PVDF Chemical Resistance Guide

SECOND EDITION

PVDF CHEMICAL RESISTANCE GUIDE

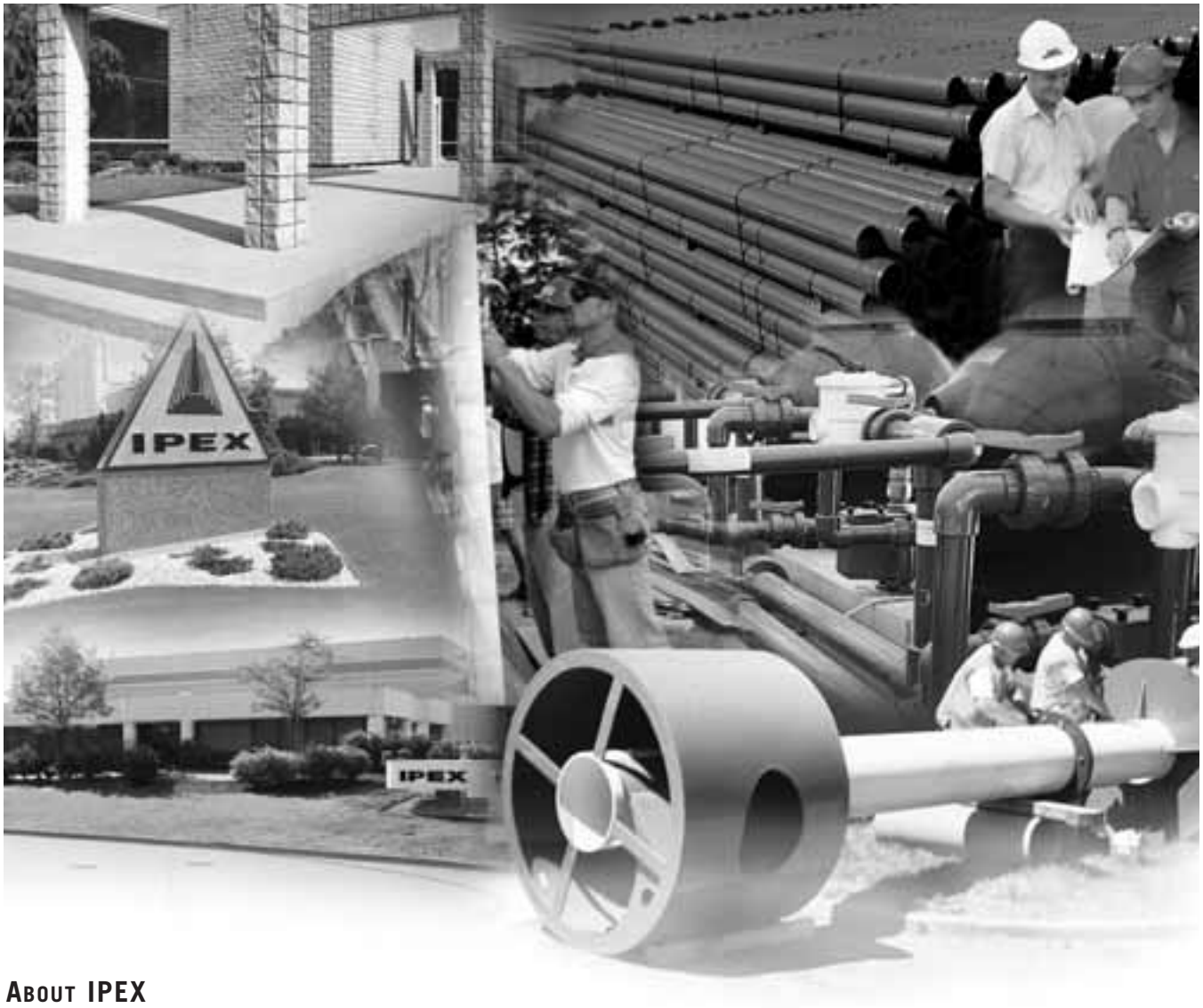
Thermoplastics:
Kynar® Polyvinylidene Fluoride (PVDF)
for Waste Drainage Systems

IPEX

Chemical Resistance Guide

Kynar® Polyvinylidene Fluoride (PVDF) for Waste Drainage Systems

2nd Edition



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations from coast-to-coast. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

INTRODUCTION

Thermoplastics and elastomers have outstanding resistance to a wide range of chemical reagents. The chemical resistance of plastic piping is basically a function of the thermoplastic material and the compounding components. In general, the less compounding components used the better the chemical resistance. Thermoplastic pipes with significant filler percentages may be susceptible to chemical attack where an unfilled material may be affected to a lesser degree or not at all.

Some newer piping products utilize a multi-layered (composite) construction, where both thermoplastic and non-thermoplastic materials are used for the layers. Layered composite material pipe may have chemical resistance that differs from the chemical resistance of the individual material. Such resistance however, is a function both of temperatures and concentration, and there are many reagents which can be handled for limited temperature ranges and concentrations. In borderline cases, it will be found that there is limited attack, generally resulting in some swelling due to absorption. There are also many cases where some attack will occur under specific conditions, but for many such applications, the use of plastic will be justified on economic grounds when considered against alternative materials. Resistance is often affected (and frequently reduced) when handling a number of chemicals or compounds containing impurities. For this reason, when specific applications are being considered, it may be worthwhile to carry out tests using the actual product that will be encountered in service. The listing that follows does not address chemical combinations.

The information is based on immersion tests on unstressed coupons, experiments and, when available, actual process experience as well as data from tests inclusive of stress from temperature and pressure. The end user should be aware of the fact that actual service conditions will affect the chemical resistance.

Chemicals that do not normally affect the properties of an unstressed thermoplastic may cause completely different behavior (such as stress cracking) when under thermal or mechanical stress (such as constant internal pressure or frequent thermal or mechanical stress cycles). Chemical resistance data from immersion tests cannot be unconditionally applied to thermoplastic piping components subjected to continuous or frequent mechanical or thermal stresses.

When the pipe will be subject to a continuous applied mechanical or thermal stress, or to combinations of chemicals, testing that duplicates the expected field conditions, as closely as possible, should be performed on representative samples of the pipe product to properly evaluate plastic pipe for use in this application.

RATINGS

Ratings are according to the product and suppliers.

The absence of any class indication for any given materials, signifies the absence of data for such material(s) with respect to the specific chemical(s), temperature(s) and concentration(s).

NOTE: Chemical resistance data is found in a laboratory setting and cannot account for all possible variables of an installed application. It is up to the design engineer or final user to use this information as guidance for a specific application design.

If a material is chemically resistant to the concentrated form of a specific chemical, it should be resistant to the diluted form of that same chemical.

All Chemical Resistance data for Polyvinylidene Fluoride (PVDF) contained within this manual has been provided, with written consent, by Arkema Inc.

Notes

KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

All Chemical Resistance data for Polyvinylidene Fluoride (PVDF) contained within this manual has been provided, with written consent, by Arkema Inc.

Kynar® Polyvinylidene fluoride (PVDF) resin is a tough engineering thermoplastic that offers a unique balance of performance properties. It has the characteristic stability of fluoropolymers when exposed to harsh thermal, chemical and ultraviolet environments.

For chemical and high temperature resistance, low permeability and high mechanical strength, Kynar PVDF resin is used as a contact surface for the production, storage and transfer of corrosive fluids. Kynar PVDF resin is used in mechanical components, fabricated vessels, tanks, pumps, valves, filters, heat exchangers, tower packing, piping systems, as well as other applications.

Corrosive Waste Drainage and Plenum Applications

IPEX Plenumline grade Kynar PVDF resin easily achieves the flame spread / smoke developed rating of 25/50 when tested in accordance with ASTM E84. This enables Plenumline PVDF pipe to be used in the plenum for applications such as corrosive waste drainage and laboratory chemical systems.

IPEX Plenumline utilizes Kynar PVDF resins that are designed especially for harsh environments such as:

- Pharmaceutical industries
- Chemical industries
- College laboratories
- High school laboratories
- Hospital laboratories

Third party testing of PVDF resin has confirmed the resin and the piping molded from the resin meet the International Mechanical Code (IMC) requirements for material installed in the plenum.

Material	Flame Spread Rating	Smoke Developed Rating
IMC Plenum Requirement	25	50
PVDF 740-02	5	35

In addition to its notable fire and smoke characteristics, PVDF resin has these important properties.

- Mechanical strength and toughness
- High abrasion resistance
- High thermal stability
- High dielectric strength
- High purity
- Resistant to most chemicals and solvents
- Resistant to ultraviolet and nuclear radiation
- Resistant to weathering
- Resistant to fungi
- Low permeability to most gases and liquids

The following pages list the guidelines for using PVDF products in chemical waste drainage applications. PVDF resin is suitable for short-term contact with many chemicals up to 300ºF (150ºC). If your application involves mixtures of chemicals and temperatures above 104ºF (40ºC), PVDF resin will likely be fine, but IPEX recommends that you consult our technical staff prior to installing your system.

Guidelines for using KYNAR® PVDF products in chemical waste drainage.

A+	Suitable for elevated temperatures varying with chemical in question.
A	Suitable for continuous ambient conditions and for short term elevated temperature varying with chemical in question.
A-	Suitable for short term use at full strength under ambient conditions, and suitable for continuous use at ambient conditions in diluted form.
NR	If concentration will be less than 100%, please contact IPEX technical staff for assessment of a safe concentration at maximum exposure temperature.

KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*
CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
A		
Acetaldehyde		A-
Acetamide		A-
Acetic Acid		A
Acetic Acid	10% in water	A+
Acetic Acid	50% in water	A+
Acetic Acid	80% in water	A+
Acetic Anhydride		A-
Acetone		A-
Acetone	10% in water	A+
Acetonitrile		A-
Acetophenone		A-
Acetyl Bromide		A+
Acetyl Chloride		A+
Acetylacetone		A-
Acetylene		A+
Acrylonitrile		A
Adipic Acid		A+
Air		A+
Alcoholic Spirits	40% Ethyl Alcohol	A+
Allyl Alcohol		A+
Allyl Chloride		A+
Aluminum Acetate	Aqueous solution/solid	A+
Aluminum Bromide		A+
Aluminum Chloride	Up to 40% in water	A+
Aluminum Fluoride	Aqueous solution/solid	A+
Aluminum Hydroxide		A+
Aluminum Nitrate	Aqueous solution/solid	A+
Aluminum Oxychloride		A+
Aluminum Sulfate	Aqueous solution/solid	A+
Ammonia, gas		A
Ammonia, Liquid		A
Ammonium Acetate	Aqueous solution/solid	A+
Ammonium Alum	Aqueous solution/solid	A+
Ammonium Bifluoride	Aqueous solution/solid	A+
Ammonium Bromide	Aqueous solution/solid	A+
Ammonium Carbonate	Aqueous solution/solid	A+

Chemical Substance	Concentration*	Rating
Ammonium Chloride	Aqueous solution/solid	A+
Ammonium Dichromate	Aqueous solution/solid	A+
Ammonium Fluoride	Aqueous solution/solid	A+
Ammonium Hydroxide	Up to “concentrated”	A+
Ammonium Metaphosphate	Aqueous solution/solid	A+
Ammonium Nitrate	Aqueous solution/solid	A+
Ammonium Persulfate	Aqueous solution/solid	A
Ammonium Phosphate	Aqueous solution/solid	A+
Ammonium Sulfate	Aqueous solution/solid	A+
Ammonium Sulfide	Aqueous solution/solid	A+
Ammonium Thiocyanate	Aqueous solution/solid	A+
Amyl Acetate		A
Amyl Alcohol		A+
Sec-Amyl Alcohol		A+
Amyl Chloride		A+
Aniline		A
Aniline Hydrochloride	Aqueous solution/solid	A
Aqua Regia		A
Arsenic acid	Aqueous solution	A+
Asphalt		A+
B		
Barium Carbonate		A+
Barium Chloride	Aqueous solution/solid	A+
Barium Hydroxide		A+
Barium Nitrate	Aqueous solution/solid	A+
Barium Sulfate		A+
Barium Sulfi de		A+
Beer		A+
Beet Sugar Liquors		A+
Benzaldehyde		A-
Benzene		A+
Benzenesulfonic Acid	Aqueous solution/solid	A+
Benzoic Acid		A+
Benzoyl Chloride		A+
Benzoyl Peroxide		A+

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Benzyl Alcohol		A+
Benzyl Chloride		A+
Benzyl Ether		A
Benzylamine	Aqueous solution/solid	A-
Black Liquor		A+
Bleaching Agents		A+
Borax		A+
Boric Acid		A+
Boron Trifluoride		A+
Brine		A+
Brine, acid		A+
Brine, basic		A+
Brine, chlorinated acid		A+
Bromic Acid	Aqueous solution	A+
Bromine dry gas		A+
Bromine, liquid		A+
Bromine, water		A+
Bromobenzene		A+
Bromoform		A+
m-Bromotoluene		A+
Butadiene		A+
Butane		A+
Butanediol	Aqueous solution/liquid	A+
Butyl Acetate		A-
Butyl Acrylate		A
Butyl Alcohol	Aqueous solution/liquid	A+
sec-Butyl Alcohol	Aqueous solution/liquid	A+
t-Butyl Alcohol	Aqueous solution/liquid	A+
Butyl Bromide		A+
Butyl Chloride		A+
Butyl Ether		A-
Butyl Mercaptan		A+
Butyl Stearate		A+
Butylamine	Aqueous solution/liquid	A-
sec-Butylamine	Aqueous solution/liquid	A-
t-Butylamine	Aqueous solution/solid	A-
1-Butylene		A+

Chemical Substance	Concentration*	Rating
Butylphenol		A+
Butyraldehyde		A+
Butyric Acid		A+
C		
Calcium Acetate	Aqueous solution/solid	A+
Calcium Bisulfate	Aqueous solution/solid	A+
Calcium Bisulfite	Aqueous solution/solid	A+
Calcium Acetate	Aqueous solution/solid	A+
Calcium Bisulfate	Aqueous solution/solid	A+
Calcium Bisulfite	Aqueous solution/solid	A+
Calcium Bromide	Aqueous solution/solid	A+
Calcium Carbonate		A+
Calcium Chlorate	Aqueous solution/solid	A+
Calcium Chloride	Aqueous solution/solid	A+
Calcium Hydroxide		A+
Calcium Hypochlorite	Aqueous solution/solid	A+
Calcium Nitrate	Aqueous solution/solid	A+
Calcium Oxide		A+
Calcium Phosphate		A+
Calcium Sulfate		A+
Cane Sugar Liquors		A+
Caprylic Acid		A+
Carbon Dioxide		A+
Carbon Disulfide		A
Carbon Monoxide		A+
Carbon Tetrachloride		A+
Carbonic Acid		A+
Casein		A+
Castor Oil		A+
Chloral Hydrate		A
Chlorinated Phenol		A+
Chlorine	5% in CCl4	A+
Chlorine, gas		A+
Chlorine, liquid		A+
Chlorine Dioxide		A+

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Chlorine Water		A+
Chloroacetic Acid	Aqueous solution/pure	A
Chloroacetyl Chloride		A+
Chlorobenzene		A+
Chlorobenzene-sulfonic Acid	Aqueous solution/pure	A+
Chlorobenzyl Chloride		A+
Chlorofluorocarbon 11		A+
Chlorofluorocarbon 12		A+
Chlorofluorocarbon 13		A+
Chlorofluorocarbon 14		A+
Chlorofluorocarbon 21		A+
Chlorofluorocarbon 22		A+
Chlorofluorocarbon 113		A+
Chlorofluorocarbon 114		A+
Chloroform		A+
6-Chlorohexanol		A+
Chlorohydrin		A+
Chloropicrin		A+
Chlorosulfonic Acid		A
Chlrotrimethylsilane		A+
Chrome Alum	Aqueous solution/solid	A+
Chromic Acid	Up to 40% in water	A+
Chromic Acid	50% in water	A+
Chromyl Chloride		A+
Cider		A+
Citric Acid	Aqueous solution/solid	A+
Coal Gas		A+
Coconut Oil		A+
Copper Acetate		A+
Copper Carbonate, basic		A+
Copper Chloride	Aqueous solution/solid	A+
Copper Cyanide		A+
Copper Fluoride		A+
Copper Nitrate	Aqueous solution/solid	A+
Copper Sulfate	Aqueous solution/solid	A+
Corn Oil		A+
Corn Syrup		A+

Chemical Substance	Concentration*	Rating
Cottonseed Oil		A+
Cresol		A+
Cresylic Acid		A+
Crotonaldehyde		A
Crude Oil		A+
Cryolite		A+
Cuprous Chloride		A+
Cyclohexane		A+
Cyclohexanol		A+
Cyclohexanone		A
Cyclohexyl Acetate		A+
D		
Decane		A+
Dextrin	Aqueous solution/solid	A+
Diacetone Alcohol		A
p-Dibromobenzene		A+
1,2,-Dibromopropane		A+
Dibutyl Phthalate		A-
Dibutyl Sebacate		NR
Dibutylamine	Aqueous solution/liquid	A
Dichloroacetic Acid	Aqueous solution/liquid	A+
o-Dichlorobenzene		A+
Dichlorodimethylsilane		A+
Dichloroethylene		A+
2,2-Dichloropropionic Acid		A
aa-Dichlorotoluene		A+
Diesel Fuels		A+
Diethanolamine	Aqueous solution/liquid	A-
Diethylamine	Aqueous solution/liquid	A-
Diethyl Malonate		NR
Diethylenetriamine	Aqueous solution/liquid	A
Diglycolic Acid		A
Diisobutyl Ketone		A-
Diisobutylene		A+
Diisopropyl Ketone		A-

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Dimethyl Acetamide		NR
Dimethyl Formamide		NR
Dimethyl Phthalate		A-
Dimethyl Sulfate		A
Dimethyl Sulfoxide		A-
Dimethylamine	Aqueous solution/gas	A
Dimethylaniline		A
2,6,-Dimethyl-4-heptanol		A+
2,5-Dimethyl-1,5-hexadiene		A+
Dioctyl Phthalate		A
Dipropylene Glycol Methyl Ether		A-
Disodium Phosphate	Aqueous solution/solid	A+
Divinyl Benzene		A
E		
Epichlorohydrin		A-
Epsom Salts	Aqueous solution/solid	A+
Ethanethiol		A
Ethanolamine	Aqueous solution/iquid	A-
2-Ethoxyethyl Acetate	Aqueous solution/liquid	A+
Ethyl Acetate		A-
Ethyl Acetoacetate		A
Ethyl Acrylate		A
Ethyl Alcohol	Aqueous solution/liquid	A+
Ethyl Chloride		A+
Ethyl Chloroacetate		A
Ethyl Chloroformate		A
Ethyl Cyanoacetate		A
Ethyl Ether		A
Ethyl Formate		A
Ethylbenzene		A+
Ethylene Chlorohydrin	Aqueous solution/liquid	A
Ethylene Dichloride		A+
Ethylene Glycol	Aqueous solution/liquid	A+
Ethylene Oxide		A+
Ethylenediamine	Aqueous solution/liquid	A+

Chemical Substance	Concentration*	Rating
2-Ethyl-1-hexanol		A+
F		
Fatty Acids		A+
Fatty Acids, Sulfonates		A+
Ferric Chloride	Aqueous solution/solid	A+
Ferric Hydroxide		A+
Ferric Nitrate	Aqueous solution/solid	A+
Ferric Sulfate		A+
Ferric Sulfide		A+
Ferrous Chloride	Aqueous solution/solid	A+
Ferrous Hydroxide		A+
Ferrous Nitrate	Aqueous solution/solid	A+
Ferrous Sulfate		A+
Fluorine		A
Fluoroboric Acid	Aqueous solution	A+
Fluorosilic Acid		A+
Formaldehyde	37% in water	A+
Formic Acid	Aqueous solution/liquid	A+
Fructose	Aqueous solution/solid	A+
Fruit Juices, Pulp		A+
Fuel Oil		A+
Fumaric Acid		A+
Furan		A-
Furfural		A
Furfuryl Alcohol	Aqueous solution/liquid	A
G		
Gallic Acid		A
Gas, manufactured		A+
Gas, natural		A+
Gasoline, leaded		A+
Gasoline, sour		A+
Gasoline, unleaded		A+
Gelatin		A+

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Gin		A+
Glucose	Aqueous solution/solid	A+
Glue		A+
Glutamic Acid		A+
Glycerin	Aqueous solution/liquid	A+
Glycine	Aqueous solution/solid	A
Glycolic Acid		A
H		
Heptane		A+
Hexachloro-1,3-butadiene		A
Hexamethylenediamine		A-
Hexamethylphosphotriamide		A-
Hexane		A+
Hexyl Alcohol		A+
Hydrazine	Aqueous solution/liquid	A+
Hydrazine Dihydrochloride	Aqueous solution/solid	A
Hydrazine Hydrate	Aqueous solution/liquid	A+
Hydriodic Acid	Aqueous solution	A+
Hydrobromic Acid	Up to 50% in water	A+
Hydrochloric Acid	Up to “concentrated”	A+
Hydrocyanic Acid	Aqueous solution	A+
Hydrofl uoric Acid	Up to 40% in water	A+
Hydrofluoric Acid	41-100% in water	A+
Hydrogen		A+
Hydrogen Chloride		A+
Hydrogen Cyanide		A+
Hydrogen Fluoride		A+
Hydrogen Peroxide	Up to 30% in water	A+
Hydrogen Peroxide	90% in water	A
Hydrogen Sulfide		A+
Hydrogen Sulfide	Aqueous solution	A+
Hydroquinone		A+
Hyprochlorous Acid	Aqueous solution	A

Chemical Substance	Concentration*	Rating
I		
Iodine	10% in Non-Aqueous solvent	A+
Iodine, gas		A+
Iodoform		A+
Isoamyl Ether		A+
Isobutyl Alcohol		A+
Isoocatne		A+
Isophorone		A+
Isopropyl Alcohol		A+
Isopropyl Chloride		A
Isopropyl Ether		A
Isopropylbenzene		A
J		
Jet Fuel (JP4, JP5)		A+
K		
Kerosene		A+
L		
Lactic Acid	Aqueous solution/pure	A+
Lanolin		A+
Lard Oil		A+
Lauric Acid		A+
Lauroyl Chloride		A+
Lauryl Mercaptan		A+
Lauryl Sulfate		A+
Lead Acetate	Aqueous solution/solid	A+
Lead Chloride		A+
Lead Nitrate	Aqueous solution/solid	A+
Lead Sulfate		A+
Lemon Oil		A+
Linoleic Acid		A+
Linseed Oil		A+

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CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Lithium Bromide	Aqueous solution/solid	A+
Lithium Chloride	Aqueous solution/solid	A+
Lubricating Oil		A+
M		
Magnesium Carbonate		A+
Magnesium Chloride	Aqueous solution/solid	A+
Magnesium Citrate		A+
Magnesium Hydroxide		A+
Magnesium Nitrate	Aqueous solution/solid	A+
Magnesium Sulfate	Aqueous solution/solid	A+
Maleic Acid	Aqueous solution/solid	A+
Maleic Anhydride		A
Malic Acid	Aqueous solution/solid	A+
Manganese Sulfate	Aqueous solution/solid	A+
Mercuric Chloride		A+
Mercuric Cyanide		A+
Mercuric Nitrate	Aqueous solution/solid	A+
Mercury		A+
Methacrylic Acid		A
Methane		A+
Methanesulfonic Acid	Aqueous solution/liquid	A+
Methyl Acetate		A
Methyl Acrylate		A
Methyl Alcohol	Aqueous solution/liquid	A+
Methyl Bromide		A+
Methyl Chloride		A+
Methyl Chloroacetate		A
Methyl Chloromethyl Ether		A
Methyl Ethyl Ketone		A-
Methyl Isobutyl Ketone		A-
Methyl Methacrylate		A
Methyl Salicylate		A+
Methylamine		A-
Methylchloroform		A+
Methylene Bromide		A+

Chemical Substance	Concentration*	Rating
Methylene Chloride		A+
Methylene Iodine		A+
Methylsulfuric Acid	Aqueous solution/liquid	A+
Methyltrichlorosilane		A+
Milk		A+
Mineral Oil		A+
Molasses		A+
Morpholine	Aqueous solution/liquid	A
Motor Oil		A+
N		
Naphtha		A+
Naphthalene		A+
Nickel Acetate	Aqueous solution/solid	A+
Nickel Chloride	Aqueous solution/solid	A+
Nickel Nitrate	Aqueous solution/solid	A+
Nickel Sulfate	Aqueous solution/solid	A+
Nicotine		A
Nicotinic Acid		A+
Nitric Acid	Up to 10% in water	A+
Nitric Acid	11-70% in water	A+
Nitric Acid, fuming		A-
Nitrobenzene		A
Nitroethane		A
Nitrogen		A+
Nitrogen Dioxide		A+
Nitroglycerin		A+
Nitromethane		A+
Nitrotoluene		A+
Nitrous Oxide		A-
O		
Octane		A+
Octene		A+
Oleic Acid		A+

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*
CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Oleum		A-
Olive oil		A+
Oxalic Acid		A+
Oxygen		A+
Ozone		A+
P		
Palm Oil		A+
Palmitic Acid		A+
Paraffin		A+
Paraffin Oil		A+
Peanut Oil		A+
Perchloric Acid	10% in water	A+
Perchloric Acid	70% in water	A+
Perchloroethylene		A+
Perchloromethyl Mercaptan		A+
Petrolatum		A+
Petroleum		A+
Phenol	5% in water	A+
Phenol		A+
1-Phenol-2-sulfonic-Acid		A+
Phenyl Ether		A
Phenylhydrazine		A
Phenylhydrazine Hydrochloride	Aqueous solution/solid	A
o-Phenylphenol		A+
Phosgene		A+
Phosphoric Acid	Less than 85% in water	A+
Phosphoric Acid	85% in water	A+
Phosphorus, red		A
Phosphorus, Oxychloride		A-
Phosphorus, Pentachloride		A+
Phosphorus, Pentoxide		A+
Phosphorus, Trichloride		A+
Phthalic Acid		A+
Picric Acid		A
Plating Solutions: Brass		A+

Chemical Substance	Concentration*	Rating
Plating Solutions: Cadmium		A+
Plating Solutions: Chrome		A+
Plating Solutions: Copper		A+
Plating Solutions: Iron		A+
Plating Solutions: Lead		A+
Plating Solutions: Nickel		A+
Plating Solutions: Rodium		A+
Plating Solutions: Silver		A+
Plating Solutions: Speculum		A+
Plating Solutions: Tin		A+
Plating Solutions: Zinc		A+
Polyethylene Glycol		A+
Polyvinyl Acetate		A+
Polyvinyl Alcohol		A+
Potassium Acetate	Aqueous solution/solid	A+
Potassium Alum	Aqueous solution/liquid	A+
Potassium Aluminum Chloride		A+
Potassium Bicarbonate	Aqueous solution/solid	A+
Potassium Bisulfate	Aqueous solution/solid	A+
Potassium Borate	Aqueous solution/solid	A+
Potassium Bromate	Aqueous solution/solid	A+
Potassium Bromide	Aqueous solution/solid	A+
Potassium Carbonate	Aqueous solution/solid	A+
Potassium Chlorate		A+
Potassium Chloride	Aqueous solution/solid	A+
Potassium Chromate	Aqueous solution/solid	A+
Potassium Cyanide	Aqueous solution/solid	A+
Potassium Dichromate		A+
Potassium Ferricyanide	Aqueous solution/solid	A+
Potassium Ferrocyanide	Aqueous solution/solid	A+
Potassium Fluoride	Aqueous solution/solid	A+
Potassium Hydroxide	5 to 10% in water	A-
Potassium Hydroxide	> 50% in water	A-
Potassium Hypochlorite	Aqueous solution	A+
Potassium Iodide	Aqueous solution/solid	A+
Potassium Nitrate	Aqueous solution/solid	A+
Potassium Perborate		A+

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*Pure substance unless otherwise indicated

KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Potassium Perchlorate		A+
Potassium Permanganate	Aqueous solution/solid	A+
Potassium Persulfate		A+
Potassium Sulfate	Aqueous solution/solid	A+
Potassium Sulfide		A+
Propane		A+
Propyl Acetate		A
Propyl Alcohol	Aqueous solution/liquid	A+
Propylamine		A-
Propylene Dibromide		A+
Propylene Dichloride		A+
Propylene Glycol	Aqueous solution/liquid	A+
Propylene Oxide		A-
Pyridine		A-
Pyrogallol	Aqueous solution/solid	A
S		
Salicylaldehyde		A
Selenic Acid	Aqueous solution/pure	A+
Silicon Tetrachloride		A+
Silcone Oil		A+
Silver Cyanide		A+
Silver Nitrate	Aqueous solution/solid	A+
Silver Sulfate		A+
Sodium Acetate	Aqueous solution/solid	A+
Sodium Benzoate	Aqueous solution/solid	A+
Sodium Bicarbonate	Aqueous solution/solid	A+
Sodium Bisulfate	Aqueous solution/solid	A+
Sodium Bisulfite	Aqueous solution/solid	A+
Sodium Bromate	Aqueous solution/solid	A+
Sodium Bromide	Aqueous solution/solid	A+
Sodium Carbonate	Aqueous solution/solid	A+
Sodium Chlorate	Aqueous solution/solid	A+
Sodium Chlorite	Aqueous solution/solid	A+
Sodium Chromate	Aqueous solution/solid	A+
Sodium Cyanide	Aqueous solution/solid	A+

Chemical Substance	Concentration*	Rating
Sodium Dichromate	Aqueous solution/solid	A+
Sodium Dithionite	Aqueous solution/solid	A
Sodium Ferricyanide	Aqueous solution/solid	A+
Sodium Ferrocyanide	Aqueous solution/solid	A+
Sodium Fluoride	Aqueous solution/solid	A+
Sodium Fluosilcate		A+
Sodium Hydrogen Phosphate	Aqueous solution/solid	A+
Sodium Hydroxide	Up to 10% in water*	A
Sodium Hydroxide	> 50% in water	A
Sodium Hypochlorite	Up to 5% in water	A+
Sodium Hypochlorite	6-15% in water	A+
Sodium Iodide	Aqueous solution/solid	A+
Sodium Nitrate	Aqueous solution/solid	A+
Sodium Nitrite	Aqueous solution/solid	A+
Sodium Palmitate		A+
Sodium Perchlorate	Aqueous solution/solid	A+
Sodium Peroxide		A+
Sodium Phosphate	Aqueous solution/solid	A+
Sodium Thiocyanate	Aqueous solution/solid	A+
Sodium Thiosulfate	Aqueous solution/solid	A+
Sour Crude Oil		A+
Soybean Oil		A+
Stannic Chloride	Aqueous solution/solid	A+
Stannous Chloride	Aqueous solution/solid	A+
Starch		A+
Stearic Acid		A+
Stilbene		A+
Styrene		A+
Succinic Acid		A+
Sugar Syrup		A+
Sulfur		A+
Sulfur Chloride		A
Sulfur Dichloride		A
Sulfur Dioxide		A+
Sulfur Trioxide		A-
Sulfuric Acid	Up to 60% in water	A+
Sulfuric Acid	60-93% in water	A+

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KYNAR® POLYVINYLIDENE FLUORIDE (PVDF) *FOR WASTE DRAINAGE SYSTEMS*

CHEMICAL RESISTANCE DATA

Chemical Substance	Concentration*	Rating
Sulfuric Acid	98% in water	A
Sulfuric Acid, fuming		A
Sulfuryl Chloride		A-
T		
Tetraethyllead		A+
Tetrahydrofuran	Aqueous solution/liquid	A-
Tetramethylammonium Hydroxide	Up to 10% in water	A+
Tetramethylurea		A-
Thioglycol		A
Thioglycolic Acid		A+
Thionyl Chloride		A-
Thiophosphoryl Chloride		A-
Thread Cutting Oils		A+
Titanium Tetrachloride		A+
Toluene		A+
Toluenesulfonyl Chloride		A
Tomato Juice		A+
Tributyl Phosphate		A
Trichloroacetic Acid	Up to 10% in water	A+
Trichloroacetic Acid	50% in water to pure	A
1,2,4-Trichlorobenzene		A+
1,1,2-Trichloroethane		A+
Trichloroethylene		A+
2,4,5-Trichlorophenol		A+
Tricresyl Phosphate		A-
Triethanolamine	Aqueous solution/liquid	A
Triethylamine		A
Trifluoroacetic Acid	50% in water	A+
Trifluoroacetic Acid		A
Trimethylamine	Aqueous solution/gas	A
Turpentine		A+
U		
Urea	Aqueous solution/solid	A+

Chemical Substance	Concentration*	Rating
V		
Varnish		A+
Varsol		A+
Vegetable Oil		A+
Vinegar		A+
Vinyl Acetate		A+
Vinyl Chloride		A+
Vinylidene Chloride		A+
W		
Water		A+
Water, salt		A+
Water, sewage		A+
Whiskey		A+
Wine		A+
X		
Xylene		A+
Z		
Zinc Acetate	Aqueous solution	A+
Zinc Bromide	Aqueous solution/solid	A+
Zinc Chloride	Aqueous solution/solid	A+
Zinc Nitrate	Aqueous solution/solid	A+
Zinc Sulfate	Aqueous solution/solid	A+

The ratings given on the previous pages are a guide and do not constitute a warranty of any kind, expressed or implied, with respect to the performance of Kynar® polyvinylidene fl uoride resin in any specifi c application.

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Notes

Notes

SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.

Toll free: (866) 473-9462

www.ipexinc.com

U.S. Customers call IPEX USA LLC

Toll free: (800) 463-9572

www.ipexamerica.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the world's largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

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