

# Materials Selection

Selecting an elastomeric material is important to the life of a radial shaft seal. The elastomer's resistance to temperature, abrasion, chemicals, weather, sunlight and ozone can affect a profile's success in an application. The base polymer must be selected to ensure that these parameters are satisfied without creating excessive costs. Table 3 and the material descriptions that follow will help in understanding the base polymers properties, limitations and strengths.

Radial Shaft seals are made from various elastomers, but the most widely used are Nitrile (NBR), Polyacrylate (ACM) and Fluorocarbon (FKM). There are a variety of compounds available depending on the system parameters. Select the elastomer that best suits your application and consult the **Fluid Compatibility** tables to confirm chemical resistance. For parameters or chemicals that are not listed, contact ESP Engineering for more information.

**Table 3: Property Comparison of Commonly Used Elastomers**

Properties	Nitrile	Ethylene Propylene	Fluoro-carbon	Silicon	Poly-acrylate	HNBR	PTFE (Teflon)
Temperature °F Range °C	(-40) - 250 (-40) - 120	(-50) - 300 (-45) - 150	(-30) - 400 (-34) - 200	(-80) - 350 (-60) - 175	(-30) - 300 (-34) - 150	(-10) - 300 (-23) - 150	(-100) - 500 (-75) - 250
Abrasive Resistance	Good to Excellent	Good to Excellent	Good	Poor to Good	Fair to Good	Good to Excellent	Poor to Good
<b>Solvent Resistance</b>							
Aliphatic Hydrocarbons	Good to Excellent	Poor	Excellent	Poor to Fair	Excellent	Good to Excellent	Outstanding
Aromatic Hydrocarbons	Fair to Good	Poor	Excellent	Poor	Poor to Good	Poor to Fair	Outstanding
Ketones	Poor	Good to Excellent	Poor	Poor	Poor	Poor	Outstanding
Lacquer Solvents	Fair	Poor	Poor	Poor	Poor	Fair	Outstanding
<b>Resistance</b>							
Weather	Poor to Fair	Excellent	Excellent	Excellent	Excellent	Good to Excellent	Excellent
Sunlight	Poor	Outstanding	Good to Outstanding	Excellent	Good to Excellent	Fair to Good	Outstanding
Ozone	Poor to Fair	Good to Excellent	Outstanding	Excellent to Outstanding	Good to Excellent	Good to Excellent	Outstanding

## Nitrile (N)

Nitrile elastomers are the most commonly used material in the radial shaft seal industry. Nitrile carries the ASTM designation of NBR and is covered by ASTM D2000 / SAE J200 - BF, BG, BK or CH classifications.

Nitrile is a copolymer of acrylonitrile and butadiene. The higher the acrylonitrile content the greater the resistance to oil and fuel. This increase also has an adverse affect on elasticity and resistance to compression set. In general, NBR has good mechanical properties and wear resistance.

Nitrile is recommended for general purpose sealing

of the following media: dilute acids, salt solutions, alkali solutions, HFA, HFB, HFC, aliphatic hydrocarbons (fuels and oils), vegetable and mineral oils, grease and water.

It is not suited for use with strong oxidizing agents; chlorinated solvents such as carbon tetrachloride, nitrated hydrocarbons such as nitrobenzene or aniline; phosphate esters such as Skydrol, Fyrquel, or Pydraul; acetates; ketones such as methyl ethyl ketone and acetone; and aromatic hydrocarbons. Ozone will usually attack nitrile materials, but resistance can be greatly increased by the addition of antiozonant compounds.

## PTFE (T)

Polytetrafluoroethylene (PTFE, Teflon) offers superior chemical resistance to oils, solvents, acids and salts. High temperature resistance and low friction are also advantages compared to other elastomers.

With the addition of appropriate fillers, PTFE has excellent mechanical properties, favorable for applications where low lubrication could be a problem.

# Materials Selection

## Fluorocarbon (F)

Fluorocarbon (Viton, Fluorel, Kel-F) elastomers are selected for high underlip temperatures and excellent chemical resistance. Fluorocarbon carries the ASTM designation of FKM and is covered by the ASTM D2000 / SAE J200 - HK classification.

Low temperature resistance is not favorable for dynamic applications. For temperatures below -30°F (-34°C) an alternate elastomer should be selected.

Fluorocarbon elastomers have good resistance to the swelling and deteriorating effects of aromatic solvents,

aliphatic hydrocarbons, halogenated hydrocarbons such as carbon tetrachloride, trichloroethylene, diester oils, silicate ester oils, petroleum oils, and many mineral acids. They are also highly recommended in applications involving ozone combined with heat, as in electric motors and electrical equipment.

Fluorocarbons are not recommended for use with highly polar fluids such as hydrazine, ketones, phosphate esters like Skydrol, anhydrous ammonia, low-molecular-weight esters and hot hydrofluoric or chlorosulfonic acids.

## Polyacrylate (P)

Polyacrylate elastomers are most commonly selected for higher operating temperatures or extreme pressure (EP) lubricants. Polyacrylate carries the ASTM designation ACM and is covered by the ASTM D2000 / SAE J200 - DF, DH or EH classification.

The main advantage Polyacrylate has over Nitriles is

a higher temperature range and additional resistance to ozone and weather attack.

It is not compatible with glycol based brake fluids, aromates, chlorinated hydrocarbons, hot water / steam, acids, alkalis, amines and is not to be used in dry running applications.

## Silicone (S)

Silicone elastomers are generally selected for use in low friction, high temperature applications. Silicone carries the ASTM designation of VMQ and is covered by ASTM D2000 / SAE J200 - FC, FE or GE classifications.

Silicone elastomers are compounded from dimethyl silicone polymers, and will deteriorate if used with silicone oils or greases. Various additives have extended the functional temperature range of silicone rubber beyond any other elastomer. Flexibility below -175° F

and service above 700°F for short periods of time have been demonstrated.

Silicone is recommended for the following media: engine and transmission oil; animal and vegetable oils and greases; high molecular weight chlorinated aromatic hydrocarbons; diluted salt solutions and water.

It is not compatible with hydrocarbon based fuels; aromatic hydrocarbons; acids and alkalis; steams and oxidized oils.

## Ethylene Propylene (E)

Ethylene Propylene is not commonly used in the radial shaft seal industry because of its chemical reaction to oils, greases, and fuels. It is however extremely effective for glycol based brake fluids and phosphate ester hydraulic oils. Ethylene Propylene carries the ASTM designation of EP or EPDM and is covered by the

ASTM D2000 / SAE J200 - CA, BA, AA or DA classifications.

EPDM is compatible with alcohols; ketones; esters; organic and inorganic acids; cleaning agents; glycol based brake fluids; hot water / steam.

## High Temperature Nitrile (H)

Hydrogenated Nitrile (HNBR) is a synthetic polymer that results from the hydrogenation of Nitrile rubber. The affect is an increase resistance to lip hardening at

higher temperatures. It also provides improved tensile strength, abrasion and ozone resistance. HNBR should not be used in low temperature applications.

## Carboxylated Nitrile (X)

Carboxylated Nitrile (XNBR) is a syntetic polymer compounded for highly abrasive operating conditions. It is used for applications involving abrasive materials such as scale, sand, grit or other abrasive material that

is likely to collect at the point of shaft contact. Carboxylated nitrile has many of the same fluid compatability characteristics as nitrile.

# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Acetaldehyde	4	4	2	4
Acetamide	1	4	2	2
Acetic Acid, Glacial	3	4	2	3
Acetic Acid, 30%	2	4	1	2
Acetic Acid, 5%	2	—	1	1
Acetic Acid, hot high pressure	4	—	4	4
Acetic Anhydride	3	4	3	4
Acetone	4	4	3	4
Acetophenetidine	2	4	—	1
Acetophenone	4	4	4	4
Acetotoluidide	2	4	—	1
Acetyl Acetone	4	—	4	4
Acetyl Bromide	4	4	4	1
Acetyl Chloride	4	4	3	1
Acetylene	1	4	2	1
Acetylene Tetrabromide	4	—	—	1
Acetylene Tetrachloride	4	—	—	1
Acrylonitrile	4	4	4	3
Adipic Acid	1	—	—	—
Aero Lubriplate	1	—	2	1
Aero Safe 2300	4	—	4	4
Aero Safe 2300W	4	—	4	4
Aero Shell 17 grease	1	1	2	1
Aero Shell 750	2	2	4	1
Aero Shell 7A grease	2	1	2	1
Aero Shell IAC	1	1	2	1
Aerosafe 2300	4	4	3	4
Aerosafe 2300W	4	4	3	4
Aerozene 50 (50% Hydrazine, 50% UDMH)	3	—	4	4
Air below 200° F	2	1	1	1
Air, 200 - 300° F	3	2	1	1
Air, 300 - 400° F	4	4	1	1
Air, 400 - 500° F	2	4	—	1
Alkanes (Paraffin Hydrocarbons)	1	1	2	1
Alkazene	4	4	4	2
Alum-NH3-Cr_K (AQ)	1	4	1	4
Aluminum Acetate (AQ)	2	4	4	4
Aluminum Bromide	1	—	1	1
Aluminum Chloride (AG)	1	1	2	1
Aluminum Fluoride (AQ)	1	—	2	1
Aluminum Nitrate (AQ)	1	—	2	1
Aluminum Phosphate (AQ)	1	—	1	1
Aluminum salts	1	—	1	1
Aluminum Sulfate(AQ)	1	4	1	1
Ambrex 33 (Mobil)	1	1	4	1
Ammonia and Lithium in solution	2	—	4	4
Ammonia, Anhydrous	2	4	3	4

Chemical	Sealing Material			
	N	P	S	F
Ammonia gas (cold)	1	4	1	4
Ammonia gas (hot)	4	4	1	4
Ammonium Carbonate (AQ)	4	4	—	—
Ammonium Chloride (AQ)	1	—	—	1
Ammonium Hydroxide (concentrate)	4	4	1	2
Ammonium Nitrate (AQ)	1	2	—	—
Ammonium Nitrite (AQ)	1	—	2	—
Ammonium Persulfate (AQ)	4	4	—	—
Ammonium Persulfate 10%	4	—	—	—
Ammonium Phosphate Dibasic Ammonium Phosphate	1	—	1	—
Monobasic	1	—	1	—
Ammonium Phosphate Tribasic	1	—	1	—
Ammonium Phosphate (AQ)	1	—	1	—
Ammonium salts	1	—	1	4
Ammonium Sulfate (AQ)	1	4	—	4
Ammonium Sulfide	1	—	—	4
Amyl Acetate (banana oil)	4	4	4	4
Amyl Alcohol	2	4	4	2
Amyl Borate	1	—	—	1
Amyl Chloride	—	—	4	1
Amyl Chloronaphthalene	4	4	4	1
Amyl Naphthalene	4	2	4	1
AN-0-3 Grade M	1	—	2	1
AN-0-366	1	—	4	1
AN-0-6	1	—	4	1
AN-W-0-366B Hydraulic Fluid	1	—	4	1
Anderol L-774 (MIL-L-7808D)	2	4	1	1
Anderol L-826 (Diester)	2	—	4	1
Anderol L-829 (Diester)	2	—	4	1
ANG (Diester base) (TG749)	2	—	2	1
ANG (Glycerol Ester)	2	—	2	1
Anhydrous Ammonia	2	—	2	4
Anhydrous Hydrazine	4	—	—	4
Anhydrous Hydrogen Fluoride	4	—	—	4
Aniline	4	4	4	3
Aniline dyes	4	4	3	2
Aniline Hydrochloride	2	4	4	2
Aniline oils	4	—	4	4
Animal fats (butter)	1	1	2	1
Ansul Ether (anesthetics)	3	4	4	4
API GL-5	2	1	4	1
Aqua Regia	4	4	4	2
Argon	4	—	2	1
Aroclor 1248	3	4	2	1
Aroclor 1254	4	4	3	1
Aroclor 1260	1	4	2	1
Aromatic fuel 50%	2	—	4	1

Lip Codes: N = Nitrile P = Polyacrylate S = Silicon F = Fluorocarbon (Viton)

Ratings: 1 = Minor Affect 2 = Moderate Affect 3 = Static Only 4 = Not Recommended — = Insufficient Data (AQ) = Aqueous

# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Arsenic Acid	1	3	1	1
Arsenic Trichloride (AQ)	1	—	—	—
Askrel	2	4	4	1
Asphalt	2	2	4	1
ASTM #1 Method D-471	1	1	3	1
ASTM #2 Method D-471	1	1	3	1
ASTM #3 Method D-471	1	1	3	1
ASTM #4 Method D-471	2	—	4	1
ASTM #5 Method D-471	1	—	—	1
ASTM Reference Fuel A (MIL-S-3136B Type 1)	1	2	4	1
ASTM Reference Fuel B (MIL-S-3136B Type 3)	1	—	4	1
ASTM Reference Fuel C	2	4	4	1
ASTM Reference Fuel D	2	—	—	1
ATF Type (Mercon)	1	1	1	1
ATF Type A	1	1	2	1
ATF Type F	1	1	2	1
ATF Type I	1	1	2	1
ATF Type II	1	1	2	1
ATL-857	2	—	4	1
Atlantic Dominion	1	—	4	1
Aurex 903R Mobile	1	—	4	1
Automatic Transmission Fluid	1	1	4	1
Automotive brake fluid	3	4	3	4
B.P. Aero Hydraulic Fluid #1 (DTD585)	—	—	—	1
Banana oil (Amyl Acetate)	4	4	4	4
Bardol	4	—	4	1
Barium Chloride (AQ)	1	1	1	1
Barium Hydroxide (AQ)	1	4	1	1
Barium Sulfate (AQ)	1	4	1	1
Barium Sulfide (AQ)	1	4	1	1
Beer	1	4	1	1
Beer sugar liquids	1	—	—	1
Beer sugar liquors	1	4	1	1
Bel Ray SE 140	1	—	—	1
Bel Ray SE 290	2	—	—	4
Benzaldehyde	4	4	2	4
Benzene	4	4	4	2
Benzene Sulfonic Acid	4	4	4	1
Benzine (Ligroin) (Nitrobenzine)	1	1	4	1
Benzine (Pet Ether)	1	1	4	1
Benzoic Acid	3	3	3	1
Benzoin	2	4	—	1
Benzonitrile	3	4	2	3
Benzophenone	—	—	—	1
Benzoyl Chloride	4	4	—	1
Benzyl Alcohol	4	4	2	1
Benzyl Benzoate	4	4	—	1

Chemical	Sealing Material			
	N	P	S	F
Benzyl Chloride	4	4	4	1
Benzyl Phenol	2	4	—	1
Biphenyl (Diphenyl) (Phenylbenzene)	4	4	4	1
Black Point 77	1	—	4	1
Black Sulphate Liquors	2	—	2	1
Blast furnace gas	4	4	1	1
Bleach Liquor	3	—	2	1
Bleach solutions	4	4	2	1
Borax	2	2	2	1
Borax solutions	—	—	—	1
Bordeaux Mixture	2	4	2	1
Boric Acid	1	4	1	1
Boron fluids (HEF)	2	—	4	1
Brake fluid DOT3 (Glycol type)	3	—	4	3
Brake fluid (Wagner 21B)	3	—	3	4
Bray GG-130	2	—	4	1
Brayco 719-R (VV-H-910)	4	—	2	4
Brayco 885 (MIL-L-6085A)	2	—	4	1
Brayco 910	2	—	4	4
Bret 710	2	—	4	4
Brine	1	4	1	1
Brine (seawater)	1	—	—	1
BP, ISO 220 Mineral Oil, PM-220	1	1	2	1
Brom-113	4	—	4	—
Brom-114	2	—	4	2
Bromine	4	—	4	1
Bromine Pentafluoride	4	4	4	4
Bromine Trifluoride	4	4	4	4
Bromine water	4	4	4	1
Bromine-Anhydrous	4	4	4	1
Bromine-Pentafluoride	4	—	4	4
Bromobenzene	4	4	4	1
Bromochloro Trifluoroethane	4	—	4	1
Bunker oil	1	1	2	1
Bunker's "C" (Fuel Oil)	1	—	—	1
Butadiene	4	4	4	1
Butane	1	1	4	1
Butane 2, 2-Dimethyl	1	—	4	1
Butane 2, 3-Dimethyl	1	—	4	1
Butanol (Butyl Alcohol)	1	—	2	1
Butter (animal fat)	1	1	2	1
Butyl Acetate	4	4	4	4
Butyl Acetyl Ricinoleate	3	—	—	1
Butyl Acrylate	4	4	—	4
Butyl Alcohol	1	4	2	1
Butyl Amine	3	4	4	4
Butyl Benzoate	4	4	—	1

Lip Codes: N = Nitrile P = Polyacrylate S = Silicon F = Fluorocarbon (Viton)

Ratings: 1 = Minor Affect 2 = Moderate Affect 3 = Static Only 4 = Not Recommended — = Insufficient Data (AQ) = Aqueous

# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Butyl Butyrate	4	—	—	1
Butyl Carbitol	4	4	4	1
Butyl Cellosolve	3	4	—	4
Butyl Cellosolve Adipate	4	—	2	2
Butyl Ether	4	—	4	4
Butyl Glycolate	3	4	2	3
Butyl Oleate	4	—	—	1
Butyl Stearate	2	—	—	1
Butylene	2	4	4	1
Butylaldehyde	4	4	4	4
Butyric Acid	4	—	—	2
Calcine liquors	1	—	—	1
Calcium Acetate (AQ)	2	4	4	4
Calcium Bisulfate (AQ)	4	4	1	1
Calcium Carbonate	1	—	1	1
Calcium Chloride (AQ)	1	1	1	1
Calcium Cynide	1	—	1	—
Calcium Hydroxide (AQ)	1	4	1	1
Calcium Hypochloride	4	—	—	1
Calcium Hypochlorite (AQ)	2	4	2	1
Calcium Nitrate (AQ)	1	1	2	1
Calcium Phosphate	1	—	1	1
Calcium salts	1	—	—	1
Calcium Sulfide (AQ)	1	4	2	1
Calcium Sulfite	1	—	1	1
Calcium Thiosulphate	2	—	1	1
Caliche liquors	1	—	2	1
Cane sugar liquors	1	4	1	1
Caporic Aldehyde	—	—	2	4
Carbamate	3	4	—	1
Carbitol	2	4	2	2
Carbolic Acid (Phenol)	4	4	4	1
Carbon Bisulfide	3	3	4	1
Carbon Dioxide (wet or dry)	1	—	2	1
Carbon Disulfide	4	—	—	1
Carbon Monoxide	1	—	1	1
Carbon Tetrachloride	3	4	4	1
Carbonic Acid	2	—	1	1
Castor oil	1	1	1	1
Caustic soda	2	3	2	2
Cellosolve	4	4	4	3
Cellosolve Acetate	4	4	4	4
Cellosolve Butyl	4	—	4	4
Celluguard	1	—	1	1
Cellulube (Fryquel)	4	4	1	1
Cellulube 220 (see MIL-L-19457)	4	4	3	3
Cellulube 90, 100, 150, 220, 300, 500	4	—	1	1

Chemical	Sealing Material			
	N	P	S	F
Cellultherm 2505A	2	—	4	1
Cetane (Hexadecane)	1	—	4	1
China wood oil (tung oil)	1	—	4	1
Chloracetic Acid	4	—	—	4
Chlorextol	2	—	4	1
Chlorinated salt brine	4	—	4	1
Chlorinated solvents (wet or dry)	4	—	4	1
Chlorine (dry)	4	4	4	1
Chlorine (wet)	4	4	4	1
Chlorine Dioxide	4	4	—	1
Chlorine Trifluoride	4	4	4	4
Chloroacetic Acid	4	4	—	4
Chloroacetone	4	4	4	4
Chlorobenzene	4	4	4	1
Chlorobenzene (Mono)	4	—	4	1
Chlorobromomethane	4	4	4	1
Chlorobutadiene	4	4	4	1
Chlorodane	2	—	4	1
Chlorododecane	4	4	4	1
Chloroform	4	4	4	1
Chlorosulfonic Acid	4	4	4	4
Chlorotoluene	4	4	4	1
Chlorox (Sodium Hypochlorite NAOC1)	2	4	2	1
Chrom Alum	1	—	1	1
Chrome plating solutions	4	4	2	1
Chromic Acid	4	4	3	1
Chromic Oxide .88 wt. % aqueous sol.	4	—	2	1
Circo light processing oil	1	—	4	1
Citric Acid	1	—	1	1
City Service #'s 65, 120, 250	1	—	4	1
City Service Kool Motor-AP gear oil	1	—	4	1
City Service Pacemaker #2	1	—	4	1
CM Coolant #5	1	—	—	—
Coal Tar (Creosote)	1	1	4	1
Cobalt Chloride (2N)	1	—	1	1
Cobalt Chloride (AQ)	1	4	2	1
Coconut oil	1	1	1	1
Cod liver oil	1	1	2	1
Coffee (basically water)	1	—	—	1
Coke oven gas	4	4	2	1
Coliche liquors	2	—	—	—
Convelex 10	4	—	4	—
Coolanol (Monsanto)	1	—	4	1
Coolanol 45 (Monsanto)	1	—	4	1
Copper Acetate (AQ)	2	4	4	4
Copper Chloride (AQ)	1	1	1	1
Copper Cyanide (AQ)	1	1	1	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Copper salts	1	—	1	1
Copper Sulfate (AQ)	1	4	1	1
Copper Sulfate 10%	1	—	1	1
Copper Sulfate 50%	1	—	1	1
Corn oil	1	1	1	1
Cottonseed oil	1	1	1	1
Creosote (coal tar)	1	1	4	1
Creosote (wood)	1	—	4	1
Cresol	4	4	4	1
Cresylic Acid	4	4	4	1
Crude oil	2	—	4	1
Cumene	4	4	4	1
Cutting oil	1	—	4	1
Cyclohexane	1	1	4	1
Cyclohexanol	3	—	4	1
Cyclohexanone	4	4	4	1
DC44M (Dow Corning)	3	3	3	1
DC44M hi temp Silicone grease	3	3	3	1
Decalin	4	—	4	1
Decane	1	1	2	1
Delco brake fluid	4	—	4	4
Denatured Alcohol	1	4	1	1
Detergent solutions	1	4	1	1
Developing fluids	1	—	1	1
Dexron	1	1	4	1
Di-Ester lubricant (MIL. L-7808)	2	—	4	1
Di-Ester synthetic lubricant	2	—	4	1
Diacetone	4	4	4	4
Diacetone Alcohol	4	4	2	4
Diazion	4	—	4	2
Dibenzyl Ether	4	—	—	4
Dibenzyl Sebecate	4	4	3	2
Dibromoethylbenzene (Alkazene)	4	4	4	2
Dibutyl Amine	4	4	3	4
Dibutyl Ether	4	3	4	3
Dibutyl Phthalate	4	4	2	3
Dibutyl Sebecate	4	4	2	2
Dichloro-Butane	2	—	4	1
Dichloro-Isopropyl Ether	4	3	4	3
Dicyclohexylamine	3	4	—	4
Diesel fuel	1	1	4	1
Diethyl Benzene	4	—	4	1
Diethyl Ether	4	3	4	4
Diethyl Sebecate	2	4	2	2
Diethylamine	2	4	2	4
Diethylene Glycol	1	2	2	1
Difluorodibromomethane	4	—	4	—

Chemical	Sealing Material			
	N	P	S	F
Diisobutylene	2	4	4	1
Diisooctyl Sebacate	4	—	4	2
Diisopropyl Benzene	4	—	—	1
Diisopropyl Ketone	4	4	4	4
Diisopropylidene Acetone (Phorone)	4	4	4	4
Dimethyl Aniline (Xylidine)	3	4	4	4
Dimethyl Disulfite (DMS)	4	4	4	4
Dimethyl Ether (Methyl Ether)	3	4	4	4
Dimethyl Ether (Monomethyl Ether)	1	4	1	1
Dimeter Formamide	2	4	2	4
Dimethyl Phthalate	4	4	—	2
Dinitrotolene	4	4	4	4
Diocetyl Phthalate	3	4	3	2
Diocetyl Sebecate	4	4	3	2
Dioxane	4	4	4	4
Dioxolane	4	4	4	4
Dipentene	2	4	4	1
Diphenyl (Biphenyl) (Phenybenzene)	4	4	4	1
Diphenyl Oxides	4	4	3	1
DMS (Dimethyl Disulfite)	4	4	4	4
Dow chemical 50-4	—	—	—	4
Dow chemical ET378	4	—	4	—
Dow chemical ET588	4	—	—	4
Dow Corning-11	1	—	4	1
Dow Corning-1208	1	—	4	1
Dow Corning-200	1	—	4	1
Dow Corning-220	1	—	4	1
Dow Corning-3	1	—	4	1
Dow Corning-33	1	—	4	1
Dow Corning-4	1	—	4	1
Dow Corning-4050	1	—	4	1
Dow Corning-44	1	—	4	1
Dow Corning-5	1	—	4	1
Dow Corning-510	1	—	4	1
Dow Corning-55	1	—	4	1
Dow Corning-550	1	—	4	1
Dow Corning-6620	1	—	4	1
Dow Corning-704	2	—	4	1
Dow Corning-705	2	—	—	1
Dow Corning-710	1	—	4	1
Dow Corning-F60	1	—	4	1
Dow Corning-F61	1	—	2	1
Dow Corning-XF61	1	—	4	1
Dow Guard	1	—	1	1
Dowtherm 209, 50% solution	4	—	4	4
Dowtherm A or E	4	—	4	1
Dowtherm oil	4	4	3	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Drinking water	1	—	1	1
Dry cleaning fluids	3	4	4	1
Elco 28-EP lubricant	1	—	4	1
Engine oil (Diester motor oil)	2	1	1	1
Engine oil (Hydrocarbon motor oil)	1	1	1	1
EP lubes	2	1	4	1
Epichlorohydrin	4	4	4	4
Epoxy resins	—	—	—	4
ESAM-6 fluid	—	—	—	4
Esso fuel 208	1	—	4	1
Esso golden gasoline	2	—	4	1
Esso GX 80W90 (GL-5)	2	1	4	1
Esso motor oil	1	—	4	1
Esso transmission fluid (Type A)	1	—	4	1
Esso WS3812 (MIL-L-7808)	1	—	4	1
Esso XP90 EP lubricant	1	—	4	1
Esstic 42,43	1	—	4	1
Esters	4	—	4	4
Ethane	1	—	4	1
Ethanol (Ethyl Alcohol)	1	4	1	3
Ethanolamine	2	4	2	4
Ethyl Acetate	4	4	2	4
Ethyl Acetate-organic Ester	4	—	2	4
Ethyl Acetoacetate	4	4	2	4
Ethyl Acrylate	4	4	2	4
Ethyl Acrylic Acid	4	—	4	—
Ethyl Alcohol (Ethanol)	1	4	1	3
Ethyl Benzene	4	4	4	1
Ethyl Benzoate	4	4	4	1
Ethyl Bromide	2	—	4	1
Ethyl Cellosolve	4	4	4	4
Ethyl Cellulose	2	4	3	4
Ethyl Chloride	1	4	4	1
Ethyl Chlorocarbonate	4	4	4	1
Ethyl Chloroformate	4	4	4	4
Ethyl Cyclopentane	1	—	4	1
Ethyl Ether	3	4	4	4
Ethyl Formate	4	—	—	1
Ethyl Hexanol	1	—	2	1
Ethyl Mercapton	4	—	3	2
Ethyl Oxalate	4	4	4	1
Ethyl Pentachlorobenzene	4	4	4	1
Ethyl Silicate	1	—	—	1
Ethylene	1	—	—	1
Ethylene Chloride	4	4	4	2
Ethylene Chlorohydrin	4	4	3	1
Ethylene Diamine	1	4	1	4

Chemical	Sealing Material			
	N	P	S	F
Ethylene Dibromide	4	—	4	1
Ethylene Dichloride	4	4	4	1
Ethylene Glycol	1	3	1	1
Ethylene Oxide	4	4	4	4
Ethylene Trichloride	4	4	4	1
Ethylmorpholene Stannus Octate (50/50)	4	—	—	4
Fatty Acids	2	—	3	1
FC-43 Heptacosofluorotributylamine	1	—	1	1
FC75 Fluorocarbon	1	—	1	2
Ferric Chloride (AQ)	1	1	2	1
Ferric Nitrate (AQ)	1	1	3	1
Ferric Sulfate (AQ)	1	1	2	1
Fish oil	1	—	1	1
Fluorine (liquid)	4	4	4	2
Fluorobenzene	4	4	4	1
Fluoroboric Acid	1	—	—	—
Fluorolube	1	—	1	2
Formaldehyde (RT)	3	4	2	4
Formaldehyde, 37%	3	4	2	1
Formic Acid	2	—	—	3
Freon 11	2	—	—	1
Freon 112	3	—	4	1
Freon 113	1	—	4	2
Freon 114	1	—	4	2
Freon 114B2	2	—	4	2
Freon 115	1	—	—	2
Freon 12	1	1	4	2
Freon 12 and ASTM #2 oil (50/50)	1	—	4	1
Freon 12 and Suniso 4G (50/50)	1	—	4	1
Freon 13	1	—	4	1
Freon 134A	4	4	4	4
Freon 13B1	1	—	4	1
Freon 14	1	—	4	1
Freon 142B	1	—	—	4
Freon 152A	1	—	—	4
Freon 21	4	—	4	4
Freon 218	1	—	—	1
Freon 22	4	4	4	4
Freon 22 and ASTM #2 oil (50/50)	4	—	4	2
Freon 31	4	—	—	4
Freon 32	1	—	—	4
Freon 502	2	—	—	2
Freon BF	2	—	4	1
Freon C316	1	—	—	—
Freon C318	1	—	—	2
Freon MF	1	—	4	2
Freon PCA	1	—	4	2

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Freon T-P35	1	—	1	1
Freon T-WD602	2	—	4	1
Freon TA	1	—	3	3
Freon TC	1	—	4	1
Freon TF	1	—	4	2
Freon TMC	2	—	3	1
Fuel oil	1	1	4	1
Fuel oil #6	2	—	4	1
Fuel oil, acidic	1	—	4	1
Fumaric Acid	1	4	2	1
Fuming Sulphuric Acid (20/25% Oleum)	4	—	4	1
Furan, Furfuran	4	4	—	—
Furaryl Alcohol	4	—	4	—
Furfural	4	4	4	4
Furfuraldehyde	4	—	4	4
Fyrquel (Cellulube)	4	—	1	1
Fyrquel 90, 100, 150, 220, 300, 500	4	—	1	1
Fyrquel A60	4	—	4	4
Gallic Acid	2	4	—	1
Gasohol (10% Ethanol or Methanol)	2	4	4	3
Gasoline (lead and no-lead)	2	4	4	1
Gelatin	1	4	1	1
Girling brake fluid	4	—	4	4
Glacial Acetic Acid	2	—	2	4
Glauber's salt (AQ)	4	4	—	1
Glucose	1	—	1	1
Glue	1	—	1	1
Glycerin	1	3	1	1
Grease	1	2	1	1
Green Sulfate liquor	2	2	1	1
Gulf endurance oils	1	—	4	1
Gulf FR fluids (emulsion)	1	—	4	1
Gulf FRG fluids	1	—	1	1
Gulf FRP fluids	4	—	1	2
Gulf harmony oils	1	—	4	1
Gulf high temperature grease	1	—	4	1
Gulf legion oils	1	—	4	1
Gulf paramount oils	1	—	4	1
Gulf security oils	1	—	4	1
Gulfcrown grease	1	—	4	1
Halothane	4	—	4	1
Halowax oil	4	—	4	1
Hannifin Lube A	1	—	2	1
Heavy water (Deturium)	1	—	1	1
Hef (high energy fuel)	2	—	4	1
Helium	1	1	1	1
Hexane	1	1	4	1

Chemical	Sealing Material			
	N	P	S	F
Hexyl alcohol	1	4	2	1
High viscosity lubricant, H2	1	—	1	1
High viscosity lubricant, U4	1	—	1	1
Hilo MS #1	4	—	4	4
Houghto-Safe 1010, Phosphate Ester	4	—	4	1
Houghto-Safe 1055, Phosphate Ester	4	—	4	1
Houghto-Safe 1120, Phosphate Ester	4	—	4	1
Houghto-Safe 271 H2O and Glycol base	1	—	2	2
Houghto-Safe 5040, water/oil emulsion	1	—	4	1
Houghto-Safe 620 water/glycol	1	—	2	2
Hydraulic oil (Petroleum)	1	1	3	1
Hydrazine	2	—	3	4
Hydro-Driv, MIH-10 (Petroleum base)	1	—	2	1
Hydro-Driv, MIH-50 (Petroleum base)	1	—	2	1
Hydrobromic Acid	4	4	4	1
Hydrobromic Acid 40%	4	4	4	1
Hydrocarbons (saturated)	1	—	4	1
Hydrochloric Acid (cold) 37%	3	4	3	1
Hydrochloric Acid (hot) 37%	4	4	4	2
Hydrochloric Acid 3 molar	4	—	4	1
Hydrocyanic Acid	2	4	3	1
Hydrofluoric Acid (conc.) cold	4	4	4	1
Hydrofluoric Acid (conc.) hot	4	4	4	3
Hydrofluoric Acid, Anhydrous	4	4	4	4
Hydrofluorsilicic	1	—	4	1
(Fluosilicic) Acid	1	—	4	1
Hydrogen gas	1	2	3	1
Hydrogen Peroxide (90%)	4	4	2	2
Hydrogen Sulfide (wet) cold	4	4	3	4
Hydrogen Sulfide (wet) hot	4	4	3	4
Hydrolube-water/Ethylene Glycol	1	—	2	1
Hydroquinone	3	4	—	2
Hydyne	2	—	4	4
Hyjet	4	—	—	4
Hyjet III	4	—	—	4
Hyjet S	4	—	—	4
Hyjet W	4	—	—	4
Hypochlorous Acid	4	4	—	1
Isopropyl Acetate	4	4	4	4
Industron FF44	1	—	4	1
Industron FF48	1	—	4	1
Industron FF53	1	—	4	1
Industron FF80	1	—	4	1
Iodine	2	—	—	1
Iodine Pentafluoride	4	4	4	4
ISO-Butyl N-Butyrate	4	—	—	1
Isobutyl Alcohol	2	4	1	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Isododecane	1	—	4	1
Isooctane	1	1	4	1
Isophorone	4	4	4	4
Isopropanol	2	—	1	1
Isopropyl Acetate	4	4	4	4
Isopropyl Alcohol	2	4	1	1
Isopropyl Chloride	4	4	4	1
Isopropyl Ether	2	3	4	4
JP3, JP4, JP5 (see MIL-J-5624G)	1	2	4	1
JP6 (see MIL-F-25656B)	1	—	4	1
JPX (see MIL-F-25604)	1	—	4	4
KEL-F liquids	1	—	1	2
Kerosene	1	1	4	1
Keystone #87 HX-grease	1	—	4	1
Keystone (KSL) Diester lube	2	—	—	1
Krytox, LVP (Dupont)	1	1	1	1
Lacquer solvents	4	4	4	4
Lacquers	4	4	4	4
Lactams-Amino Acids	4	—	—	4
Lacquer solvents	4	4	4	4
Lactic Acid (cold)	1	4	1	1
Lactic Acid (hot)	4	4	2	1
Lard	1	1	2	1
Lavender oil	2	2	4	1
Lead Acetate (AQ)	2	4	4	4
Lead Nitrate (AQ)	1	—	2	—
Lead Sulfamate (AQ)	2	4	2	1
Legroin (Benzine)	1	1	4	1
Legroin (Nitrobenzine)	1	1	4	1
Legroin (Pet Ether)	1	1	4	1
Lehigh X1169	1	—	4	1
Lehigh X1170	1	—	4	1
Light grease	1	—	4	1
Lime bleach	1	4	2	1
Lime Sulfur	4	4	4	1
Lime water (Calcium Hydroxide-AQ)	1	4	1	1
Lindol (hydraulic fluid)	4	4	2	2
Linoleic Acid	2	—	1	2
Linseed oil	1	1	—	1
Liquefied Petroleum gas	1	3	1	1
Liquid Oxygen	4	—	4	4
Lubricating oils (Crude and Refined)	2	—	—	1
Lubricating oils (Synthetic base)	—	4	—	1
Lubricating oils (Di-Ester)	2	2	4	1
Lubricating oils (Petroleum base)	1	1	4	1
Lubrication oils (SAE 10, 20, 30, 40, 50)	1	2	4	1
Lye	2	3	2	2

Chemical	Sealing Material			
	N	P	S	F
Magnesium Chloride (AQ)	1	—	1	1
Magnesium Hydroxide (AQ)	2	4	—	1
Magnesium salts	1	—	1	1
Magnesium Sulfate (AQ)	1	4	1	1
Magnesium Sulfite	1	—	1	1
Malathion	2	—	4	1
Maleic Acid	4	4	—	1
Maleic Anhydride	4	4	—	4
Malic Acid	1	4	2	1
MCS 312	4	—	1	1
MCS 352,463	4	—	4	1
MEK (Methyl Ethyl Ketone)	4	4	4	4
Mercury	1	—	—	1
Mercury Chloride (AQ)	1	—	—	1
Mercury vapors	1	—	—	1
Mesityl oxide	4	4	4	4
Methane	1	1	4	2
Methane, Sulfurated (odor detection)	1	1	4	2
Menthanol (Methyl Alcohol)	1	4	1	4
Methyl Acetate	4	4	4	4
Methyl Acetoacetate	4	—	2	4
Methyl Acetone	4	4	3	4
Methyl Acrylate	4	4	4	4
Methyl Alcohol (Ethanol)	1	4	1	4
Methyl Benzoate	4	—	4	1
Methyl Bromide	2	3	—	1
Methyl Butyl Ketone (Propyl Acetone)	4	4	3	4
Methyl Carbonate	4	—	4	1
Methyl Cellosolve	3	4	4	4
Methyl Cellulose	2	—	2	4
Methyl Chloride	4	4	4	2
Methyl Chloroformate	4	—	4	1
Methyl Cyclopentane	4	4	4	2
Methyl D-Bromide	4	—	4	1
Methyl Ether (Dimethyl Ether)	1	4	1	1
Methyl Ether (Monomethyl Ether)	1	4	1	1
Methyl Ethyl Ketone (MEK)	4	4	4	4
Methyl Ethyl Ketone Peroxide	4	—	2	4
Methyl Formate	4	—	—	—
Methyl Isobutyl Ketone	4	4	4	4
Methyl Methacrylate	4	4	4	4
Methyl Oleate	4	—	—	2
Methyl Salicylate	4	—	—	—
Methylacrylic Acid	4	4	4	4
Methylene Chloride	4	4	4	2
Methylene Dichloride	4	—	4	2
MIL-1-8660 B	1	—	4	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
MIL-A-6091	2	—	1	1
MIL-A-8243 B	1	3	2	2
MIL-C-4339 C	1	1	3	1
MIL-C-5545 A	2	2	4	1
MIL-C-6529 C	2	2	4	1
Mil-C-8188 C	1	3	3	1
MIL-E-9500	1	—	1	1
MIL-F-16884	1	—	4	1
MIL-F-16929 A	1	3	3	1
MIL-F-17111	1	1	3	1
MIL-F-19605	1	—	4	1
MIL-F-25172	1	—	4	1
MIL-F-25524 A	1	—	4	1
MIL-F-25558 B (RJ-1)	1	1	3	1
MIL-F-25576 C (RP-1)	1	1	4	1
MIL-F-25656 B	1	—	4	1
MIL-F-5566	1	—	1	1
MIL-F-5602	1	1	3	1
MIL-F-7024 A	1	2	4	1
MIL-G-10924	1	1	4	1
MIL-G-10924 B	1	1	3	1
MIL-G-15793	1	3	3	1
MIL-G-18709 A	1	1	3	1
MIL-G-2108	1	1	3	1
MIL-G-23827 A	1	3	3	1
MIL-G-25013 D	1	2	4	1
MIL-G-25537 A	1	1	3	1
MIL-G-25760 A	1	3	4	1
MIL-G-27343	1	—	4	1
MIL-G-27617	4	—	4	1
MIL-G-3278	2	—	4	1
MIL-G-4343 B	2	1	4	1
MIL-G-7118 A	1	3	3	1
MIL-G-7187	1	1	3	1
MIL-G-7421 A	1	—	3	1
MIL-G-7711 A	1	1	3	1
MIL-G-81322	2	—	—	—
MIL-H-13862	1	1	3	1
MIL-H-13866 A	1	1	3	1
MIL-H-13910 B	2	2	4	1
MIL-H-13919 A	1	1	3	1
MIL-H-19457 B	4	4	3	3
MIL-H-22072	1	3	2	2
MIL-H-22251	2	—	4	—
MIL-H-25598	1	1	3	1
MIL-H-27601 A	2	2	4	1
MIL-H-46001 A	1	1	3	1

Chemical	Sealing Material			
	N	P	S	F
MIL-H-46004	1	1	3	1
MIL-H-5559 A	1	3	2	2
MIL-H-5606 B red oil	1	1	4	1
MIL-H-6083 C	1	1	3	1
MIL-H-7083 A	1	3	2	2
MIL-H-7644	2	2	4	1
MIL-H-81019 B	1	1	3	1
MIL-H-8446 B (MLO-8515)	2	3	4	1
MIL-I-27686 D	1	3	2	2
MIL-J-5161 F	1	—	4	1
MIL-J-5624 G JP-3, JP-4, JP-5	1	2	4	1
MIL-L-10295 A	1	1	3	1
MIL-L-10324 A	1	1	3	1
MIL-L-11734 B	1	3	3	1
MIL-L-14107 B	3	—	4	1
MIL-L-15016	1	—	4	1
MIL-L-15017	1	1	3	1
MIL-L-15018 B	1	1	3	1
MIL-L-15019 C	1	1	3	1
MIL-L-15719 A	2	2	4	1
MIL-L-16958 A	1	1	3	1
MIL-L-17331 D	1	1	3	1
MIL-L-17353 A	1	—	3	1
MIL-L-17672 B	1	1	3	1
MIL-L-18486 A	1	1	3	1
MIL-L-19457	4	4	3	3
MIL-L-19701	1	3	3	1
MIL-L-2104 B	1	1	3	1
MIL-L-2105 B	1	1	3	1
MIL-L-2105 C (API GL-5)	2	1	4	1
MIL-L-21260	1	1	3	1
MIL-L-22396	1	1	3	1
MIL-L-23699 A	1	3	3	1
MIL-L-25336 B	1	3	3	1
MIL-L-25681 C	1	2	4	1
MIL-L-25968	1	3	3	1
MIL-L-26087 A	1	1	3	1
MIL-L-27694 A	1	—	4	1
MIL-L-3150 A	1	1	3	1
MIL-L-3503	1	1	3	1
MIL-L-3545 B	2	2	4	1
MIL-L-46000 A	1	3	3	1
MIL-L-46002	1	—	3	1
MIL-L-5020 A	1	2	4	1
MIL-L-5606	1	1	4	1
MIL-L-6082 A	1	1	1	1
MIL-L-6082 C	1	1	3	1

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Chemical	Sealing Material			
	N	P	S	F
MIL-L-6085 A	1	3	3	1
MIL-L-6086 B	1	1	3	1
MIL-L-6387 A	1	—	3	1
MIL-L-644 B	1	2	3	—
MIL-L-7645	2	2	4	1
MIL-L-7808 D	2	4	1	1
MIL-L-7808 E	2	4	1	2
MIL-L-7808 F	2	3	1	1
MIL-L-7870 A	1	1	3	1
MIL-L-8383 B	1	1	3	1
MIL-L-9000 F	1	2	4	1
MIL-L-9236 B	1	3	4	1
MIL-O-11773	1	3	3	1
MIL-O-6081 C	1	1	3	1
MIL-P-12098	2	2	4	1
MIL-P-46046 A	2	2	4	1
MIL-S-21568 A	1	1	4	1
MIL-S-3136 B Type I	1	2	4	1
MIL-S-3136 B Type II	1	—	4	1
MIL-S-3136 B Type III	1	—	4	1
MIL-S-3136 B Type IV	1	1	3	1
MIL-S-3136 Type V	1	1	3	1
MIL-S-3136 B Type VI	1	1	3	1
MIL-S-3136 B Type VII	1	—	4	1
MIL-S-81087	1	—	4	1
MIL-T-9188 B	4	4	4	4
Milk	1	4	1	1
Mineral oil	1	1	2	1
Mineral spirits	2	—	4	1
Mobil 24dte	1	—	—	1
Mobil Delvac 1100, 1110, 1120, 1130	1	—	—	1
Mobil HF	1	—	—	1
Mobil Nivac 20, 30	1	—	—	1
Mobil SHC 525	1	4	4	3
Mobil SHC 624	2	4	4	3
Mobil SHC 626	2	4	4	3
Mobil SHC 629	2	3	4	2
Mobil SHC 630	2	2	4	1
Mobil SHC 632	2	1	4	1
Mobil SHC 634	1	1	4	1
Mobil SHC 75W90	1	3	4	2
Mobil Therm 600	1	—	—	1
Mobil Velocite c	1	—	—	1
Mobilgear 600 Series	3	1	1	1
Mobilgear SHC ISO Series	3	1	1	1
Mobilgrease HP	2	1	2	1
Mobilgrease HTS	2	1	2	1

Chemical	Sealing Material			
	N	P	S	F
Mobilgrease SM	2	1	2	1
Mono Ethanolamine	4	—	2	4
Monobromobenzene	4	—	4	1
Monochlorobenzene	4	4	4	1
Monoethanol Amine	4	4	2	4
Monomethyl Aniline	4	4	—	2
Monomethyl Ether (Dimethyl Ether)	1	4	1	1
Monomethyl Ether (Methyl Ether)	1	4	1	1
Monomethyl Hydrazine	2	—	4	—
Mononitrotoluene/Dinitrotoluene 40/60	4	—	4	4
Monovinyl Acetylene	1	—	2	1
Mopar brake fluid	4	—	4	4
Mustard gas	—	—	1	—
Myvacet 9-45	1	—	—	1
N-Heptane	1	—	4	1
N-Hexaldehyde	4	—	2	4
N-Hexene-1	2	1	4	1
N-Octane	2	4	4	1
N-Pentane	1	—	4	1
N-Propyl Acetate	4	4	4	4
Naptha	2	2	4	1
Naphthaienic Acid	2	—	4	1
Naphthalene	4	—	4	1
Natural gas	1	2	1	1
Neat's foot oil	1	1	2	1
Neon	1	—	1	1
Neville Acid	4	4	4	1
Nickel Acetate (AQ)	2	4	4	4
Nickel Chloride (AQ)	1	3	1	1
Nickel salts	1	—	1	1
Nickel Sulfate (AQ)	1	4	1	1
Niter cake	1	4	1	1
Nitric Acid (conc.)	4	4	4	3
Nitric Acid (dilute)	4	4	2	1
Nitric Acid, red fuming	4	4	4	4
Nitrobenzene	4	4	4	2
Nitrobenzene (Petroleum Ether)	1	1	4	1
Nitrobenzine	—	—	—	1
Nitroethane	4	4	4	4
Nitrogen	1	1	1	1
Nitrogen Tetroxide	4	4	4	4
Nitromethane	4	4	4	4
Nitropropane	4	—	4	4
No. 5 cm coolant	1	—	—	—
O-A-548A	1	3	2	2
O-Chloronaphthalene	4	4	4	1
O-Chlorophenol	4	—	4	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
O-Dichlorobenzene	4	4	4	1
O-Dichlorobenzene	4	4	4	1
O-T-634B	3	4	4	1
Octachlorotoluene	4	4	4	1
Octadecane	1	2	4	1
Octyl Alcohol	2	4	2	1
Oleic Acid	3	4	4	2
Oleum (fuming Sulfuric Acid)	4	—	4	1
Oleum spirits	2	—	4	1
Olive oil	1	1	3	1
Oronite 8200 (see MIL-H-8446B)	2	3	4	1
Orthochloro Ethyl Benzene	4	—	4	1
OS 45 Type III (OS45)	2	—	4	1
OS 45 Type IV (OS45-1)	2	—	4	1
OS 70	2	—	4	1
Oxalic Acid	2	—	2	1
Oxygen (200 °-400 °F)	4	4	2	2
Oxygen, cold	2	2	1	1
Ozone	4	2	1	1
P-Cymene	4	4	4	1
P-D-680	1	—	4	1
P-D-680B	1	—	4	1
P-Dichlorobenzene	4	—	4	1
P-S-661B	1	—	4	1
Paint thinner, Duco	4	4	4	2
Palmitic Acid	1	—	4	1
Par-Al-Ketone	4	—	4	4
Para-Dichlorobenzene	4	—	4	1
Parker O-Lube	1	—	1	1
Peanut oil	1	1	1	1
Pentane, 2 Methyl	1	—	4	1
Pentane, 2-4 Dimethyl	1	—	4	1
Pentane, 3 Methyl	1	—	4	1
Perchloric Acid	4	4	4	1
Perchloroethylene	2	4	4	1
Petroleum, above 250 °F	4	4	4	2
Petroleum, below 250 °F	1	2	2	1
Phenol (Carbolic Acid)	4	4	4	1
Phenol, 70%/30% water	4	—	4	1
Phenol, 85%/15% water	4	—	4	1
Phenylbenzene	4	4	4	1
Phenyl Ethyl Ether	4	4	4	4
Phenyl Hydrazine	4	4	—	1
Phenylbenzene	4	4	4	1
Phorone (Disopropylidene Acetone)	4	4	4	4
Phosphate Ester	4	4	1	1
Phosphoric Acid, 20%	2	—	2	1

Chemical	Sealing Material			
	N	P	S	F
Phosphoric Acid 3 molar	4	—	2	1
Phosphoric Acid 45%	4	—	3	1
Phosphoric Acid, concentrated	4	—	2	1
Phosphorus Trichloride	4	—	—	1
Pickling solution	4	4	4	2
Picric Acid	2	—	4	1
Pine oil	4	—	4	1
Pinene	2	4	4	1
Piperidine	4	4	4	4
Plating solution, chrome	—	—	4	1
Plating solution, others	1	—	4	1
Polyalkylene Glycol (Ucon-51 lube)	—	—	2	2
Potassium Acetate (AQ)	2	4	4	4
Potassium Chloride (AQ)	1	1	1	1
Potassium Cupro Cyanide (AQ)	1	1	1	1
Potassium Cyanide (AQ)	1	1	1	1
Potassium Dichromate (AQ)	1	1	1	1
Potassium Hydroxide (AQ)	2	4	3	4
Potassium Nitrate (AQ)	1	1	1	1
Potassium salts	1	—	1	1
Potassium Sulfate (AQ)	1	4	1	1
Potassium Sulfite	1	—	1	1
Prestone anti-freeze	1	—	1	1
PRL-high temp Hydraulic oil	2	—	2	1
Producer gas	1	2	2	1
Propane	1	1	4	1
Propane Propionitrile	1	—	4	1
Propyl Acetone (Methyl Butyl Ketone)	4	4	3	4
Propyl Alcohol	1	4	1	1
Propyl Nitrate	4	4	4	4
Propylene	4	4	4	1
Propylene Oxide	4	4	4	4
Pydraul, 10E, 29 ELT	4	4	4	1
Pydraul, 115E	4	4	4	1
Pydraul, 230E, 312C, 540C	4	4	4	1
Pydraul, 30E, 50E, 65E, 90E	4	4	1	1
Pyranol	1	—	4	1
Pyranol, transformer oil	1	1	4	1
Pyridine	4	4	4	4
Pyrogard, 42, 43, 53, 55 (Phosphate Ester)	4	—	4	1
Pyrogard C, D	1	—	2	1
Pyroigenous Acid	4	4	—	4
Pyrolube	4	—	2	1
Pyrrrole	4	4	2	4
Quaker 613-AS	2	3	2	2
Radiation	3	3	3	4
Rapeseed oil	2	2	4	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Red Line 100 oil	1	—	4	1
Red oil (MIL-H-5606)	1	1	4	1
RJ-1 (MIL-F-25558B)	1	1	4	1
RP-1 (MIL-F-25576C)	1	1	4	1
SAE 30	1	1	1	1
SAE 90	1	1	4	1
SAE 90 EP (GL-5)	2	1	4	1
Sal Ammoniac	1	1	2	1
Salicylic Acid	2	—	—	1
Salt water	1	4	1	1
Santo Safe 300	4	—	1	1
Sewage	1	4	2	1
Shell Alvania grease #2	1	1	2	1
Shell Carnea 19 and 29	1	1	—	1
Shell Diala	1	—	—	1
Shell Iruis 905	1	1	4	1
Shell Lo Hydrax 27 and 29	1	1	4	1
Shell Macome 72	1	1	4	1
Shell Tellus #32 Pet. Base	1	1	4	1
Shell Tellus #68	1	1	4	1
Shell Tellus 27 (Pet. Base)	1	—	—	1
Shell Tellus 33	1	—	—	1
Shell UMF (5% Aromatic)	1	1	4	1
Silicate Esters	2	—	4	1
Silicone greases	1	1	3	1
Silicone oils	1	1	3	1
Silver Nitrate	2	1	1	1
Sinclair Opaline CX-EP lube	1	—	4	1
Skelly solvent B, C, E	1	—	—	1
Skydrol 500	4	4	3	4
Skydrol 7000	4	4	3	2
Skydrol LD-4	4	4	3	4
Soap solutions	1	4	1	1
Socony Mobil Type A	1	—	4	1
Socony vacuum AMV AC781 (grease)	1	—	4	1
Socony vacuum PD959B	4	—	4	1
Soda ash	1	—	1	1
Sodium Acetate (AQ)	2	4	4	4
Sodium Bicarbonate (AQ) (baking soda)	1	—	1	1
Sodium Bisulfite (AQ)	1	4	1	1
Sodium Borate (AQ)	1	—	1	1
Sodium Carbonate (soda ash)	1	—	1	1
Sodium Chloride (AQ)	1	—	1	1
Sodium Cyanide (AQ)	1	—	1	1
Sodium Hydroxide (AQ)	2	3	2	2
Sodium Hypochlorite (AQ)	2	4	2	1
Sodium Metaphosphate (AQ)	1	—	—	1

Chemical	Sealing Material			
	N	P	S	F
Sodium Nitrate (AQ)	2	—	4	—
Sodium Perborate (AQ)	2	—	2	1
Sodium Peroxide (AQ)	2	4	4	1
Sodium Phosphate (AQ)	1	1	4	1
Sodium salts	1	—	1	1
Sodium Silicate (AQ)	1	—	—	1
Sodium Sulfate (AQ)	1	4	1	1
Sodium Sulfite	1	—	1	1
Sodium Sulphide	1	—	1	1
Sodium Thiosulfate (AQ)	2	4	1	1
Sovasol #1, 2, 3	1	—	4	1
Sovasol #73, 74	2	—	4	1
Soybean oil	1	1	1	1
SPRY	1	—	1	1
SR-10 fuel	1	—	4	1
SR-6 fuel	2	—	4	1
Stannic Chloride (AQ)	1	—	2	1
Stannous Chloride (AQ)	1	—	2	1
Stauffer 7700	2	—	4	1
Steam over 300 °F (water)	4	4	4	4
Steam under 300 °F (water)	4	4	3	4
Stearic acid	2	—	2	—
Stoddard solvent	1	1	4	1
Styrene	4	4	4	2
Sucrose solution	1	4	1	1
Sulfite liquors	2	4	4	1
Sulfur	4	4	3	1
Sulfur Chloride (AQ)	3	4	3	1
Sulfur Dioxide (dry)	4	4	2	1
Sulfur Dioxide (wet)	4	4	2	1
Sulfur Dioxide liquid (under pressure)	4	4	2	1
Sulfur Hexafluoride	2	4	2	1
Sulfur liquors	2	—	4	1
Sulfur Trioxide	4	4	2	1
Sulfur Molten	4	—	4	1
Sulfuric Acid (20% Oleum)	4	4	4	1
Sulfuric Acid (conc.)	4	4	4	1
Sulfuric Acid (dilute)	3	2	4	1
Sulfuric Acid 3 Molar	4	—	4	1
Sulfurous Acid	2	4	4	1
Sunoco #3661	1	—	4	1
Sunoco all purpose grease	1	—	4	1
Sunoco SAE 10	1	—	4	1
Sunsafe (fire resistant hydraulic fluid)	1	—	—	1
Super Shell gasoline	1	—	4	1
Swan Finch EP lube	1	—	4	1
Swan Finch Hypoid	1	—	4	1

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# Fluid Compatibility

Chemical	Sealing Material			
	N	P	S	F
Tannic Acid	1	4	2	1
Tar, Bituminous	2	4	2	1
Tartaric Acid	1	—	1	1
Terpineol	2	—	—	1
Tertiary-Butyl Alcohol Turbine oil #15 (MIL-L-7808A)	2	—	4	1
Texaco 3450 Gear Oil	1	1	4	1
Texaco Capella A and AA	1	1	4	1
Texaco Meropa 220 (No Lead)	1	1	4	1
Texaco Regal B	1	1	4	1
Texaco Uni-Temp Grease	1	1	2	1
Texamatic "A" 1581 fluid	1	1	4	1
Texamatic "A" 3401 fluid	1	1	4	1
Texamatic "A" 3525 fluid	1	1	4	1
Texamatic "A" 3528 fluid	1	1	4	1
Texamatic "A" transmission oil	1	1	4	1
Texas 1500 oil	1	1	2	1
Therminol 44	4	4	4	1
Therminol 55	2	2	4	1
Therminol VP-1, 60, 65	4	4	2	1
Toluene	4	4	4	1
Transformer Oil	1	2	2	1
Transmission Fluid Type A	1	1	2	1
Turbo oil #35	1	—	4	1
Turpentine	1	2	4	1
Type I fuel (MIL-S-3136)	1	—	4	1
Type II fuel (MIL-L-3136)	2	—	4	1
Type III fuel (MIL-L-3136)	2	—	4	1
Ucon Hydrolube J-4	1	—	1	1
Ucon lubricant 50-HB100	1	—	1	1
Ucon lubricant 50-HB260	1	—	1	1
Ucon lubricant 50-HB5100	1	—	1	1
Ucon lubricant 50-HB55	1	—	1	1
Ucon lubricant 50-HB660	1	—	1	1
Ucon lubricant LB-1145	1	—	1	1
Ucon lubricant LB-135	1	—	1	1
Ucon lubricant LB-285	1	—	1	1
Ucon lubricant LB-300	1	—	1	1
Ucon lubricant LB-625	1	—	1	1
Ucon lubricant LB-65	1	—	1	1
Ucon oil 50-HB-280x	2	—	—	3
Ucon oil LB-385	1	—	1	1
Ucon oil LB-400X	1	—	1	1
Ultra-violet light	4	2	1	1
Univis (hydraulic fluid)	1	—	4	1
Univolt #35 (mineral oil)	1	—	4	1
Varnish	2	4	4	1
Vegetable oils	1	1	2	1

Chemical	Sealing Material			
	N	P	S	F
Versilube F-50	1	1	3	1
Vinegar	2	4	1	1
Vinyl Chloride	4	4	—	1
W-B-680	2	2	4	1
W-G-632	1	1	3	1
W-G-671C	1	1	3	1
W-H-910	2	2	4	1
W-I-530A	1	1	3	1
W-K-211D	1	—	4	1
W-K-220A	1	2	4	1
W-L-751B	2	2	4	1
W-L-800	1	1	3	1
W-L-820B	1	1	3	1
W-L-825A Type I	1	1	3	1
W-L-825A Type II	1	1	3	1
W-L-825A Type III	2	2	4	1
W-O-526	1	1	3	1
W-P-216A	1	1	3	1
W-P-236	2	2	4	1
Wagner 21B brake fluid	3	—	3	4
Water	1	4	1	1
Wemco	1	—	4	1
Whiskey, wines	1	4	1	1
White gas	2	4	4	1
White Liquor	1	—	—	1
White oil	1	1	4	1
White pine oil	2	—	4	1
Wolmar salt	1	—	1	1
Wood alcohol	1	—	1	1
Wood oil	1	1	4	1
Xenon	1	—	1	1
Xylene	4	4	4	1
Xylidine (Di-Methyl Aniline)	3	4	4	4
Xylo	4	—	4	1
Zeolites	1	—	—	1
Zinc Acetate (AQ)	2	4	4	4
Zinc Chloride (AQ)	1	4	1	1
Zinc Chromate	3	4	2	3
Zinc Cyanide	3	4	2	3
Zinc Nitrate	1	4	—	1
Zinc Oxide	1	4	—	1
Zinc Phosphate	1	4	1	1
Zinc salts	1	—	1	1
Zinc Stearate	3	4	2	3
Zinc Sulfate	1	1	4	1
Zinc Sulfide	3	4	2	3
Zirconium Nitrate	1	4	1	1

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