Technical Note

TN 4.02 Chemical Resistance of Polypropylene and Elastomers

The results reported herein are of testing performed on polypropylene (PP) material, compiled from multiple sources. A listing of sources is available at the conclusion of this document. Actual results may vary on the environmental conditions for each particular application. In evaluating the capability of polypropylene pipe, fittings, and manholes to withstand chemical attack, consideration should be given to the following:

1. The effect of an active substance on polypropylene is not as severe when contact is intermittent.
2. Increasing temperature increases chemical activity.
3. Internal pressure may affect the rate of penetration of a substance.
4. Excessive bending and other stresses resulting from improper installation may affect the life of polypropylene products. An example would be circumferential deflection beyond 50% or placing pipe directly on a large, sharp rock.

This listing contains accurate and reliable information to the best of our knowledge. The data contained herein is a compilation of studies conducted by various sources which Advanced Drainage Systems believes to be reliable. However, the information cannot be guaranteed because the conditions of use are beyond our control. The user of this information assumes all risk associated with its use.

Polypropylene

Test Procedure

Polypropylene specimens were placed in the relevant substance for a period of time without the application of mechanical stress. They were then tested for swelling or weight loss and subjected to tensile testing. In critical applications, it is suggested that greater reliance be placed on actual field experience or testing should be performed under similar conditions of stress, exposure, temperature and duration which can be related to the anticipated application. Data regarding resistance to chemicals not listed may be available by contacting an ADS representative.

Symbols used in the following table:	
Symbol	***Description***
+	specimen is resistant swelling < 3% or alternatively weight loss <. 0.5%, elongation of break not significantly changed
/	specimen has limited swelling 3 - 8% or alternatively weight resistance only loss 0.5 - 5%, and/or elongation at break decreased by < 50%
–	specimen is not resistant swelling > 8% or alternatively weight loss > 5%, and/or elongation a break decreased by> 50%
D	discoloration
*	or at the boil

Substance	POLYPROPYLENE		
	Concentration	68°F	140°F
Acetaldehyde		/	–
Acetic acid (glacial)	97%	+	/ (176°)
Acetic acid	50%	+	+ (176°)
Acetic acid	40%	+	
Acetic acid	10%	+	+
Acetone	100%	+	+
Acetophenone	100%	/	/
Acrylic emulsions		+	+
Aluminum chloride		+	+
Aluminum fluoride		+	+
Aluminum sulfate		+	+
Alums (all types)		+	+
Ammonia gas (dry)		+	+
Ammonia, aqueous	30%	+	
Ammonium carbonate	All	+	+
Ammonium chloride	All	+	+
Ammonium fluoride	20%	+	+
Ammonium hydroxide	28%	+	+
Ammonium metaphosphate		+	+
Ammonium nitrate	All	+	+
Ammonium persulfate	All	+	+
Ammonium sulphate	All	+	+
Ammonium sulphide	All	+	+
Ammonium thiocyanate		+	+
Amyl acetate	100%	/	–
Amyl alcohol	100%	+	/
Amyl chloride	100%	–	–
Aniline	100%	+	+
Anisole		/	/ to –
Antimony chloride		+	+
Aviation fuel (115/145 octane)	100%	/	–
Aviation turbine fuel	100%	/	–
Barium carbonate		+	+
Barium chloride		+	+
Barium hydroxide		+	+
Barium sulfate		+	+
Barium sulfide		+	+
Beer		+	+
Benzene	100%	/	–
Benzoic acid	all	+	+
Benzyl alcohol		+	+ (176°)
Benzyl chloride		/	–
Bismuth carbonate		+	+
Borax		+	+
Boric acid	all	+	+
Brine	saturated	+	+
Bromine, liquid	100%	–	
Bromine water	saturated	–	–
Butyl acetate	100%	–	–
Butyl alcohol		+	+
Calcium carbonate		+	+
Calcium chlorate		+	+
Calcium chloride	50%	+	+
Calcium hydroxide		+	+
Calcium hypochlorite bleach	20% (a)	+	/
Calcium nitrate	50%	+	+
Calcium phosphate	50%	+	
Calcium sulphate		+	+
Carbon dioxide (dry)	100%	+	+
Carbon dioxide (wet)	100%	+	+
Carbon disulphide		/	–
Carbon monoxide		+	+
Carbon tetrachloride	100%	–	–
Carbonic acid	All	+	+
Castor oil		+	
Cetyl alcohol (hexadecanol)	100%	+	
Chlorine, gaseous		–	–
Chlorine water		+	/
Chlorobenzene		–	–
Chloroform	100%	–	–
Chlorosulphonic acid		–	–
Chrome alum		+	+
Chromic acid	80% (a)	+	
Chromic acid	50% (a)	+	+
Chromic acid	10% (a)	+	+
Chromic/sulfuric acid	10%	–	–
Cider		+	+
Citric acid	10%	+	+

Substance	POLYPROPYLENE		
	Concentration	68°F	140°F
Citrus juices		+	+
Copper chloride	saturated	+	+
Copper cyanide	saturated	+	+
Copper fluoride	saturated	+	+
Copper nitrate	saturated	+	+
Copper sulphate	all	+	+
Cotton seed oil		+	+
Cuprous chloride	saturated	+	+
Cyclohexanol		+	+
Cyclohexanone		/	–
Decahydronaphthalene (Decalin)	100%	–	–
Detergents	2%	+	+
Developer solutions (photographic)		+	+
Dibutyl phthalate	100%	+	/ (– 212°)
Dichloroethylene	100%	+	
Diethanolamine	100%	+	+
Diisooctyl phthalate	100%	+	+
Dioxane		+	/
Emulsifiers		+	+
Ethanolamine	100%	+	+
Ethyl acetate	100%	/	/
Ethyl alcohol	96%	+	+
Ethyl chloride	100%	–	–
Ethyl dichloride	100%	/	
Ethylene glycol		+	+
Ethylene oxide	100%	/ (50°)	
Ethyl ether	100%	/	
Fatty acids (>C6)	100%	+	+
Ferric chloride	all	+	+
Ferric nitrate	saturated	+	+
Ferric sulfate	saturated	+	+
Ferrous chloride	saturated	+	+
Ferrous sulfate	all	+	+
Fluosilicic acid		+	+
Formaldehyde	40%	+	+
Formic acid	10%	+	+
Formic acid	100%	+	
Fructose		+	+
Fruit juices		+	+
Fual oil		+	+
Furfural		–	–
Gases liquor		–	
Gasoline	100%	/	–
Gearbox oil	100%	+	/
Gelatin		+	+
Glucose	20%	+	+
Glycerine	100%	+	+
Glycol		+	+
Hexane	100%	+	/
Hydrobromic acid	50% (a)	+	+
Hydrochloric acid	30% (a)	+	/
Hydrochloric acid	Up to 20%	+	+
Hydrofluoric acid	40%	+	+
Hydrofluoric acid	60% (a)	+	+
Hydrogen peroxide, aqueous	30%	+	
Hydrogen peroxide, aqueous	10%	+	/
Hydrogen peroxide, aqueous	3%	+	
Hydrogen sulfide		+	+
Hydroquinone		+	+
Ink		+	+
Iodine tincture		+	
Isooctane	100%	–	–
Isopropanol (isopropyl alcohol)	100%	+	+
Ketones		+	
Lactic acid	20%	+	+
Lanolin (wool fat)		+	+
Lead acetate	saturated	+	+
Linseed oil	100%	+	+
Lubricating oils	100%	+	/

Substance	POLYPROPYLENE		
	Concentration	68°F	140°F
Magenta dye, aqueous	2%	+	+ D
Magnesium carbonate	saturated	+	+
Magnesium chloride	saturated	+	+
Magnesium hydroxide	saturated	+	+
Magnesium sulfate	saturated	+	+
Magnesium sulfite	saturated	+	+
Meat juices		+	+
Mercuric chloride (corrosive sublimate)	40%	+	+
Mercuric cyanide	saturated	+	+
Mercurous nitrate	saturated	+	+
Mercury	100%	+	+
Methyl alcohol	100%	+	+
Methylbenzene		/	–
Methylene chloride	100%	+	
Methyl ethyl ketone	100%	+	/
Milk		+	+ (+ 212°)
Mineral oil	100%	+	/
Molasses		+	+
Motor oil (HD oil)	100%	+	/
Naphthalene	100%	+	+
Nickel chloride	saturated	+	+
Nickel nitrate	saturated	+	+
Nickel sulphate, aqueous	saturated	+	+
Nitric acid	70% (a)	–	–
Nitric acid	60%	+	–
Nitric acid	10%	+	+
Nitrobenzene		+	/
Oleic acid		+	/
Oleum			– (212°)
Olive oil	saturated	+	+
Oxalic acid, aqueous	50%	+	/
Paraffin	100%	+	/
Paraffin wax	100%	+	+
Perchloric acid	20%	+	–
Petrol	100%	/	–
Petroleum ether	100%	–	–
Phenol	100%	+	+ D
Phosphoric acid, aqueous	95%	+	+
Photographic developer		+	+
Potassium bicarbonate, aqueous	saturated	+	+
Potassium borate, aqueous	1%	+	+
Potassium bromate, aqueous	up to 10%	+	+
Potassium bromide, aqueous	saturated	+	+
Potassium carbonate, aqueous	saturated	+	+
Potassium chlorate, aqueous	saturated	+	+
Potassium chloride, aqueous	saturated	+	+
Potassium chromate, aqueous	40%	+	+
Potassium cyanide, aqueous	saturated	+	+
Potassium dichromate, aqueous	40%	+	+
Potassium ferricyanide and ferrocyanide, aqueous	saturated	+	+
Potassium fluoride, aqueous		+	+
Potassium hydroxide, aqueous	50%	+	+
Potassium nitrate, aqueous	saturated	+	+
Potassium perborate	saturated	+	+
Potassium perchlorate, aqueous	up to 10%	+	+
Potassium permanganate	20%	+	+
Potassium sulfate, aqueous		+	+
Potassium sulfide		+	+
Potassium sulfite		+	+
Propanol (propyl alcohol)	100%	+	+
Pyridine		+	
Silicone oil	100%	+	+
Silver nitrate		+	+
Soap solution, aqueous		+	+
Sodium acetate, aqueous	all	+	+
Sodium bicarbonate	saturated	+	+
Sodium bisulphate	saturated	+	+
Sodium bisulphite, aqueous	saturated	+	+
Sodium borate		+	+
Sodium bromide oil solution		+	+
Sodium carbonate, aqueous	saturated	+	+
Sodium chlorate, aqueous	saturated	+	+
Sodium chloride, aqueous	saturated	+	+
Sodium chlorite, aqueous	2%	+	+ (176°)

Substance	POLYPROPYLENE		
	Concentration	68°F	140°F
Sodium chlorite, aqueous	5%	+ (176°)	+
Sodium chlorite, aqueous	10%	+ (176°)	+
Sodium chlorite, aqueous	20%	+ (176°)	+
Sodium cyanide		+	+
Sodium dichromate		+	+
Sodium ferricyanide		+	+
Sodium ferrocyanide		+	+
Sodium fluoride		+	+
Sodium hydroxide, aqueous	50%	+	+
Sodium hydroxide, aqueous	10%	+	+
Sodium hypochlorite	20%	+	/
Sodium hypochlorite		+	
Sodium nitrate, aqueous		+	+
Sodium nitrite, aqueous		+	+
Sodium silicate		+	+
Sodium sulfate, aqueous	saturated	+	+
Sodium sulfide, aqueous	25%	+	+
Sodium sulfite, aqueous	saturated	+	+
Stannic chloride	saturated	+	+
Stannous chloride	saturated	+	+
Starch		+	+
Sugars and syrups		+	+
Sulfates of [calcium and magnesium]	saturated	+	+
Sulfates of [potassium and sodium]	saturated	+	+
Sulfur		+	+
Sulfuric acid	98% (a)	–	
Sulfuric acid	60%	+	/ (176°)
Sulfuric acid	50%	+	/
Sulfuric acid	10%	+	/
Sulfuric ether		+ to /	/*
Sulfur dioxide, aqueous	all	+	+
Sulfur dioxide, dry and moist	all	+	+
Sulfurous acid		+	+
Sulfur trioxide		–	wet, gas, dry
Sulfuryl chloride		–	
Syrup		+	+
Tallow		+	+
Tannic acid	10%	+	+
Tetrahydrofuran	100%	–	–
Tetralin	100%	–	–
Toluene	100%	–	–
Transformer oil	100%	+	/
Trichloroacetic acid	10%	+	+
Trichloroethylene	100%	+	+
Turpentine	100%	–	–
Urea, aqueous		+	+
Urine		+	+
Vegetable oil		+	+
Water, distilled		+	+
Wet chlorine gas			–
Whiskey		+	+
White paraffin	100%	+	/
White spirit	100%	/	–
Wine		+	+
Xylene	100%	–	–
Yeast		+	+
Zinc chloride	saturated	+	+
Zinc oxide		+	+
Zinc sulphate, aqueous	saturated	+	+

Elastomers

Test Procedure

The criteria for the ratings of various elastomers presented here (Natural Rubber, SBR, and EPDM) were primarily volume swell resistance, compression set resistance, and aging resistance. The ratings were developed from specific data or general agreement of the sources identified in the corresponding table enclosed. Several important factors must be considered in the use of rubber parts in service, including:

1. The Temperature of Service: Greater temperatures increase the effect of all chemicals on polymers. The affect of the temperature varies with the polymer and the chemical.
2. Conditions of Service: A compound that swells badly might still function well as a static seal yet fail in dynamic applications.

Numbers used in the following table:	
Number	***Description***
1	Minor effect
2	Moderate effect
3	Static only
4	Not recommended
–	Insufficient data

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Acetaldehyde	2	3	1
Acetamide	4	4	1
Acetic acid, glacial	2	2	1
Acetic acid 30%	2	2	1
Acetic anhydride	2	2	2
Acetone	3	3	1
Acetophenone	4	4	1
Acetyl chloride	4	4	4
Acetylene	2	2	1
Acrylonitrile	4	4	4
Adipic acid	1	1	1
Alkazene (Dibromoethylbenzene)	4	4	4
Alum-NH3-Cr-K (aq)	1	1	1
Aluminum acetate (aq)	1	2	1
Aluminum chloride (aq)	1	1	1
Aluminum fluoride (aq)	2	1	1
Aluminum nitrate (aq)	1	1	1
Aluminum phosphate (aq)	1	1	1
Aluminum sulfate (aq)	1	1	1
Ammonia anhydrous	4	4	1
Ammonia gas (cold)	1	1	1
Ammonia gas (hot)	4	4	2
Ammonium carbonate (aq)	1	1	–
Ammonium chloride (aq)	1	1	1
Ammonium hydroxide (conc.)	4	4	1
Ammonium nitrate aq)	3	2	1
Ammonium nitrite (aq)	1	1	1
Ammonium persulfate (aq)	1	4	1
Ammonium phosphate (aq)	1	1	1
Ammonium sulfate (aq)	1	1	1
Amyl acetate (banana oil)	4	4	3
Amyl alcohol	2	2	1
Amyl borate	4	4	4
Amyl chloronaphthalene	4	4	4
Amyl naphthalene	4	4	4
Aniline	4	4	1
Aniline dyes	2	2	1
Aniline hydrochloride	2	4	2
Animal fats	4	4	2
Ansul ether (anesthetics)	4	4	3
Aqua regia	4	4	3
Aroclor, 1248	4	4	3
Aroclor, 1254	4	4	3
Aroclor, 1260	1	1	1
Arsenic acid	2	1	1
Arsenic trichloride (aq)	4	4	3
Askarel	4	4	4
Asphalt	4	4	4
Banana oil (amyl acetate)	4	4	3
Barium chloride (aq)	1	1	1
Barium hydroxide (aq)	1	1	1
Barium sulfate (aq)	1	1	1
Barium sulfide (aq)	1	2	1
Beer	1	1	1
Beet sugar liquors	1	1	1
Benzaldehyde	4	4	1
Benzene	4	4	4
Bezene sulfonic acid	4	4	3
Benzine (Ligroin) (Nitrobenzine) (pet ether)	4	4	4
Benzoic acid	4	4	3
Benzoyl chloride	4	4	4
Benzyl alcohol	4	4	1
Benzyl benzoate	4	4	2
Benzyl chloride	4	4	4
Biphenyl (Diphenyl) (Phenylbenzene)	4	4	4
Blast furnace gas	4	4	4
Bleach solutions	4	4	1
Borax	2	2	1
Bordeaux mixture	2	2	1
Boric acid	1	1	1
Brine	1	1	1
Bromine-anhydrous	4	4	4
Bromine trifluoride	4	4	4
Bromine water	4	4	2
Bromobenzene	4	4	4
Binker oil	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Butadiene	4	4	3
Butane	4	4	4
Butter (animal fat)	4	4	1
Butyl acetate	4	4	3
Butyl acetyl ricinoleate	4	4	1
Butyl acrylate	4	4	4
Butyl alcohol	1	1	2
Butyl amine	4	4	2
Butyl benzoate	3	2	2
Butyl carbitol	4	4	1
Butyl cellusolve	4	4	1
Butyl oleate	4	4	2
Butyl stearate	4	4	3
Butylene	4	4	4
Butyraldehyde	4	4	2
Calcium acetate (aq)	1	4	1
Calcium bisulfite (aq)	4	4	4
Calcium chloride (aq)	1	1	1
Calcium hydroxide (aq)	1	1	1
Calcium hypochlorite (aq)	3	3	1
Calcium nitrate (aq)	1	1	1
Calcium sulfide (aq)	2	2	1
Cane sugar liquors	1	1	1
Carbamate	4	4	2
Carbitol	2	2	2
Carbolic acid (phenol)	4	4	2
Carbon bisulfide	4	4	4
Carbon dioxide	2	2	2
Carbonic acid	1	2	1
Carbon monoxide	2	2	1
Carbon tetrachloride	4	4	4
Castor oil	1	1	2
Cellosolve	4	4	2
Cellosolve acetate	4	4	2
Cellulube (Fryquel)	4	4	1
China wood oil (Tung oil)	4	4	3
Chlorine (dry)	4	4	4
Chlorine (wet)	4	4	3
Chlorine dioxide	4	4	3
Chlorine trifluoride	4	4	4
Chloroacetic acid	4	4	1
Chloroacetone	4	4	1
Chlorobenzene	4	4	4
Chlorobromomethane	4	4	2
Chlorobutadiene	4	4	4
Chlorododecane	4	4	4
Chloroform	4	4	4
O-Chloronaphthalene	4	4	4
1-Chloro-1-Nitro ethane	4	4	4
Chlorosulfonic acid	4	4	4
Chlorotoluene	4	4	4
Chlorox (sodium hypoochlorite NaOCl)	4	4	2
Chrome plating solutions	4	4	2
Chromic acid	4	4	3
Citric acid	1	1	1
Coal tar (creosote)	4	4	4
Cobalt chloride (aq)	1	1	1
Coconut oil	4	4	3
Cod liver oil	4	4	1
Coke oven gas	4	4	4
Copper acetate (aq)	1	4	1
Copper chloride (aq)	1	1	1
Copper cyanide (aq)	1	1	1
Copper sulfate (aq)	2	2	1
Cornoil	4	4	3
Cottonseed oil	4	4	2
Creosote (Coal tar)	4	4	4
Cresol	4	4	4
Cresylic acid	4	4	4
Cumene	4	4	4
Cyclohexane	4	4	4
Cyclohexanol	4	4	3
Cyclyohexanone	4	4	2
P-Cymene	4	4	4
Decalin	4	4	4
Decane	4	4	4
Denatured alcohol	1	1	1

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Detergent solutions	2	2	1
Developing fluids	1	2	2
Diacetone	4	4	1
Diacetone alcohol	4	4	1
Dibenzyl ether	4	4	2
Dibenzyl sebacate	4	4	2
Dibromoethylbenzene (Alkazene)	4	4	4
Dibutyl amine	4	4	3
Dibutyl ether	4	4	3
Dibutyl phthalate	4	4	2
Dibutyl sebecate	4	4	2
O-Dichlorobenzene	4	4	4
Dichloro-isopropyl ether	4	4	3
Dicyclohexylamine	4	4	4
Diesel oil	4	4	4
Diethylamine	2	2	2
Diethyl benzene	4	4	4
Diethyl ether	4	4	4
Diethylene glycol	1	1	1
Diethyl sebacate	4	4	2
Diisobutylene	4	4	4
Diisopropyl benzene	4	4	4
Diisopropyl ketone	4	4	1
Diisopropylidene acetone (Phorone)	4	4	3
Dimethyl aniline (Xylidene)	3	3	2
Dimethyl ether (methyl ether) (monomethyl ether)	4	4	4
Dimethyl formamide	4	4	2
Dimethyl phthalate	4	4	2
Dinitrotoluene	4	4	4
Dioctyl Phthalate	4	4	2
Dioctyl Sebecate	4	4	2
Dioxane	4	4	2
Dioxolane	4	4	2
Dipentene	4	4	4
Diphenyl (Biphenyl) (Phenylbenzene)	4	4	4
Diphenyl oxides	4	4	4
Dowtherm oil	4	4	4
Dry cleaning fluids	4	4	4
Epichlorohydrin	4	4	2
Ethane	4	4	4
Ethanolamine	2	2	2
Ethyl acetate	4	4	2
Ethyl acetoacetate	3	3	2
Ethyl acrylate	4	4	2
Ethyl alcohol	1	1	1
Ethyl benzene	4	4	4
Ethyl benzoate	1	1	1
Ethyl cellosolve	4	4	4
Ethyl cellulose	2	2	2
Ethyl chloride	4	4	3
Ethyl chlorocarbonate	4	4	2
Ethyl chloroformate	4	4	2
Ethyl ether	4	4	3
Ethyl formate	4	4	2
Ethyl mercaptan	4	4	3
Ethyl oxalate	1	1	1
Ethyl pentachlorobenzene	4	4	4
Ethyl silicate	2	2	1
Ethylene	3	3	2
Ethylene chloride	4	4	3
Ethylene chlorohydrin	2	2	2
Ethylene diamine	1	2	1
Ethylene dichloride	4	4	3
Ethylene glycol	1	1	1
Ethylene oxide	4	4	3
Ethylene trichloride	4	4	3
Fatty acids	4	4	3
Ferric chloride (aq)	1	1	1
Ferric nitrate (aq)	1	1	1
Ferric sulfate (aq)	1	1	1
Fishoil	4	4	4
Fluorinated cyclic ethers	4	4	1
Fluorine (liquid)	4	4	4
Fluorobenzene	4	4	4
Fluoroboric acid	1	1	1

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Fluorocarbon oils	2	2	1
Fluorolube	2	3	1
Fluorosilicic acid (hydrofluosilicic acid)	2	3	2
Formaldehyde (RT)	2	2	1
Formic acid	2	1	1
Freon 11	4	4	4
Freon 12	2	1	2
Freon 13	1	1	1
Freon 21	4	4	4
Freon 22	2	1	1
Freon 31	2	2	1
Freon 32	1	1	1
Freon 112	4	3	4
Freon 113	3	2	3
Freon 114	1	1	1
Freon 115	1	1	1
Freon 142b	2	2	2
Freon 152a	1	1	1
Freon 218	1	1	1
Freon C316	1	1	1
Freon C318	1	1	1
Freon 13B1	1	1	1
Freon 114B2	4	3	4
Freon 502	1	1	1
Freon TF	4	3	4
Freon T-WD602	4	3	2
Freon TMC	4	4	3
Freon T-P35	1	1	1
Freon TA	3	3	2
Freon TC	4	3	2
Freon MF	4	4	4
Freon BF	4	4	4
Fueloil	4	4	4
Fumaric acid	3	3	2
Furan, furfuran	4	4	3
Furfural	4	4	2
Fyrquel (cellulube)	4	4	1
Gallic acid	1	2	2
Gasoline	4	4	4
Gelatin	1	1	1
Glouber's salt (aq)	2	4	2
Glucose	1	1	1
Glue	2	2	1
Glycerin	1	1	1
Glycols	1	1	1
Green sulfate liquor	2	2	1
Holowax oil	4	4	4
N-Hexaldehyde	4	4	1
Hexane	4	4	4
N-Hexene-1	4	4	4
Hexyl alcohol	2	2	3
Hydrazine	1	1	1
Hydraulic oil (petroleum)	4	4	4
Hydrobromic acid	1	4	1
Hydrobromic acid 40%	1	4	1
Hydrochloric acid (cold) 37%	2	2	1
Hydrochloric acid (hot) 37%	4	4	3
Hydrocyanic acid	2	2	1
Hydrofluroic acid (conc.) cold	4	4	3
Hydrofluoric acid (conc.) hot	4	4	4
Hydrofluoric acid - anhydrous	4	4	3
Hydrofluosilicic acid (fluosilicic acid)	2	3	2
Hydrogen gas	2	1	1
Hydrogen peroxide (90%)	4	4	2
Hydrogen sulfide (wet) cold	4	4	1
Hydrogen sulfide (wet) hot	4	4	1
Hydroquinone	2	4	2
Hypochlorous acid	2	4	2
Iodine pentafluoride	4	4	4
Iodoform	4	4	4
Isobutyl alcohol	1	2	1
Isooctane	4	4	4
Isophorone	4	4	3
Isopropyl acetate	4	4	2
Isopropyl alcohol	1	2	1
Isopropyl chloride	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Isopropyl ether	4	4	4
Kerosene	4	4	4
Lacquers	4	4	4
Lacquer solvents	4	4	4
Lactic acid (cold)	1	1	1
Lactic acid (hot)	4	4	4
Lard	4	4	2
Lavender oil	4	4	4
Lead acetate (aq)	1	4	1
Lead nitrate (aq)	1	1	1
Lead sulfamate (aq)	2	2	1
Ligroin (Benzine) (Nitrobenzine) (pet ether)	4	4	4
Lime bleach	1	2	1
Lime sulfur	4	4	1
Lindol (hydraulic fluid)	4	4	1
Linoleic acid	4	4	4
Linseed oil	4	4	3
Liquefied petroleum gas	4	4	4
Lubricatting oils (petroleum)	4	4	4
Lye2	2	1	–
Magnesium chloride (aq)	1	1	1
Magnesium hydroxide (aq)	2	2	1
Magnesium sulfate (aq)	2	2	1
Maleic acid	3	3	2
Maleic anhydride	3	3	2
Malic acid	3	3	2
Mercury chloride (aq)	1	1	1
Mercury	1	1	1
Mesityl oxide	4	4	2
Methane	4	4	4
Methyl acetate	3	3	1
Methyl acrylate	4	4	2
Methylacrylic acid	4	4	2
Methyl alcohol	1	1	1
Methyl bromide	4	4	4
Methyl butyl ketone (propyl acetone)	4	4	1
Methyl cellosolve	4	4	2
Methyl chloride	4	4	3
Methyl cyclopentane	4	4	4
Methylene chloride	4	4	3
Methyl ether (dimethyl ether) (monomethyl ether)	4	4	4
Methyl ethyl ketone	4	4	1
Methyl formate	4	4	2
Methyl isobutyl ketone	4	4	2
Methyl methacrylate	4	4	3
Methyl oleate	4	4	2
Methyl salicylate	3	3	2
Milk	1	1	1
Mineral oil	4	4	3
Monochlorobenzene	4	4	4
Monomethyl aniline	4	4	2
Monoethanol amine	2	2	1
Monomethyl ether (methyl ether) (dimethyl ether)	4	4	4
Monovinyl acetylene	2	2	2
Mustard gas	1	2	1
Naphtha	4	4	4
Naphthalene	4	4	4
Naphthalenic acid	4	4	4
Natural gas	2	2	4
Neats foot oil	4	4	2
Neville acid	4	4	2
Nickel acetate (aq)	1	4	1
Nickel chloride (aq)	1	1	1
Nickel sulfate (aq)	2	2	1
Niter cake	1	1	1
Nitric acid (conc.)	4	4	4
Nitric acid (dilute)	4	4	2
Nitric acid - red fuming	4	4	4
Nitrobenzene	4	4	1
Nitrobenzene (petroleum ether)	4	4	4
Nitroethane	2	2	2
Nitrogen	1	1	1
Nitrogen tetroxide	4	4	3
Nitromethane	2	2	2
Octachlorotoluene	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Octadecane	4	4	4
N-Octane	4	4	4
Octyl alcohol	2	2	3
Oleic acid	4	4	4
Oleum spirits	4	4	4
Olive oil	4	4	2
O-Dichlorobenzene	4	4	4
Oxalic acid	2	2	1
Oxygen - cold	2	2	1
Oxygen - (200°-400°F)	4	4	3
Ozone	4	4	1
Paint thinner, duco	4	4	4
Palmitic acid	2	2	2
Peanut oil	4	4	3
Perchloric acid	4	4	2
Perchloroethylene	4	4	4
Petroleum - below 250°F	4	4	4
Petroleum - above 250°F	4	4	4
Phenol (carbolic acid)	4	–	2
Phenylbenzene (biphenyl) (diphenyl)	4	4	4
Phenyl ethyl ether	4	4	4
Phenyl hydrazine	1	2	2
Phorane (diisopropylidene acetone)	4	4	3
Phosphoric acid - 20%	2	2	1
Phosphoric acid - 45%	3	3	1
Phoshorus trichloride	4	4	1
Pickling solution	4	4	3
Picric acid	2	2	2
Pinene	4	4	4
Pineoil	4	4	4
Piperidine	4	4	4
Plating solution - chrome	4	4	1
Polyvinyl acetate emulsion	2	4	1
Potassium acetate (aq)	1	4	1
Potassium chloride (aq)	1	1	1
Potassium cupro cyanide (aq)	1	1	1
Potassium cyanide (aq)	1	1	1
Potassium dichromate (aq)	2	2	1
Potassium hydroxide (aq)	2	2	1
Potassium nitrate (aq)	1	1	1
Potassium sulfate (aq)	2	1	1
Producer gas	4	4	4
Propane	4	4	4
i-Propyl acetate	4	4	2
n-Propyl acetate	4	4	2
Propyl acetone (methyl butyl ketone)	4	4	1
Propyl alcohol	1	1	1
Propyl nitrate	4	4	2
Propylene	4	4	4
Propylene oxide	4	4	2
Pydraul, 10E, 29 ELT	4	4	1
Pydraul, 30E, 50E, 65E, 90E	4	4	1
Pydraul, 115E	4	4	1
Pydraul, 230E, 312C, 540C	4	4	4
Pyranol, transformer oil	4	4	4
Pyridine	4	4	2
Pyroligneous acid	4	4	2
Pyrrole	3	3	3
Radiation	3	3	2
Rapeseed oil	4	4	1
Red oil (MIL-H-5606)	4	4	4
RJ-1 (MIL-F-25558 B)	4	4	4
RP-1 (MIL-F-25576 C)	4	4	4
Sal ammoniac	1	1	1
Salicylic acid	1	2	1
Salt water	1	1	1
Sewage	2	2	2
Silicate esters	4	4	4
Silicone greases	1	1	1
Silicone oils	1	1	1
Silver nitrate	1	1	1
Skydrol 55	4	4	1
Skydrol 7000	4	4	1
Soap solutions	2	1	1
Soda ash	1	1	1
Sodium acetate (aq)	1	4	1

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Sodium bicarbonate (aq) (baking soda)	1	1	1
Sodium bisulfite (aq)	1	2	1
Sodium borate (aq)	1	1	1
Sodium chloride (aq)	1	1	1
Sodium cyanide (aq)	1	1	1
Sodium hydroxide (aq)	1	1	1
Sodium hypochlorite (aq) (Clorox)	4	4	2
Sodium metaphosphate (aq)	1	1	1
Sodium nitrate (aq)	2	1	1
Sodium perborate (aq)	2	2	1
Sodium peroxide (aq)	2	2	1
Sodium phosphate (aq)	1	1	1
Sodium silicate (aq)	1	1	1
Sodium sulfate (aq)	2	2	1
Sodium thiosulfate (aq)	2	2	1
Soybean oil	4	4	3
Stannic chloride (aq)	1	1	1
Stannous chloride (aq)	1	1	1
Steam under 300°F	4	4	1
Steam over 300°F	4	4	3
Stearic acid	2	2	2
Stoddard solvent	4	4	4
Styrene	4	4	4
Sucrose solution	1	1	1
Sulfite liquors	2	2	2
Sulfur	4	4	1
Sulfur chloride (aq)	4	4	4
Sulfur dioxide (dry)	2	2	1
Sulfur dioxide (wet)	4	4	1
Sulfur dioxide (liquified under pressure)	4	4	1
Sulfur hexafluoride	4	4	1
Sulfur trioxide	2	2	2
Sulfuric acid (dilute)	3	3	2
Sulfuric acid (conc.)	4	4	3
Sulfuric acid (20% oleum)	4	4	4
Sulfurous acid	2	2	2
Tannic acid	1	2	1
Tar, bituminous	4	4	3
Tartaric acid	3	4	2
Terpineol	4	4	3
Tertiary butyl alcohol	2	2	2
Tertiary butyl catechol	4	2	2
Tertiary butyl mercaptan	4	4	4
Tetrabromoethane	4	4	4
Tetrabromomethane	4	4	4
Tetrabutyl titanate	2	2	1
Tetrachloroethylene	4	4	4
Tetraethyl lead	4	4	4
Tetrahydrofuran	4	4	3
Tetralin	4	4	4
Thionyl chloride	4	4	3
Titanium tetrachloride	4	4	4
Toluene	4	4	4
Toluene diisocyanate	4	4	2
Transformer oil	4	4	4
Transmission fluid type A	4	4	4
Triacetin	2	2	1
Triaryl phosphate	4	4	1
Tributoxy ethyl phosphate	2	2	1
Tributyl mercaptan	4	4	4
Tributyl phosphate	2	4	2
Trichloroacetic acid	3	2	2
Trichloroethane	4	4	4
Trichlorethylene	4	4	4
Tricresyl phosphate	4	1	4
Triethanol amine	2	2	1
Triethyl aluminum	4	4	3
Triethyl borane	4	4	3
Trinitrotoluene	4	4	4
Trioctyl phosphate	4	4	1
Tung oil (China wood oil)	4	4	3
Turbine oil	4	4	4
Turpentine	4	4	4
Unsymmetrical dimethyl hydrazine (UDMH)	1	1	1
Varnish	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
Vegetable oils	4	4	3
Versilube F-5O	1	1	1
Vinegar	2	2	1
Vinyl chloride	4	4	4
Wagner 21B brake fluid	2	1	1
Water	1	1	1
Whiskey, wines	1	1	1
White pine oil	4	4	4
White oil	4	4	4
Woodoil	4	4	4
Xylene	4	4	4
Xylidine (Di-methyl aniline)	3	3	2
Zeolites	1	1	1
Zinc acetate (aq)	1	4	1
Zinc chloride (aq)	1	1	1
Zinc sulfate (aq)	2	2	1
TT-T-656b	4	4	1
VV-B-680	2	1	1
VV-G-632	4	4	4
VV-G-671c	4	4	4
VV-H-910	2	1	1
VV-I-530a	4	4	4
VV-K-211d	4	4	4
VV-K-220a	4	4	4
VV-L-751b	4	4	4
VV-L-800	4	4	4
VV-L-820b	4	4	4
VV-L-825a type I	4	4	4
VV-L-825a type II	4	4	4
VV-L-825a type III	4	4	4
VV-O-526	4	4	4
VV-P-216a	4	4	4
VV-P-236	4	4	4
51-F-23	4	4	4
ASTM Method D-471 1 2 3	 4 4 4	 4 4 4	 4 4 4
MIL-L-644 B	3	3	3
MIL-L-2104 B	4	4	4
MIL-L-2105 B	4	4	4
MIL-G-2108	4	4	4
MIL-S-3136 B type I	4	4	4
MIL-S-3136 B type II	4	4	4
MIL-S-3136 B type III	4	4	4
MIL-S-3136 B type IV	4	4	4
MIL-S-3136 B type V	4	4	4
MIL-S-3136 B type VI	4	4	4
MIL-S-3136 B type VII	4	4	4
MIL-L-3150 A	4	4	4
MIL-L-3503	4	4	4
MIL-L-3545 B	4	4	4
MIL-C-4339 C	4	4	4
MIL-G-4343 B	4	4	3
MIL-L-5020 A	4	4	4
MIL-J-5161 F	4	4	4
MIL-C-5545 A	4	4	4
MIL-H-5559 A	2	1	1
MIL-F-5566	1	1	1
MIL-F-5602	4	4	4
MIL-H-5606 B (red oil)	4	4	4
MIL-J-5624 G JP-3, JP-4, JP-5	4	4	4
MIL-O-6081 C	4	4	4
MIL-L-6082 C	4	4	4
MIL-H-6083 C	4	4	4
MIL-L-6085 A	4	4	4
MIL-L-6086 B	4	4	4
MIL-L-6387 A	4	4	4
MIL-C-6529 C	4	4	4
MIL-F-7024 A	4	4	4
MIL-H-7083 A	2	1	1
MIL-G-7118 A	4	4	4
MIL-G-7187	4	4	4
MIL-G-7421 A	4	4	4
MIL-H-7644	2	1	1
MIL-L-7645	4	4	4
MIL-G-7711 A	4	4	4
MIL-L-7808 F	4	4	4
MIL-L-7870 A	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
MIL-C-8188 C	4	4	4
MIL-A-8243 B	2	1	1
MIL-L-8383 B	4	4	4
MIL-H-8446 B (MLO-8515)	4	4	4
MIL-L-8660 B	1	1	1
MIL-L-9000 F	4	4	4
MIL-T-9188 B	4	4	1
MIL-L-9236 B	3	3	3
MIL-L-10295 A	4	4	4
MIL-L-10324 A	4	4	4
MIL-G-10294 B	4	4	4
MIL-L-11734 B	4	4	4
MIL-O-11773	4	4	4
MIL-P-12098	2	1	1
MIL-H-13862	4	4	4
MIL-H-13866 A	4	4	4
MIL-H-13910 B	2	1	1
MIL-H-13919 A	4	4	4
MIL-L-14107 B	4	4	4
MIL-L-15017	4	4	4
MIL-L-15015 B	4	4	4
MIL-L-15019 C	4	4	4
MIL-L-15719 A	3	2	2
MIL-G-15793	4	4	4
MIL-F-16929 A	4	4	4
MIL-L-16958 A	4	4	4
MIL-F-17111	4	4	4
MIL-L-17331 D	4	4	4
MIL-L-17353 A	4	4	4
MIL-L-17672 B	4	4	4
MIL-L-18486 A	4	4	4
MIL-G-18709 A	4	4	4
MIL-H-19457 B	4	4	1
MIL-F-19605	4	4	4
MIL-L-19701	4	4	4
MIL-21260	4	4	4
MIL-S-21568 A	2	1	1
MIL-H-22072	2	1	1
MIL-L-22396	4	4	4
MIL-L-23699 A	4	4	4
MIL-G-23827 A	4	4	4

Substance	Natural Rubber (NR, IR)	Styrene Butadiene (SBR, BR)	Ethylene Propylene (EPM, EPDM)
MIL-G-25013 D	2	1	1
MIL-F-25172	4	4	4
MIL-L-25336 B	4	4	4
MIL-F-25524 A	4	4	4
MIL-G-25537 A	4	4	4
MIL-F-25558 B (RJ-1)	4	4	4
MIL-F-25576 C (RP-1)	4	4	4
MIL-H-25598	4	4	4
MIL-F-25656 B	4	4	4
MIL-L-25681 C	2	1	1
MIL-G-25760 A	3	3	4
MIL-L-25968	4	4	4
MIL-L-26087 A	4	4	4
MIL-G-27343	1	1	1
MIL-H-27601 A	4	4	4
MIL-G-27617	-	2	1
MIL-I-27686 D	2	1	1
MIL-L-27694 A	1	1	1
MIL-L-46000 A	4	4	4
MIL-H-46001 A	4	4	4
MIL-L-46002	4	4	4
MIL-H-46004	4	4	4
MIL-P-46046 A	2	1	1
MIL-H-81019 B	4	4	4
MIL-S-81087	1	1	1
O-A-548 a	2	1	1
O-T-634 b	4	4	4
P-S-661 b	4	4	4
P-D-680	4	4	4
TT-N-95 a	4	4	4
TT-N-97 b	4	4	4
TT-I-735 b	1	1	1
TT-S-735 type I	4	4	4
TT-S-735 type II	4	4	4
TT-S-735 type III	4	4	4
TT-S-735 type IV	4	4	4
TT-S-735 type V	4	4	4
TT-S-735 type VI	4	4	4
TT-S-735 type VI	4	4	4

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