

## CHEMICAL RESISTANCE CHART

**Notice:** The Chemical Resistance Chart given on the following pages is intended as a *general guide* for rating the resistance of typical engineering materials to common industrial chemicals. *It is not intended as a guarantee of material performance.* The ratings in the chart are based on data obtained from technical publications, material manufacturers and laboratory tests. The information given in the chart should be used as a first approximation for material selection, rather than the final answer. This is because chemical effects are dependent on many

factors, which can cause chemical ratings to change within a given application. Such factors include variations in temperature, pressure and concentration, chemical combinations, impurities or filler materials, aeration, agitation and exposure time. It is recommended that pumps and materials first be tested under simulated field service conditions. *Never test or operate a pump before acceptable chemical ratings have been obtained and the proper safety precautions have been taken.*

## Interpretation of Chemical Resistance Ratings

Rating	Meaning	Corrosion Rate (CR)	Units
A	Excellent – Virtually no effect; very low corrosion rate.	CR < 0.002	in/yr
		CR < 0.05	mm/yr
B	Good – Minor effect; low corrosion rate or slight discoloration observed.	0.002 ≤ CR < 0.02	in/yr
		0.05 ≤ CR < 0.5	mm/yr
C	Fair – Moderate effect; moderate to high corrosion rate. Softening, weakening or swelling may occur. <i>Not recommended for continuous use.</i>	0.02 ≤ CR < 0.05	in/yr
		0.5 ≤ CR < 1.3	mm/yr
D	Severe Effect – Immediate attack, explosive or very high corrosion rate. <i>Not recommended for any use.</i>	CR ≥ 0.05	in/yr
		CR ≥ 1.3	mm/yr
N	No Data Available	---	---

- Notes:**
- 1 Ratings for all chemicals apply at room temperature unless chemical is molten (e.g., paraffin wax, sulfur, etc.).
  - 2 Ratings for Carbon apply to Graphite-grade Carbon (i.e., Graphite or Carbon-60).
  - 3 Ratings for SiC apply to Self-Sintered Silicon Carbide.
  - 4 Ratings for Ceramic apply to Ceramic Aluminum Oxide (Al<sub>2</sub>O<sub>3</sub>).
  - 5 Ratings apply to chemicals at 100% concentration (except for salts which are based on aqueous solutions) unless stated otherwise.

## Definition of Terms:

SS = Stainless Steel  
 Alloy-20 = High-Nickel Stainless Steel  
 Alloy-C = Ni-Cr-Mo Alloy  
 Ti = Titanium  
 C = Carbon  
 SiC = Silicon Carbide  
 Cer. = Ceramic

Teflon® = Poly-tetra-fluoro-ethylene (PTFE)  
 Ryton® = Poly-phenylene Sulfide (PPS)  
 PEEK = Poly-ether-ether-ketone  
 Viton® = Fluorocarbon Rubber  
 EPDM = Ethylene-Propylene-Diene Monomer (Rubber)  
 NBR = Nitrile Buna Rubber  
 Kalrez® = Perfluorinated Elastomer

Chemical/Fluid	Metals					Plastics			Elastomers				Minerals		
	304 SS	316 SS	Alloy-20	Alloy-C	Ti	Teflon	Ryton	PEEK	Viton	EPDM	NBR	Kalrez	C	SiC	Cer.
<b>A</b>															
Acetaldehyde	A	A	A	A	A	A	A	A	D	B	C	A	A	A	A
Acetic Acid	B	A	A	A	A	A	A	A	B	A	B	A	A	A	A
Acetone	A	A	A	A	A	A	A	A	D	A	D	A	A	A	A
Acetonitrile	A	A	A	A	N	A	A	A	A	A	C	A	A	A	A
Aluminum Chloride, 20%	D	C	C	A	D	A	A	A	A	A	A	A	A	A	A
Alum. Potass. Sulfate, 10%	A	A	A	B	A	A	N	A	A	A	A	A	A	A	A
Aluminum Sulfate	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ammonia, Anhydrous	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A
Ammonium Chloride	D	B	B	B	A	A	A	A	A	A	A	A	A	A	A
Ammonium Hydroxide	A	A	A	A	A	A	A	A	D	A	D	B	A	A	A
Ammonium Nitrate	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
Ammonium Sulfate	C	B	B	B	A	A	A	A	D	A	A	A	A	A	A
Amyl Acetate	A	A	A	A	A	A	A	A	D	C	D	A	A	A	A
Aniline	A	A	A	B	A	A	A	A	C	B	D	A	A	A	A
Aqua Regia <sup>1</sup>	D	D	D	C	A	A	D	D	A	B	D	A	D	A	A
Asphalt	A	A	A	N	N	A	A	A	A	D	B	A	A	A	A
<b>B</b>															
Barium Hydroxide	B	A	A	B	A	A	A	N	A	A	A	A	A	A	A
Benzene	A	A	A	B	A	A	A <sub>2</sub>	A <sub>2</sub>	A	D	D	A	A	A	A
Benzoic Acid	B	B	B	A	A	A	A	A	A	D	D	A	A	A	A
Benzyl Alcohol	A	A	A	A	A	A	A <sub>2</sub>	N	A	D	D	A	A	A	A
Bitumen	A	A	A	A	A	A	A	A	A	D	B	A	A	A	A
Boric Acid	B	A	B	A	A	A	A	A	A	A	A	A	A	A	A
Brine (NaCl & Water)	B	B	B	A	A	A	A	A	A	C	A	A	A	A	A
Butadiene	A	A	A	A	A	A	A	N	A	D	D	A	A	A	A
Butane	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Butyl Acetate	B	B	B	A	A	A	A	A	D	B	D	A	A	A	A
Butyl Alcohol	A	A	A	A	A	A	A	A	A	B	B	A	A	A	A
<b>C</b>															
Calcium Chloride	D	B	B	B	A	A	A	A	A	A	A	A	A	A	A
Calcium Hydroxide	B	B	B	A	A	A	A	A	A	A	A	A	A	A	A
Calcium Hypochlorite	D	B	C	B	A	A	A	A	A	A	B	A	A	A	A
Carbon Disulfide	B	B	B	B	A	A	A	D	A	D	D	A	A	A	A
Carbon Tetrachloride	A	A	A	A	A	A <sub>2</sub>	B	A	A	D	B	A	C	A	A
Carbonic Acid	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
Chlorine, anhydrous liquid	A	A	A	A	D	A	D	D	A	D	B	A	A	A	A
Chlorobenzene	B	B	B	B	A	A <sub>2</sub>	A <sub>2</sub>	A <sub>2</sub>	A	D	D	A	A	A	A
Chloroform	A	A	A	B	A	A <sub>2</sub>	B	A	A	D	D	A	C	A	A
Chlorosulfonic Acid	B	B	B	A	A	A	D	A	D	D	D	A	A	A	A
Chromic Acid, 30%	D	D	D	B	A	A	B	A	A	B	D	A	A	A	A
Citric Acid	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Copper Sulfate	B	B	B	A	A	B	A	A	A	A	A	A	A	A	A
Crude Oil	A	A	A	A	A	A	A	A	A	D	B	A	A	A	A
Cyclohexane	B	B	B	B	A	A	A	A	A	D	A	A	A	A	A
Cyclohexanol	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
<b>D</b>															
Diesel Fuel	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Diethylamine (DEA)	A	A	A	A	A	A	N	A	C	A	C	A	A	A	A
Diethylether	A	A	A	A	A	A	A	A	D	D	D	A	A	A	A
Diocetyl Phthalate (DOP)	A	A	A	A	A	A	A	N	B	B	D	A	A	A	A
Dowtherm	A	A	A	A	A	A	A	N	A	D	D	A	A	A	A

Footnotes:

- 1) Aqua Regia consists of 3:1 or 4:1 conc. HCl / conc. HNO<sub>3</sub>.
- 2) Swelling of plastic material may occur.
- 3) Depends on specific type of Freon.
- 4) For MDI or TDI service, pump must be completely dry. Carbon must not come into contact with humid environments or any compound containing a hydroxyl (-OH) group (e.g., water, alcohols and polyols).

Chemical/Fluid	Metals					Plastics			Elastomers				Minerals		
	304 SS	316 SS	Alloy-20	Alloy-C	Ti	Teflon	Ryton	PEEK	Viton	EPDM	NBR	Kalrez	C	SiC	Cer.
<b>E</b>															
Ethanol	A	A	A	A	A	A	A	A	C	A	C	A	A	A	A
Ether	A	A	A	B	A	A	A	A	C	C	D	A	A	A	A
Ethyl Acetate	A	A	A	A	A	A	A	A	D	B	D	A	A	A	A
Ethylene Glycol	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ethylene Oxide	A	A	A	A	A	A	N	A	D	C	D	A	A	A	A
<b>F</b>															
Fatty Acid	B	A	A	A	B	A	N	A	A	C	B	A	A	A	A
Ferric Chloride	D	D	D	B	A	A	A	B	A	A	A	A	C	A	A
Ferric Sulfate	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Fluosilicic Acid	C	C	C	B	D	A	A	N	B	B	A	A	A	A	C
Formaldehyde	A	A	A	B	A	A	N	A	D	B	C	A	A	A	A
Freon, general	A	A	A	A	A	A <sub>2</sub>	A	A	----- See Footnote 3 -----			A	A	A	
Fuel Oil	A	A	A	A	A	B	A	A	A	D	A	A	A	A	A
<b>G</b>															
Gasoline, unleaded	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Gasoline, high-aromatic	A	A	A	A	B	A	A <sub>2</sub>	A <sub>2</sub>	A	D	A	A	A	A	A
Glucose (Corn Syrup)	A	A	A	A	A	A	N	A	A	A	A	A	A	A	A
Glycerin (Glycerol)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
<b>H</b>															
Heptane	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Hexane	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Hydraulic Fluid, petro.	A	A	A	A	N	A	N	A	A	D	A	A	B	A	A
Hydraulic Fluid, synth.	A	A	A	A	N	A	N	A	A	D	B	A	B	A	A
Hydrazine	A	A	A	A	A	A	N	A	D	A	B	A	A	A	N
Hydrobromic Acid, 20%	D	D	D	A	A	A	N	D	A	A	D	A	A	A	N
Hydrochloric Acid, 37%	D	D	D	B	D	A	D	A	A	C	D	A	A	A	C
Hydrofluoric Acid, 20%	D	D	D	B	D	A	A	D	D	D	D	A	A	A	D
Hydrogen Peroxide, 50%	B	B	B	D	A	A	D	A	A	C	D	A	C	A	N
<b>I-J-K-L</b>															
Isopropyl Alcohol	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
Jet Fuel	A	A	A	A	A	A	A	A	A	D	B	A	A	A	A
Kerosene	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
Lactic Acid	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A
<b>M</b>															
Maleic Acid	A	B	B	B	A	A	N	A	A	D	D	A	A	A	N
Methanol	A	A	A	A	B	A	A	A	D	A	D	A	A	A	A
Methyl Ethyl Ketone (MEK)	A	A	A	A	A	A	A	A	D	A	D	A	A	A	A
Methylene Chloride	B	B	B	B	B	A <sub>2</sub>	A	A	B	D	D	A	C	A	A
Methylene p-diphenyl-Di-Isocyanate (MDI) <sup>4</sup>	N	A	N	A	N	A	N	N	D	B	D	A	A <sub>4</sub>	A	A
Mineral Oil	A	A	A	A	A	A	A	A	A	D	A	A	A	A	A
<b>N</b>															
Naphtha	A	A	A	A	A	A	A	A	A	D	B	A	A	A	A
Naphthalene	A	A	A	B	A	A	A	A	A	D	D	A	A	A	A
Nitric Acid, 20%	A	A	A	A	A	A	D	B	A	B	D	A	A	A	A
Nitrous Acid	D	B	B	D	B	A	N	A	C	A	C	A	A	A	A
<b>O</b>															
Oleic Acid	B	B	B	A	A	A	A	A	B	D	C	A	A	A	A
Oleum	A	A	A	B	D	A	B	N	A	D	D	A	D	A	A
Oxalic Acid	B	A	A	B	A	A	A	A	A	A	B	A	A	A	A

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<b>P</b>															
Paraffin	A	A	A	B	A	A	N	A	A	D	A	A	A	A	A
Pentane	B	B	N	A	A	A	N	A	A	D	A	A	A	A	A
Perchloric Acid	D	D	D	B	D	A	A	A	A	A	D	A	D	A	A
Perchloroethylene	B	B	B	A	A	A <sub>2</sub>	A	A	A	D	B	A	A	A	A
Phenol	A	A	A	A	A	A	A <sub>2</sub>	D	A	D	D	A	A	A	A
Phosphoric Acid, 40%	B	B	B	A	C	A	C	A	A	B	D	A	A	A	A
Phthalic Acid	B	A	A	B	A	A	N	A	C	A	C	A	A	A	N
Potassium Hydroxide, 50%	B	B	B	B	C	A	A	A	D	A	B	A	A	A	D
Potassium Nitrate	B	B	B	B	A	A	A	A	A	A	A	A	A	A	B
Potassium Permanganate	B	B	B	A	A	A	A	A	C	A	C	A	A	A	A
Propyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Propylene Glycol	B	B	B	B	A	A	N	N	C	A	C	A	A	A	A
Pyridine	A	A	A	B	B	A	A	A	A	B	D	A	A	A	A
<b>S</b>															
Silver Nitrate	B	A	A	A	A	A	A	A	A	A	B	A	A	A	A
Sodium Bicarbonate	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
Sodium Bisulfite	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A
Sodium Chlorate	B	B	A	A	A	A	A	A	C	A	C	A	A	A	A
Sodium Chloride	B	B	B	A	A	A	A	A	A	C	A	A	A	A	A
Sodium Hydroxide, 50%	B	B	B	A	B	A	A	A	B	A	B	A	A	A	D
Sodium Hypochlorite, ≤20%	D	D	D	A	A	A	C	A	A	A	B	A	B	A	A
Sodium Peroxide	A	A	A	B	N	A	N	A	A	A	B	A	A	A	A
Sodium Silicate	A	A	A	B	A	A	A	A	A	A	A	A	A	A	A
Sodium Sulfide	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A
Sulfur, molten	B	A	A	A	A	A	N	N	A	C	D	A	A	A	A
Sulfuric Acid, <10%	D	B	A	A	D	A	A	A	A	A	A	A	A	A	A
Sulfuric Acid, 10-75%	D	D	A	A	D	A	B	D	A	B	B	A	A	A	A
Sulfuric Acid, 75-93%	D	D	A	A	D	A	B	D	A	B	C	A	A	A	A
Sulfuric Acid, 93-100%	A	A	A	A	D	A	B	D	A	C	N	A	A	A	A
Sulfurous Acid	B	B	B	B	A	A	A	A	A	B	B	A	A	A	A
<b>T</b>															
Tall Oil (Liquid Rosin)	B	B	B	A	N	A	N	N	A	D	A	A	A	A	A
Tallow	A	A	N	N	N	A	N	A	A	D	A	A	A	A	A
Tetrahydrofuran (THF)	A	A	A	A	B	A	A	A	D	B	D	A	A	A	A
Thionyl Chloride	N	D	N	A	N	A <sub>2</sub>	N	N	A	D	B	A	A	A	A
Toluene	A	A	A	A	A	A	A <sub>2</sub>	A <sub>2</sub>	A	D	D	A	A	A	A
Toluene Di-Isocyanate (TDI) 4	N	A	N	A	N	A	N	N	D	B	D	A	A <sub>4</sub>	A	A
Toluenesulphonic Acid	N	N	N	A	N	A	N	N	C	A	C	A	A	A	A
Trichloroethane	A	A	A	A	A	A <sub>2</sub>	N	A	A	D	D	A	A	A	A
Trichloroethylene	B	B	B	A	A	A <sub>2</sub>	C	A	A	D	C	A	A	A	A
Trichlorotrifluoroethane	A	A	A	A	A	A <sub>2</sub>	A	A	B	D	A	C	A	A	A
<b>U-V-W-X</b>															
Urea	B	B	B	B	A	A	A	A	A	A	B	N	A	A	B
Vinyl Chloride	B	A	A	A	A	A <sub>2</sub>	N	A	A	D	B	A	A	A	A
Water, distilled	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Water, deionized	A	A	N	A	A	A	A	A	A	A	A	A	A	A	B
Xylene	A	A	A	A	A	A	A <sub>2</sub>	A <sub>2</sub>	A	D	D	A	A	A	A

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