric Acid, 98%	R	125
Sulfuric Acid, 85%	R	170
Sulfuric Acid, 80%	R	180
Sulfuric Acid, 50%	R	180
Tall Oil	C	C
Tannic Acid, 30%	R	–
Tartaric Acid	R	–
Terpenes	N	N
Tetrahydrofuran	N	N
Tetrasodiumpyrophosphate	R	200
Texanol	N	N
Thionyl Chloride	N	N
Toluene	N	N
Tributyl Phosphate	N	N
Trichloroethylene	N	N
Trisodium Phosphate	R	200
Turpentine	N	N
Urea	R	180
Urine	R	200
Vegetable Oils	N	N
Vinegar	R	200
Vinyl Acetate	N	N
Water, Deionized	R	200
Water, Demineralized	R	200
Water, Distilled	R	200
Water, Salt	R	200
Water, Swimming Pool	R	200
WD-40	C	C
White Liquor	R	200
Xylene	N	N
Zinc Acetate	R	200
Zinc Carbonate	R	200
Zinc Chloride	R	200
Zinc Nitrate	R	200
Zinc Sulfate	R	200

R – Recommended   N – Not recommended   C – Caution, further testing suggested – suspect with certain stress levels   – Incomplete data   N.B. Given percentages are by weight

Noted Caution Areas for CPVC

CPVC is not recommended for use with most polar organic materials including various solvents i.e., chlorinated or aromatic hydrocarbons, esters, or ketones.

Resistance of CPVC to certain other fluid mixtures such as fuel oils with moderate aromatic content cannot be determined on basis of immersion testing alone. Actual use data must be obtained.

There are a number of similarities in chemical resistance between PVC and CPVC materials. However, one must exercise caution when comparing the chemical resistance properties of CPVC to those of PVC, which are not always the same.

CPVC test samples exposed while under stress to surfactants, certain oils, or grease have shown signs of environmental stress cracking. Environmental stress cracking is a situation in which the manufactured pipe or fittings are weakened by contact with certain chemicals and cracks are propagated by external stresses. External stresses include not only the known pressure stress on a system but also stresses from sources such as expansion and installation. When CPVC is intended for use in handling such chemicals, special consideration should be taken during design and installation to avoid unusual stresses in the piping system, or advance testing of the chemical in simulated use conditions is strongly suggested.

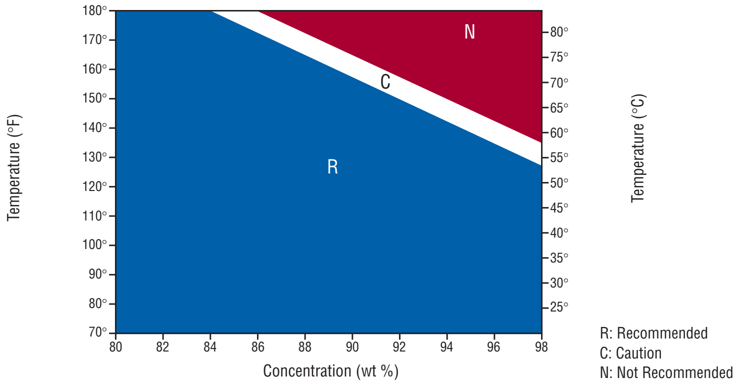
Certain organic solvents which are soluble with water, such as alcohols, may safely be handled below a certain concentration. Many of these limiting concentrations are noted in Table 1. Solvents which are insoluble in water, such as aromatics, will be absorbed by the piping over time, even when they are present at very low levels in the water. This will lead to a decreased service life expectancy for the system.

The full hydrostatic pressure rating of the pipe may not apply to the entire range of temperature and concentration designated as "recommended".

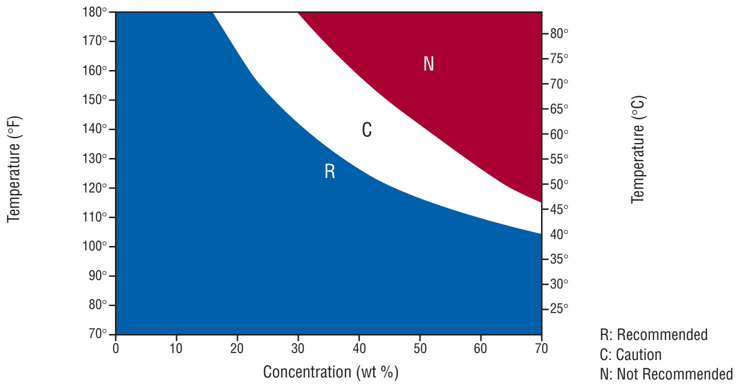
CPVC is not recommended for fuming acid service.

Contact your piping supplier or Noveon for consultation and/or the latest chemical resistance information.

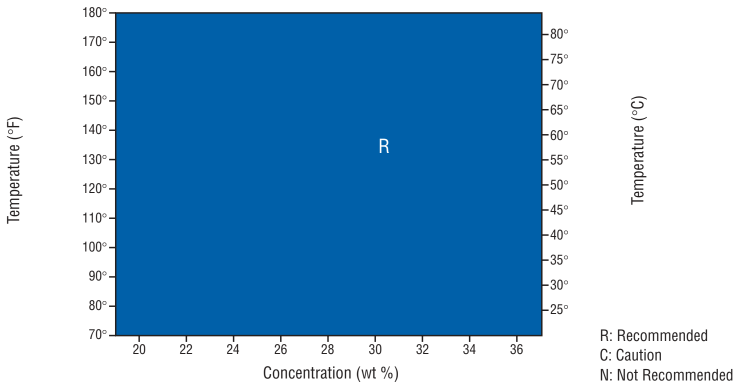
Chemical Resistance of Corzan® CPVC to Sulfuric Acid



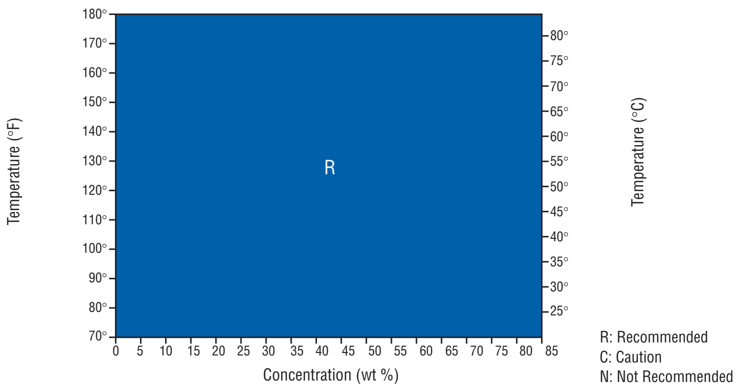
Chemical Resistance of Corzan® CPVC to Nitric Acid



Chemical Resistance of Corzan® CPVC to Hydrochloric Acid



Chemical Resistance of Corzan® CPVC to Phosphoric Acid



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The Specialty Chemicals Innovator™

www.corzancpvc.com

Noveon, Inc.
Corzan® Marketing Department
9911 Brecksville Road
Cleveland, OH 44141-3247 **USA**
216-447-5000
888-234-2436
Fax: 216-447-5750

Noveon Europe B.V.B.A.
Chaussée de Wavre, 1945
1160 Brussels
Belgium
32-2-678-19-11
Fax: 32-2-678-19-90

Noveon Asia Pacific Limited
Units 1107-1110 Shui On Centre
6-8 Harbour Road
Wanchai, **Hong Kong**
852-2508-1021
Fax: 852-2512-2241

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