

O-Ring Compound Selection for Fluids and Chemicals

	NITRILE	CHLORO-PRENE	ETHYLENE PROPYLENE (EPR)	FLUORO-ELASTOMER	SILICONE	STYRENE BUTADIENE (SBR)	FLUORO-SILICONE	BUTYL	AFLAS®	URETHANE
Acetaldehyde	D	C	A	D	B	C	D	A	D	D
Acetamide	A	B	A	B	B	D	A	A	B	D
Acetic Acid, Glacial	C	D	A	C	B	B	D	B	C	D
Acetic Acid, 30%	B	A	A	B	A	B	B	B	D	D
Acetic Anhydride	C	B	B	D	C	B	D	B	D	D
Acetone	D	C	A	D	C	C	D	A	D	D
Acetophenone	D	D	A	D	D	D	D	A	D	D
Acetyl Chloride	D	D	D	A	C	D	A	D	D	D
Acetylene	A	B	A	A	B	B	E	A	A	D
Acrylonitrile	D	D	D	C	D	D	E	D	B	D
Adipic Acid	A	A	A	E	E	A	A	A	D	E
Alkazene (Dibromoethyl-benzene)	D	D	D	B	D	D	B	D	B	D
Alum-NH ₃ -Cr-K (aq)	A	A	A	D	A	A	D	A	A	E
Aluminum Acetate (aq)	B	B	A	D	D	B	D	A	A	D
Aluminum Chloride (aq)	A	A	A	A	B	A	A	A	A	C
Aluminum Fluoride (aq)	A	A	A	A	B	A	A	A	A	C
Aluminum Nitrate (aq)	A	A	A	A	B	A	E	A	A	C
Aluminum Phosphate (aq)	A	A	A	A	A	A	E	A	D	E
Aluminum Sulfate (aq)	A	A	A	A	A	A	A	A	A	D
Ammonia, Anhydrous	B	A	A	D	C	D	D	A	A	D
Ammonia Gas (cold)	A	A	A	D	A	A	D	A	A	E
Ammonia Gas (hot)	D	B	B	D	A	D	D	B	A	E
Ammonium Carbonate (aq)	D	A	B	E	E	A	E	A	A	D
Ammonium Chloride (aq)	A	A	A	A	E	A	E	A	A	A
Ammonium Hydroxide(conc.)	D	A	A	B	A	D	B	A	A	D
Ammonium Nitrate (aq)	A	A	A	E	E	B	E	A	A	E
Ammonium Nitrite (aq)	A	A	A	E	B	A	E	A	A	E
Ammonium Persulfate (aq)	D	A	A	E	E	D	E	A	A	D
Ammonium Phosphate (aq)	A	A	A	E	A	A	E	A	A	E
Ammonium Sulfate (aq)	A	A	A	D	E	A	E	A	A	E
Amyl Acetate(Banana Oil)	D	D	A	D	D	D	D	C	D	D
Amyl Alcohol	B	B	A	B	D	B	A	A	A	D
Amyl Borate	A	A	D	A	E	D	E	D	A	E
Amyl Chloronaphthalene	D	D	D	A	D	D	B	D	B	E
Amyl Naphthalene	D	D	D	A	D	D	A	D	B	D
Aniline	D	D	A	C	D	D	C	A	A	D
Aniline Dyes	D	B	A	B	C	B	B	B	A	D
Aniline Hydrochloride	B	D	B	B	D	D	B	B	A	D
Animal Fats	A	B	B	A	B	D	A	B	A	B
Ansul Ether(Anesthetics)	C	D	C	D	D	D	C	C	D	B
Aqua Regia	D	D	C	B	D	D	C	D	B	E
Aroclor, 1248	C	D	C	A	B	D	B	C	A	D
Aroclor, 1254	D	D	C	A	C	D	B	D	A	D
Aroclor, 1260	A	A	A	A	B	A	A	A	A	D
Arsenic Acid	A	A	A	A	A	A	A	A	A	C
Arsenic Trichloride (aq)	A	A	C	E	E	D	E	C	D	E
Askarel	B	D	D	A	D	D	B	D	A	D
Asphalt	B	B	D	A	D	D	B	D	A	B
ASTM Fuel A	A	B	D	A	D	D	A	D	B	A
ASTM Fuel B	A	C	D	A	D	D	A	D	D	B
ASTM Fuel C	A	C	D	A	D	D	A	D	D	D
ASTM Fuel D	A	C	D	A	D	D	A	D	D	E
ASTM Oil One	A	A	D	A	C	D	A	D	A	A
ASTM Oil Two	A	B	D	A	C	D	A	D	A	B

A. SATISFACTORY B. FAIR C. SEVERE EFFECT – EXCEPT FOR SOME STATIC APPLICATIONS D. UNSATISFACTORY E. INSUFFICIENT INFORMATION

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	NITRILE	CHLORO-PRENE	ETHYLENE PROPYLENE (EPR)	FLUORO-ELASTOMER	SILICONE	STYRENE BUTADIENE (SBR)	FLUORO-SILICONE	BUTYL	AFLAS®	URETHANE
ASTM Oil Three	A	B	D	A	C	D	A	D	A	B
Barium Chloride (aq)	A	A	A	A	A	A	A	A	A	A
Barium Hydroxide (aq)	A	A	A	A	A	A	A	A	A	D
Barium Sulfate (aq)	A	A	A	A	A	A	A	A	A	E
Barium Sulfide (aq)	A	A	A	A	A	B	A	A	A	A
Beer	A	A	A	A	A	A	A	A	A	B
Beet Sugar Liquors	A	B	A	A	A	A	A	A	A	D
Benzaldehyde	D	D	A	D	B	D	C	A	B	D
Benzene	D	D	D	A	D	D	C	D	C	D
Benzene Sulfonic Acid	D	B	C	A	D	D	B	D	D	D
Benzine (Ligroin) (Nitrobenzene)	A	B	D	A	D	D	A	D	B	B
Benzoic Acid	C	D	C	A	C	D	B	D	A	D
Benzoyl Chloride	D	D	D	A	E	D	B	D	A	E
Benzyl Alcohol	D	B	A	A	B	D	B	A	A	D
Benzyl Benzoate	D	D	B	A	E	D	A	B	A	D
Benzyl Chloride	D	D	D	A	D	D	B	D	A	D
Biphenyl (Phenylbenzene)	D	D	D	A	D	D	B	D	D	D
Bleach Solutions	D	D	A	A	B	D	B	A	A	D
Borax	B	A	A	A	B	B	B	A	A	A
Bordeaux Mixture	B	B	A	A	B	B	B	A	A	D
Boric Acid	A	A	A	A	A	A	A	A	A	A
Brine	A	A	A	A	A	A	A	A	D	B
Bromine, Anhydrous	D	D	D	A	D	D	B	D	E	D
Bromine Trifluoride	D	D	D	D	D	D	D	D	E	D
Bromine Water	D	D	B	A	D	D	B	C	A	D
Bromobenzene	D	D	D	A	D	D	A	D	D	D
Bunker Oil	A	D	D	A	B	D	A	D	A	B
Butadiene	D	D	C	A	D	D	B	D	E	D
Butane	A	A	D	A	D	D	A	D	B	A
Butter (Animal Fat)	A	B	A	A	B	D	A	B	A	A
Butyl Acetate	D	D	C	D	D	D	D	C	D	D
Butyl Acetyl Ricinoleate	C	B	A	A	E	D	B	A	A	D
Butyl Acrylate	D	D	D	D	E	D	D	D	D	E
Butyl Alcohol	A	A	B	A	B	A	B	B	A	D
Butyl Amine	C	D	B	D	D	D	D	C	B	D
Butyl Benzoate	D	D	B	A	E	B	A	B	A	E
Butyl Carbitol	D	C	A	A	D	D	D	A	B	E
Butyl Cellosolve	D	C	A	D	E	D	D	A	E	D
Butyl Oleate	D	D	B	A	E	D	B	B	A	E
Butyl Stearate	B	D	C	A	E	D	B	C	A	E
Butylene	B	C	D	A	D	D	B	D	A	D
Butyraldehyde	D	C	B	D	D	D	D	B	D	D
Calcium Acetate (aq)	B	B	A	D	D	D	D	A	A	D
Calcium Bisulfite (aq)	B	A	A	A	A	D	A	D	A	C
Calcium Chloride (aq)	A	A	A	A	A	A	A	A	A	A
Calcium Hydroxide (aq)	A	A	A	A	A	A	A	A	A	B
Calcium Hypochlorite(aq)	B	C	A	A	B	C	B	A	A	D
Calcium Nitrate (aq)	A	A	A	A	B	A	A	A	A	A
Calcium Sulfide (aq)	A	A	A	A	B	B	A	A	A	A
Cane Sugar Liquors	A	A	A	A	A	A	A	A	A	D
Carbamate	C	B	B	A	E	D	A	B	A	D
Carbitol	B	B	B	B	B	B	B	B	A	D
Carbolic Acid (Phenol)	D	C	B	A	D	E	A	B	A	C
Carbon Bisulfide	C	D	D	A	D	D	A	D	A	E

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Carbon Dioxide	A	B	B	A	B	B	A	B	A	A
Carbonic Acid	B	A	A	A	A	B	A	A	A	A
Carbon Monoxide	A	B	A	A	A	B	B	A	A	A
Carbon Tetrachloride	C	D	D	A	D	D	C	D	C	D
Castor Oil	A	A	B	A	A	A	A	B	A	A
Cellosolve	D	D	B	C	D	D	D	B	A	D
Cellosolve Acetate	D	D	B	D	D	D	D	B	C	D
Cellulube (Fryquel)	D	D	A	A	E	D	C	A	B	D
China Wood Oil (Tung Oil)	A	B	C	A	D	D	B	C	A	C
Chlorine (dry)	D	C	D	A	D	D	A	D	E	E
Chlorine (wet)	D	C	C	A	D	D	B	C	E	E
Chlorine Dioxide	D	D	C	A	E	D	B	C	E	D
Chlorine Trifluoride	D	D	D	D	D	D	C	D	E	D
Chloroacetic Acid	D	D	A	D	E	D	D	B	E	E
Chloroacetone	D	C	A	D	D	D	D	B	D	D
Chlorobenzene	D	D	D	A	D	D	B	D	C	D
Chlorobromomethane	D	D	B	A	D	D	B	B	E	D
Chlorobutadiene	D	D	D	A	D	D	B	D	C	D
Chlorododecane	D	D	D	A	D	D	A	D	B	D
Chloroform	D	D	D	A	D	D	D	D	D	D
O-Chloronaphthalene	D	D	D	A	D	D	B	D	E	D
1-Chloro 1-Nitro Ethane	D	D	D	D	D	D	D	D	E	D
Chlorosulfonic Acid	D	D	D	D	D	D	D	D	B	D
Chlorotoluene	D	D	D	A	D	D	B	D	D	D
Chlorox (Sodium Hypochlorite NaOCl)	B	A	B	A	B	D	B	B	A	D
Chrome Plating Solutions	D	D	B	A	B	D	B	B	A	D
Chromic Acid	D	C	C	A	C	D	C	C	E	E
Citric Acid	A	A	A	A	A	A	A	A	A	A
Coal Tar (Creosote)	A	B	D	A	D	D	A	D	E	C
Cobalt Chloride (aq)	A	A	A	A	B	A	A	A	A	E
Coconut Oil	A	B	C	A	A	D	A	C	A	C
Cod Liver Oil	A	B	A	A	B	D	A	A	A	A
Coke Oven Gas	D	D	D	A	B	D	B	D	A	D
Copper Acetate (aq)	B	B	A	D	D	D	D	A	D	D
Copper Chloride (aq)	A	B	A	A	A	A	A	A	A	A
Copper Cyanide (aq)	A	A	A	A	A	A	A	A	B	A
Copper Sulfate (aq)	A	A	A	A	A	B	A	B	A	E
Corn Oil	A	C	C	A	A	D	A	C	A	A
Cottonseed Oil	A	B	B	A	A	D	A	C	A	A
Creosote (coal tar)	A	B	D	A	D	D	A	D	A	C
Cresol	D	C	D	A	D	D	B	D	A	E
Cresylic Acid	D	C	D	A	D	D	B	D	A	D
Cumene	D	D	D	A	D	D	B	D	C	D
Cyclohexane	A	C	D	A	D	D	B	D	B	A
Cyclohexanol	C	A	C	A	D	D	A	D	A	E
Cyclohexanone	D	D	B	D	D	D	D	B	C	D
P-Cymene	D	D	D	A	D	D	B	D	C	D
Decalin	D	D	D	A	D	D	A	D	B	E
Decane	A	D	D	A	B	D	A	D	B	B
Denatured Alcohol	A	A	A	A	A	A	A	A	A	D
Detergent Solutions	A	B	A	A	A	B	A	A	A	D
Developing Fluids	A	A	B	A	A	B	A	A	A	E
Diacetone	D	D	A	D	D	D	D	A	C	D
Diacetone Alcohol	D	B	A	D	B	D	D	A	C	D

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Dibenzyl Ether	D	C	B	D	E	D	E	B	D	B
Dibenzyl Sebecate	D	D	B	B	C	D	C	B	A	B
Dibromoethyl benzene (Alkazene)	D	D	D	B	D	D	B	D	D	D
Dibutyl Amine	D	D	C	D	C	D	D	D	A	D
Dibutyl Ether	D	C	C	C	D	D	C	C	D	B
Dibutyl Phthalate	D	D	B	C	B	D	C	C	B	C
Dibutyl Sebecate	D	D	B	B	B	D	B	B	B	D
O-Dichlorobenzene	D	D	D	A	D	D	B	D	D	D
Dichloro-Isopropyl Ether	D	D	C	C	D	D	C	D	D	B
Dicyclohexylamine	C	D	D	D	E	D	D	D	B	D
Diesel Oil	A	C	D	A	D	D	A	D	A	C
Diethylamine	B	B	B	D	B	B	D	B	B	C
Diethyl Benzene	D	D	D	A	D	D	C	D	E	E
Diethyl Ether	D	C	D	D	D	D	C	D	D	A
Diethylene Glycol	A	A	A	A	B	A	A	A	A	D
Diethyl Sebecate	B	D	B	B	B	D	B	B	B	D
Diisobutylene	B	D	D	A	D	D	C	D	B	D
Diisopropyl Benzene	D	D	D	A	E	D	B	D	E	E
Diisopropyl Ketone	D	D	A	D	D	D	D	A	D	D
Diisopropylidene Acetone	D	D	C	D	D	D	D	C	E	E
Dimethyl Aniline (Xylidine)	C	C	B	D	D	C	D	C	E	E
Dimethyl Ether (Methyl Ether)	A	C	D	A	A	D	A	D	E	E
Dimethyl Formamide	B	C	B	D	B	D	D	B	B	D
Dimethyl Phthalate	D	D	B	B	E	D	B	B	B	E
Dinitrotoluene	D	D	D	D	D	D	D	D	D	D
Diocetyl Phthalate	C	D	B	B	C	D	B	B	B	D
Diocetyl Sebecate	D	D	B	B	C	D	C	B	B	B
Dioxane	D	D	B	D	D	D	C	B	D	D
Dioxolane	D	D	B	D	D	D	D	C	D	D
Dipentene	A	D	D	A	D	D	C	D	C	D
Diphenyl (Phenylbenzene)	D	D	D	A	D	D	B	D	D	D
Diphenyl Oxides	D	D	D	A	C	D	B	D	B	D
Dowtherm Oil	D	D	D	A	C	D	B	D	E	E
Dry Cleaning Fluids	C	D	D	A	D	D	B	D	C	D
Epichlorohydrin	D	D	B	D	D	D	D	B	D	D
Ethane	A	B	D	A	D	D	B	D	A	C
Ethanolamine	B	B	B	D	B	B	D	B	A	C
Ethyl Acetate	D	C	B	D	B	D	D	B	D	D
Ethyl Acetoacetate	D	C	B	D	B	C	D	B	D	D
Ethyl Acrylate	D	D	B	D	B	D	D	B	D	D
Ethyl Alcohol	A	A	A	C	A	A	A	A	A	D
Ethyl Benzene	D	D	D	A	D	D	A	D	D	D
Ethyl Benzoate	D	D	A	A	D	A	A	A	C	D
Ethyl Cellosolve	D	D	B	D	D	D	D	D	A	D
Ethyl Cellulose	B	B	B	D	C	B	D	B	A	B
Ethyl Chloride	A	D	C	A	D	D	A	D	B	B
Ethyl Chlorocarbonate	D	D	B	A	D	D	B	C	B	D
Ethyl Chloroformate	D	D	B	D	D	D	D	C	B	D
Ethyl Ether	C	C	C	D	D	D	C	C	D	D
Ethyl Formate	D	B	B	A	E	D	A	B	A	D
Ethyl Mercaptan	D	C	C	B	C	D	E	D	B	E
Ethyl Oxalate	D	C	A	A	D	A	B	A	E	E
Ethyl Pentachlorobenzene	D	D	D	A	D	D	B	D	D	D
Ethyl Silicate	A	A	A	A	E	B	A	A	A	E

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Ethylene	A	C	B	A	E	C	A	B	E	E
Ethylene Chloride	D	D	C	B	D	D	C	C	A	D
Ethylene Chlorohydrin	D	B	B	A	C	B	B	B	A	D
Ethylene Diamine	A	A	A	D	A	B	D	A	A	D
Ethylene Dichloride	D	D	C	A	D	D	C	C	E	D
Ethylene Glycol	A	A	A	A	A	A	A	A	A	B
Ethylene Oxide	D	D	C	D	D	D	D	C	D	D
Ethylene Trichloride	D	D	C	A	D	D	C	C	E	D
Fatty Acids	B	B	C	A	C	D	E	C	A	E
Ferric Chloride (aq)	A	A	A	A	B	A	A	A	A	A
Ferric Nitrate (aq)	A	A	A	A	C	A	A	A	A	A
Ferric Sulfate (aq)	A	A	A	A	B	A	A	A	A	E
Fish Oil	A	D	D	A	A	D	A	D	E	E
Fluorinated Cyclic Ethers	E	D	A	E	E	D	E	A	E	E
Fluorine (liquid)	D	D	D	E	D	D	E	D	E	E
Fluorobenzene	D	D	D	A	D	D	B	D	E	E
Fluoroboric Acid	A	A	A	E	E	A	E	A	E	E
Fluorocarbon Oils	E	B	A	E	E	B	E	A	E	E
Fluorolube	A	B	A	B	A	C	B	A	B	E
Fluorosilicic Acid	A	B	B	A	D	C	D	B	E	E
Formaldehyde (RT)	C	B	A	D	B	B	D	A	B	D
Formic Acid	B	A	A	C	B	A	C	A	E	E
Freon 11	B	C	D	A	D	D	B	D	D	E
Freon 12	A	A	B	B	D	A	C	B	D	A
Freon 13	A	A	A	A	D	A	D	A	D	E
Freon 21	D	D	D	D	D	D	E	D	D	E
Freon 22	D	A	A	D	D	A	D	A	D	D
Freon 31	D	B	A	D	E	B	E	A	D	E
Freon 32	A	A	A	D	E	A	E	A	D	E
Freon 112	B	C	D	A	D	C	E	D	D	E
Freon 113	A	A	C	B	D	B	D	D	D	A
Freon 114	A	A	A	B	D	A	B	A	D	E
Freon 115	A	A	A	B	E	A	E	A	D	E
Freon 142b	A	A	B	D	E	B	E	A	D	E
Freon 152a	A	A	A	D	E	A	E	A	D	E
Freon 218	A	A	A	A	E	A	E	A	D	E
Freon C316	A	A	A	E	E	A	E	A	D	E
Freon C318	A	A	A	B	E	A	E	A	D	E
Freon 13B1	A	A	A	A	D	A	E	A	D	E
Freon 114B2	B	B	D	B	D	C	E	D	D	E
Freon 502	B	A	A	B	E	A	E	A	D	E
Freon TF	A	A	D	B	D	C	E	D	D	A
Freon T-WD602	B	B	B	A	D	C	E	B	D	E
Freon TMC	B	C	C	A	C	D	E	C	D	E
Freon T-P35	A	A	A	A	A	A	E	A	E	E
Freon TA	A	B	B	C	C	C	E	B	E	E
Freon TC	A	A	B	A	D	C	E	B	E	E
Freon MF	A	C	D	B	D	D	E	D	D	C
Freon BF	B	C	D	A	D	D	E	D	D	E
Fuel Oil	A	B	D	A	D	D	A	D	A	B
Fumaric Acid	A	B	B	A	B	C	A	B	A	E
Furan, Furfuran	D	D	C	E	E	D	E	D	E	E
Furfural	D	C	B	D	D	D	E	B	E	C
Fyrquel (Cellulube)	D	D	A	A	E	D	C	A	E	D

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Gallic Acid	B	B	B	A	E	B	A	B	A	D
Gasoline	B	C	D	A	D	D	A	D	C	B
Gelatin	A	A	A	A	A	A	A	A	A	D
Glauber's Salt (aq)	D	B	B	A	E	D	A	B	A	E
Glucose	A	A	A	A	A	A	A	A	A	D
Glue	A	A	A	A	A	B	A	B	E	E
Glycerin	A	A	A	A	A	A	A	A	A	D
Glycols	A	A	A	A	A	A	A	A	A	D
Green Sulfate Liquor	B	B	A	A	A	B	B	A	A	D
Halowax Oil	D	D	D	A	D	D	A	D	A	E
N-Hexaldehyde	D	A	A	D	B	D	D	B	D	B
Hexane	A	B	D	A	D	D	A	D	B	B
N-Hexene-1	B	B	D	A	D	D	A	D	B	B
Hexyl Alcohol	A	B	C	A	B	B	B	C	A	D
Hydrazine	B	B	A	D	C	A	D	A	E	D
Hydraulic Oil(Petroleum)	A	B	D	A	C	D	A	D	A	A
Hydrobromic Acid	D	D	A	A	D	D	C	A	A	D
Hydrobromic Acid 40%	D	B	A	A	D	D	C	A	A	D
Hydrochloric Acid (cold) 37%	C	B	A	A	C	B	B	A	E	D
Hydrochloric Acid (hot) 37%	D	D	C	B	D	D	C	C	E	D
Hydrocyanic Acid	B	B	A	A	C	B	B	A	A	E
Hydrofluoric Acid (conc.) cold	D	D	C	A	D	D	D	C	A	E
Hydrofluoric Acid (conc.) hot	D	D	D	C	D	D	D	D	C	E
Hydrofluoric Acid -Anhydrous	D	D	C	D	D	D	D	C	D	E
Hydrofluosilicic Acid	B	B	B	A	D	C	D	B	A	E
Hydrogen Gas	A	A	A	A	C	A	C	A	A	A
Hydrogen Peroxide (90%)	D	D	B	B	B	D	B	C	A	A
Hydrogen Sulfide (wet) cold	D	B	A	D	C	D	C	A	A	E
Hydrogen Sulfide (wet) hot	D	C	A	D	C	D	C	A	B	E
Hydroquinone	C	D	B	B	E	D	B	B	E	E
Hypochlorous Acid	D	D	B	A	E	D	E	B	E	E
Iodine Pentafluoride	D	D	D	D	D	D	D	D	D	D
Iodoform	E	D	D	E	E	D	E	D	E	E
Isobutyl Alcohol	B	A	A	A	A	B	B	A	A	D
Isooctane	A	B	D	A	D	D	A	D	B	B
Isophorone	D	D	B	D	D	D	D	C	C	D
Isopropyl Acetate	D	D	B	D	D	D	D	B	D	D
Isopropyl Alcohol	B	B	A	A	A	B	B	A	A	D
Isopropyl Chloride	D	D	D	A	D	D	B	D	E	D
Isopropyl Ether	B	C	D	D	D	D	C	D	D	B
Kerosene	A	B	D	A	D	D	A	D	A	A
Lacquers	D	D	D	D	D	D	D	D	D	D
Lacquer Solvents	D	D	D	D	D	D	D	D	D	D
Lactic Acid (cold)	A	A	A	A	A	A	A	A	A	E
Lactic Acid (hot)	D	D	D	A	B	D	B	D	A	E
Lard	A	B	B	A	B	D	A	B	A	A
Lavender Oil	B	D	D	A	D	D	B	D	A	E
Lead Acetate (aq)	B	B	A	D	D	D	D	A	D	D
Lead Nitrite (aq)	A	A	A	E	B	A	A	A	E	E
Lead Sulfamate (aq)	B	A	A	A	B	B	A	A	A	E
Ligroin (Benzine) (Nitrobenzene)	A	B	D	A	D	D	A	D	B	B
Lime Bleach	A	B	A	A	B	B	A	A	A	E
Lime Sulfur	D	A	A	A	A	D	A	A	A	E
Lindol (Hydraulic fluid)	D	D	A	B	C	D	C	A	A	D

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Linoleic Acid	B	D	D	B	B	D	E	D	A	E
Linseed Oil	A	B	C	A	A	D	A	C	A	B
Liquefied Petroleum Gas	A	B	D	A	C	D	C	D	C	A
Lubricating Oils(petroleum)	A	B	D	A	D	D	A	D	A	B
Lye	B	B	A	B	B	B	A	A	A	D
Magnesium Chloride (aq)	A	A	A	A	A	A	A	A	A	A
Magnesium Hydroxide (aq)	B	A	A	A	E	B	E	A	A	D
Magnesium Sulfate (aq)	A	A	A	A	A	B	A	A	A	E
Maleic Acid	D	C	B	A	E	C	E	B	A	E
Maleic Anhydride	D	C	B	D	E	B	E	B	A	E
Malic Acid	A	C	B	A	B	C	A	B	A	E
Mercury Chloride (aq)	A	A	A	A	E	A	E	A	A	E
Mercury	A	A	A	A	E	A	E	A	A	E
Mesityl Oxide	D	D	B	D	D	D	D	B	C	D
Methane	A	B	D	B	D	D	B	D	B	C
Methyl Acetate	D	B	A	D	D	C	D	A	D	D
Methyl Acrylate	D	B	B	D	D	D	D	B	E	D
Methylacrylic Acid	D	B	B	D	D	D	D	B	E	D
Methyl Alcohol	A	A	A	D	A	A	A	A	A	D
Methyl Bromide	B	D	D	A	E	D	A	D	A	E
Methyl Butyl Ketone	D	D	A	D	C	D	D	A	C	D
Methyl Cellosolve	C	C	B	D	D	D	D	B	E	D
Methyl Chloride	D	D	C	B	D	D	B	C	E	D
Methyl Cyclopentane	D	D	D	B	D	D	B	D	B	D
Methylene Chloride	D	D	C	B	D	D	B	D	E	D
Methyl Ether	A	C	D	A	A	D	A	D	C	E
Methyl Ethyl Ketone	D	C	A	D	D	D	D	B	D	D
Methyl Formate	D	B	B	E	E	D	E	B	E	E
Methyl Isobutyl Ketone	D	D	B	D	D	D	D	C	D	D
Methyl Methacrylate	D	D	C	D	D	D	D	D	E	E
Methyl Oleate	D	D	B	B	E	D	B	B	A	E
Methyl Salicylate	D	D	B	E	E	C	E	B	E	E
Milk	A	A	A	A	A	A	A	A	A	D
Mineral Oil	A	B	C	A	B	D	A	C	A	A
Monochlorobenzene	D	D	D	A	D	D	B	D	D	D
Monomethyl Aniline	D	D	B	B	E	D	E	B	E	D
Monoethanol Amine	D	D	A	D	B	B	D	B	A	D
Monomethyl Ether	A	C	D	A	A	D	A	D	E	E
Monovinyl Acetylene	A	B	A	A	B	B	E	B	A	E
Mustard Gas	E	A	A	E	A	B	E	A	E	E
Naphtha	B	C	D	A	D	D	B	D	B	B
Naphthalene	D	D	D	A	D	D	A	D	C	B
Naphthalenic Acid	B	D	D	A	D	D	A	D	B	E
Natural Gas	A	A	D	A	A	A	C	D	A	B
Neats Foot Oil	A	D	B	A	B	D	A	B	A	A
Neville Acid	D	D	B	A	D	D	B	B	A	E
Nickel Acetate (aq)	B	B	A	D	D	D	D	A	D	D
Nickel Chloride (aq)	A	A	A	A	A	A	A	A	A	C
Nickel Sulfate (aq)	A	A	A	A	A	B	A	A	A	C
Niter Cake	A	A	A	A	A	A	A	A	A	A
Nitric Acid (conc.)	D	D	D	C	D	D	C	D	B	D
Nitric Acid (dilute)	D	B	B	A	B	D	B	B	E	D
Nitric Acid - Red Fuming	D	D	D	D	D	D	D	D	C	E
Nitrobenzene	D	D	A	B	D	D	D	A	E	D

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Nitrobenzene (Ilgroin)	A	B	D	A	D	D	A	D	E	D
Nitroethane	D	C	B	D	D	B	D	B	E	D
Nitrogen	A	A	A	A	A	A	A	A	A	A
Nitrogen Tetroxide	D	D	C	D	D	D	D	C	E	D
Nitromethane	D	B	B	D	D	B	D	B	E	D
Octachlorotoluene	D	D	D	A	D	D	B	D	C	D
Octadecane	A	B	D	A	D	D	A	D	B	A
N-Octane	B	B	D	A	D	D	B	D	B	D
Octyl Alcohol	B	A	C	A	B	B	B	C	A	D
Oleic Acid	C	C	D	B	D	D	E	D	A	B
Oleum Spirits	B	C	D	A	D	D	B	D	A	C
Olive Oil	A	B	B	A	C	D	A	B	A	A
O-Dichlorobenzene	D	D	D	A	D	D	B	D	D	D
Oxalic Acid	B	B	A	A	B	B	A	A	A	E
Oxygen - Cold	B	A	A	A	A	B	A	A	A	A
Oxygen - (200-400°F)	D	D	C	B	B	D	D	B	E	D
Ozone	D	C	A	A	A	D	B	D	A	A
Paint Thinner, Duco	D	D	D	B	D	D	B	D	B	D
Palmitic Acid	A	B	B	A	D	B	A	B	A	A
Peanut Oil	A	C	C	A	A	D	A	C	A	B
Perchloric Acid	D	B	B	A	D	D	A	B	A	D
Perchloroethylene	B	D	D	A	D	D	B	D	E	D
Petroleum - below 250°F	A	B	D	A	B	D	B	D	A	B
Petroleum - above 250°F	D	B	D	B	D	D	D	D	B	D
Phenol (Carbolic Acid)	D	C	B	A	D	E	A	B	E	D
Phenylbenzene (Biphenyl)	D	D	D	A	D	D	B	D	D	D
Phenyl Ethyl Ether	D	D	D	D	D	D	D	D	D	D
Phenyl Hydrazine	D	D	B	A	E	B	E	B	A	E
Phorone (Diisopropylidene Acetone)	D	D	C	D	D	D	D	C	D	D
Phosphoric Acid - 20%	B	B	A	A	B	B	B	B	A	D
Phosphoric Acid - 45%	D	B	A	A	C	C	B	B	A	D
Phosphorus Trichloride	D	D	A	A	E	D	A	A	A	E
Pickling Solution	D	D	C	B	D	D	D	C	B	D
Picric Acid	B	A	B	A	D	B	B	B	A	E
Pinene	B	C	D	A	D	D	B	D	A	B
Pine Oil	A	D	D	A	D	D	A	D	A	E
Piperidine	D	D	A	D	D	D	D	D	E	D
Plating Solution - Chrome	E	D	A	A	D	D	E	A	E	E
Plating Solution - Others	A	D	A	A	D	D	E	A	E	E
Polyvinyl Acetate Emulsion	E	B	A	E	E	D	E	A	E	E
Potassium Acetate (aq)	B	B	A	D	D	D	D	A	E	D
Potassium Chloride (aq)	A	A	A	A	A	A	A	A	A	A
Potassium Cupro Cyanide (aq)	A	A	A	A	A	A	A	A	A	A
Potassium Cyanide (aq)	A	A	A	A	A	A	A	A	A	A
Potassium Dichromate (aq)	A	A	A	A	A	B	A	A	A	B
Potassium Hydroxide (aq)	B	B	A	D	C	B	C	A	A	D
Potassium Nitrate (aq)	A	A	A	A	A	A	A	A	A	A
Potassium Sulfate (aq)	A	A	A	A	A	A	A	A	A	A
Producer Gas	A	B	D	A	B	D	B	D	A	A
Propane	A	B	D	A	D	D	B	D	A	C
i-Propyl Acetate	D	D	B	D	D	D	D	B	D	D
n-Propyl Acetate	D	D	B	D	D	D	D	B	D	E
Propyl Acetone (Methyl Butyl Ketone)	D	D	A	D	C	D	D	A	C	D
Propyl Alcohol	A	A	A	A	A	A	A	A	A	D

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Propyl Nitrate	D	D	B	D	D	D	D	B	E	E
Propylene	D	D	D	A	D	D	B	D	A	D
Propylene Oxide	D	D	B	D	D	D	D	B	D	D
Pydraul, 10E, 29 ELT	D	D	A	A	D	D	D	A	A	D
Pydraul, 30E, 50E, 65E, 90E	D	D	A	A	A	D	A	A	A	D
Pydraul, 115E	D	D	A	A	D	D	C	A	A	D
Pydraul, 230E, 312C, 540C	D	D	D	A	D	D	D	D	A	D
Pyranol, Transformer Oil	A	B	D	A	D	D	A	D	A	B
Pyridine	D	D	B	D	D	D	D	B	E	E
Pyrolygenous Acid	D	B	B	D	E	D	D	B	E	D
Pyrrole	D	D	C	D	B	C	C	D	E	E
Radiation	C	B	B	D	C	C	D	D	A	D
Rapeseed Oil	B	B	A	A	D	D	A	A	A	B
Red Oil (MIL-H-5606)	A	B	D	A	D	D	A	D	A	A
RJ-1 (MIL-F-25558 B)	A	B	D	A	D	D	A	D	A	A
RP-1 (MIL-F-25576 C)	A	B	D	A	D	D	A	D	A	A
Sal Ammoniac	A	A	A	A	B	A	A	A	A	A
Salicylic Acid	B	A	A	A	E	B	A	A	A	E
Salt Water	A	B	A	A	A	A	A	A	A	B
Sewage	A	B	B	A	B	B	A	B	A	D
Silicate Esters	B	A	D	A	D	D	A	D	A	A
Silicone Greases	A	A	A	A	C	A	A	A	A	A
Silicone Oils	A	A	A	A	C	A	A	A	A	A
Silver Nitrate	B	A	A	A	A	A	A	A	A	A
Skydrol 500	D	D	A	D	C	D	C	B	B	D
Skydrol 7000	D	D	A	B	C	D	C	A	A	E
Soap Solutions	A	B	A	A	A	A	A	A	A	D
Soda Ash	A	A	A	A	A	A	A	A	A	E
Sodium Acetate (aq)	B	B	A	D	D	D	D	A	D	C
Sodium Bicarbonate (aq) (Baking Soda)	A	A	A	A	A	A	A	A	A	E
Sodium Bisulfite (aq)	A	A	A	A	A	B	A	A	A	E
Sodium Borate (aq)	A	A	A	A	A	A	A	A	A	E
Sodium Chloride (aq)	A	A	A	A	A	A	A	A	A	A
Sodium Cyanide (aq)	A	A	A	A	A	A	A	A	A	E
Sodium Hydroxide (aq)	B	A	A	B	B	A	B	A	A	B
Sodium Hypochlorite (aq) (Chlorox)	B	A	B	A	B	D	B	B	A	D
Sodium Metaphosphate(aq)	A	B	A	A	E	A	A	A	A	E
Sodium Nitrate (aq)	B	B	A	E	D	A	E	A	A	E
Sodium Perborate (aq)	B	B	A	A	B	B	A	A	A	E
Sodium Peroxide (aq)	B	B	A	A	D	B	A	A	A	D
Sodium Phosphate (aq)	A	B	A	A	D	A	E	A	A	A
Sodium Silicate (aq)	A	A	A	A	E	A	E	A	A	E
Sodium Sulfate (aq)	A	A	A	A	A	B	A	A	A	A
Sodium Thiosulfate (aq)	B	A	A	A	A	B	A	A	A	A
Soybean Oil	A	B	C	A	A	D	A	C	A	E
Stannic Chloride (aq)	A	B	A	A	B	A	A	A	A	E
Stannous Chloride (aq)	A	A	A	A	B	A	A	A	A	E
Steam, under 300°F	D	C	A	D	C	D	D	B	A	D
Steam, over 300°F	D	D	C	D	D	D	D	D	A	D
Stearic Acid	B	B	B	E	B	B	E	B	A	E
Stoddard Solvent	A	B	D	A	D	D	A	D	B	A
Styrene	D	D	D	B	D	D	C	D	E	E
Sucrose Solution	A	B	A	A	A	A	A	A	A	D
Sulfite Liquors	B	B	B	A	D	B	B	B	E	E

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Sulfur	D	A	A	A	C	D	A	A	A	E
Sulfur Chloride (aq)	C	C	D	A	C	D	A	D	A	E
Sulfur Dioxide (Dry)	D	D	A	A	B	B	B	B	E	E
Sulfur Dioxide (Wet)	D	B	A	A	B	D	B	A	E	E
Sulfur Dioxide (liquified under pressure)	D	D	A	A	B	D	B	B	E	E
Sulfur Hexafluoride	B	A	A	A	B	D	B	A	C	E
Sulfur Trioxide	D	D	B	A	B	B	B	B	A	E
Sulfuric Acid (dilute)	C	B	B	A	D	C	C	B	A	D
Sulfuric Acid (conc.)	D	D	C	B	D	D	D	D	A	D
Sulfuric Acid (20% Oleum)	D	D	D	A	D	D	D	D	E	D
Sulfurous Acid	B	B	B	A	D	B	E	B	A	C
Tannic Acid	A	A	A	A	B	B	E	A	A	E
Tar, Bituminous	B	C	C	A	B	D	A	C	A	E
Tartaric Acid	A	B	B	A	A	D	A	B	A	A
Terpineol	B	D	C	A	E	D	A	C	A	B
Tertiary Butyl Alcohol	B	B	B	A	B	B	B	B	A	D
Tertiary Butyl Catechol	D	B	B	A	E	B	A	B	A	D
Tertiary Butyl Mercaptan	D	D	D	A	D	D	E	D	E	D
Tetrabromoethane	D	D	D	A	D	D	B	D	E	E
Tetrabromomethane	D	D	D	A	D	D	B	D	E	E
Tetrabutyl Titanate	B	B	A	A	E	B	A	B	A	E
Tetrachloroethylene	D	D	D	A	D	D	B	D	E	D
Tetraethyl Lead	B	B	D	A	E	D	B	D	E	E
Tetrahydrofuran	D	D	B	D	D	D	D	C	D	C
Tetralin	D	D	D	A	D	D	A	D	E	E
Thionyl Chloride	D	D	C	B	E	D	E	D	E	E
Titanium Tetrachloride	B	D	D	A	D	D	B	D	E	D
Toluene	D	D	D	A	D	D	B	D	C	D
Toluene Diisocyanate	D	D	B	D	D	D	D	B	D	E
Transformer Oil	A	B	D	A	B	D	A	D	A	A
Transmission Fluid Type A	A	B	D	A	B	D	A	D	A	A
Triacetin	B	B	A	D	E	B	D	A	E	D
Triaryl Phosphate	D	D	A	A	C	D	B	A	A	D
Tributoxy Ethyl Phosphate	D	D	A	A	E	B	B	A	A	D
Tributyl Mercaptan	D	D	D	A	D	D	C	D	E	E
Tributyl Phosphate	D	D	B	D	D	D	D	B	E	D
Trichloroacetic Acid	B	D	B	C	E	B	D	B	C	D
Trichloroethane	D	D	D	A	D	D	B	D	E	D
Trichloroethylene	D	D	D	A	D	D	B	D	E	D
Tricresyl Phosphate	D	C	A	A	C	A	B	A	A	D
Triethanol Amine	B	A	A	D	E	B	D	B	A	D
Triethyl Aluminum	D	D	C	B	E	D	E	C	E	E
Triethyl Borane	D	D	C	A	E	D	E	C	E	E
Trinitrotoluene	D	B	D	B	E	D	B	D	E	E
Trioctyl Phosphate	D	D	A	B	C	D	B	A	A	D
Tung Oil (China Wood Oil)	A	B	C	A	D	D	B	C	A	C
Turbine Oil	B	D	D	A	D	D	B	D	A	A
Turpentine	A	D	D	A	D	D	B	D	A	D
Unsymmetrical Dimethyl Hydrazine (UDMH)	B	B	A	D	D	A	D	A	E	E
Varnish	B	D	D	A	D	D	B	D	E	C
Vegetable Oils	A	C	C	A	B	D	A	C	A	E
Versilube F-50	A	A	A	A	C	A	A	A	A	A
Vinegar	B	B	A	A	A	B	C	A	A	D

A. SATISFACTORY B. FAIR C. SEVERE EFFECT – EXCEPT FOR SOME STATIC APPLICATIONS D. UNSATISFACTORY E. INSUFFICIENT INFORMATION

- Notes:**
- (1) Temperature, concentrations, impurities, and other chemicals present can effect the chemical resistance of an elastomer. It is not possible to test in all chemicals and therefore some chemical resistance indicators are based on the manufacturer's best estimates known about various classes and the composition of the elastomer. Therefore, manufacturers do not certify results from a performance standpoint but state they should be used only as indicators of chemical resistance.
 - (2) The information contained in these tables was derived from several sources and is to be used as a general guide only. Compounds suitable for any specific application rests solely by the end user.

O-Ring Compound Selection for Fluids and Chemicals (Cont'd)

	NITRILE	CHLORO-PRENE	ETHYLENE PROPYLENE (EPR)	FLUORO-ELASTOMER	SILICONE	STYRENE BUTADIENE (SBR)	FLUORO-SILICONE	BUTYL	AFLAS®	URETHANE
Vinyl Chloride	D	D	D	A	E	D	E	D	E	E
Wagner 21B Brake Fluid	C	B	A	D	C	A	D	B	A	F
Water	A	A	A	A	A	A	A	A	A	D
Whiskey, Wines	A	A	A	A	A	A	A	A	A	D
White Pine Oil	B	D	D	A	D	D	A	D	A	E
White Oil	A	B	D	A	D	D	A	D	A	A
Wood Oil	A	B	D	A	D	D	B	D	A	C
Xylene	D	D	D	A	D	D	A	D	B	D
Xylidine (Di-methyl Aniline)	C	C	B	D	D	C	D	C	E	E
Zeolites	A	A	A	A	E	A	A	A	A	E
Zinc Acetate (aq)	B	B	A	D	D	D	D	A	D	D
Zinc Chloride (aq)	A	A	A	A	A	A	A	A	A	E
Zinc Sulfate (aq)	A	A	A	A	A	B	A	A	A	E

A. SATISFACTORY B. FAIR C. SEVERE EFFECT – EXCEPT FOR SOME STATIC APPLICATIONS D. UNSATISFACTORY E. INSUFFICIENT INFORMATION

- Notes:**
- (1) Temperature, concentrations, impurities, and other chemicals present can effect the chemical resistance of an elastomer. It is not possible to test in all chemicals and therefore some chemical resistance indicators are based on the manufacturer's best estimates known about various classes and the composition of the elastomer. Therefore, manufacturers do not certify results from a performance standpoint but state they should be used only as indicators of chemical resistance.
 - (2) The information contained in these tables was derived from several sources and is to be used as a general guide only. Compounds suitable for any specific application rests solely by the end user.

Age Controls

Because of short shelf life of very early Neoprene and/or Neoprene/Nitrile blends, the Government imposed an Age Control Program known as ANA Bulletin 438C on Military O-Rings. Its step-by-step schedule allowed the manufacturer (or his agent) four quarters beyond the part curing date to deliver it to the component builder. They had two more quarters to install the oldest part in their equipment. These components then had a maximum of 12 quarters (3 years) until delivery of the aircraft to the Government. This applied only to Nitrile Compounds. Those of other polymers were not covered.

As a result of long-term evaluations of stored O-Rings by a number of Air Force, Army, and Navy laboratories and a long-term study by the O-Ring industries laboratories and investigations of long stored and long lost crashed aircraft hydraulic systems, it is concluded that modern Nitrile Compounds are safe to use 5 to 10 years (varying on who makes the conclusion) after the date of the manufacture. Further information may be found in Air Force Technical Report AFML-TR-67-235, if desired.

MIL-STD-1523A dated Feb. 1, 1984 replaced MIL-STD-1523 and now allows the manufacturer of the O-Ring or his agent a full 40 quarters (10 years) to deliver his product to the procuring activity or contracting officer. MIL-STD-1523A does not control the age beyond this point for O-Rings although it is still very restrictive for hose which is also covered. Military Material specifications covered by MIL-STD-1523 include: MIL-P-5315, MIL-P-5510, MIL-P-5516, MIL-S-6855CI.I, MIL-R-7362, MIL-P-25732, MIL-P-83461.

Age Resistance of Elastomers

Although when properly stored, elastomers have been known to shelf age for very long periods of time, the following chart indicates the generally accepted age resistance for various elastomers (from MIL-HDBK-695):

5 TO 10 YEARS
Nitrile SBR Urethane (Polyester) Hypalon Butyl Chloroprene Ethylene Propylene Epichlorohydrin Urethane (Polyether) HSN- Not listed in MIL-HDBK-695 (Data to date indicates shelf life of 5 to 10 years)
UP TO 20 YEARS
Silicone Fluorosilicone Fluoroelastomer Polyacrylate Polysulfide Atlas® - Not listed in MIL-HDBK-695 (Data to date indicates shelf life of up to 20 years)

Suggested proper storage conditions

O-Rings should be stored in clean, dry, containers away from ozone, contaminants, sunlight, radiation at a temperature not to exceed 120°F.