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Zatkoff SEALS & PACKINGS

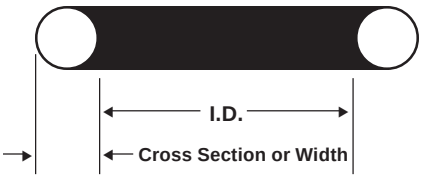
O-Rings: A Definition

For those unfamiliar with sealing technology, we have provided this brief section to assist you in understanding the O-Ring, its basic design principles, and the many sealing functions an O-Ring may be expected to perform when properly specified and installed.

What Is An O-Ring?

An O-Ring is a torus, or a doughnut shaped object, generally made from an elastomer, although such materials as plastics and metal are sometimes used. This section will deal entirely with elastomeric O-Rings used for sealing purposes.

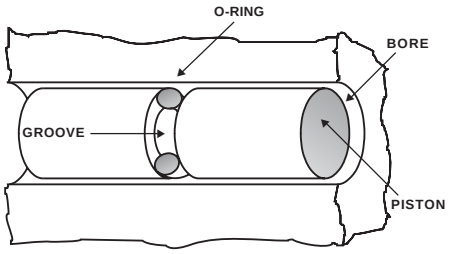
Anatomy of an O-Ring



An Elastomeric O-Ring Section

Basic Principles of the O-Ring Seal

An O-Ring Seal is a means of closing off a passageway and preventing an unwanted loss or transfer of fluid. The classic O-Ring seal consists of two elements, the O-Ring itself, and a properly designed gland or cavity to contain the elastomeric material. The illustration below shows a typical O-Ring seal.



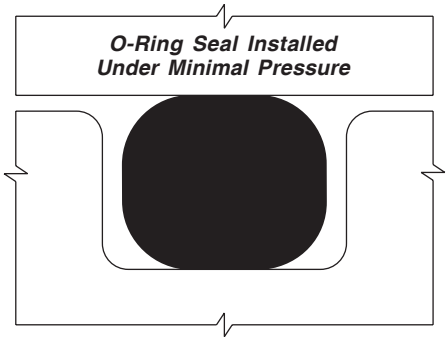
All fluid-tight operations are characterized by the absence of fluid loss or transfer. Prevention of this fluid loss or transfer may be obtained by several methods: welding, soldering, brazing or the yielding of a softer material wholly or partially confined between two mating surfaces. This latter method best describes the design principle behind the operation of an O-Ring Seal.

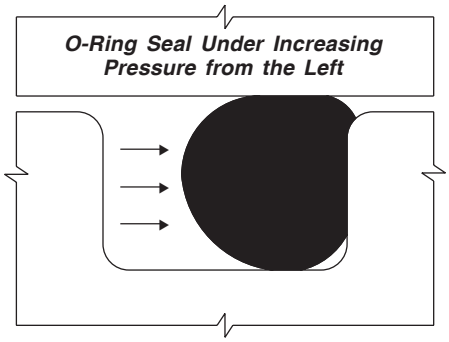
The Function of the O-Ring

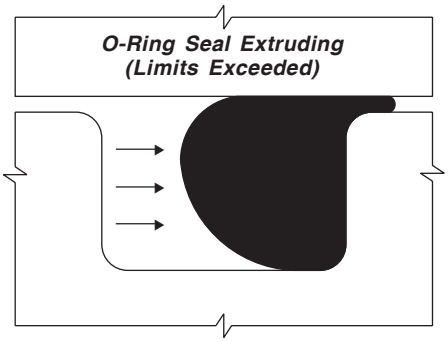
The elastomer is contained in the gland and forced to flow into the surface imperfections of the gland and any clearance available to it, thus creating a condition of "zero" clearance and thus effecting a positive block to the fluid being sealed. The pressure which forces the O-Ring to flow is supplied by mechanical pressure of "squeeze," generated by proper gland design and material selection and by system pressure transmitted by the fluid itself to the seal element. In fact, the classic O-Ring seal may be said to be "pressure assisted" in that the more system pressure, the more effective the seal, until the physical limits of the elastomer are exceeded and the O-Ring begins to extrude into the clearance gap. This condition can usually be avoided by proper gland design, material selection, and the use of back-up rings.

Static & Dynamic O-Ring Sealing Applications

O-Ring seals are generally divided into two main groups. **Static Seals,** in which there is little or no relative motion between the mating surfaces; and **Dynamic Seals,** which must function between surfaces with definite relative motion, such as the seal on the piston of a hydraulic cylinder. Of the two types, dynamic sealing is the more difficult and requires more critical design work and materials selection. The most common type of dynamic motion utilizing an O-Ring sealing system is **Reciprocal Motion,** as found in hydraulic cylinders and the like.







Effects of Cross-Section

Larger Section	Smaller Section
Dynamic Reciprocating Seals	
More Stable	Less Stable
More Friction	Less Friction
All Seals	
Requires Larger Supporting Structure	Requires Less Space – Reduces Weight
Better Compression Set (1)	Poorer Compression Set (1)
Less Volume Swell In Fluid	More Volume Swell In Fluid
Less Resistant To Explosive Decompression	More Resistant To Explosive Decompression
Allows Use of Larger Tolerances While Controlling Squeeze Adequately	Requires Closer Tolerances To Control Squeeze
Less Sensitive To Dirt, Lint, Scratches, etc.	More Likely To Leak Due To Dirt, Lint, Scratches, etc.
Poorer Physical Properties (2)	Better Physical Properties (2)

(1) Particularly true for nitrile and fluorocarbon elastomers. Doubtful for ethylene propylenes and silicones. (2) Applies to tensile and elongation of nitriles, elongation of fluorocarbons.

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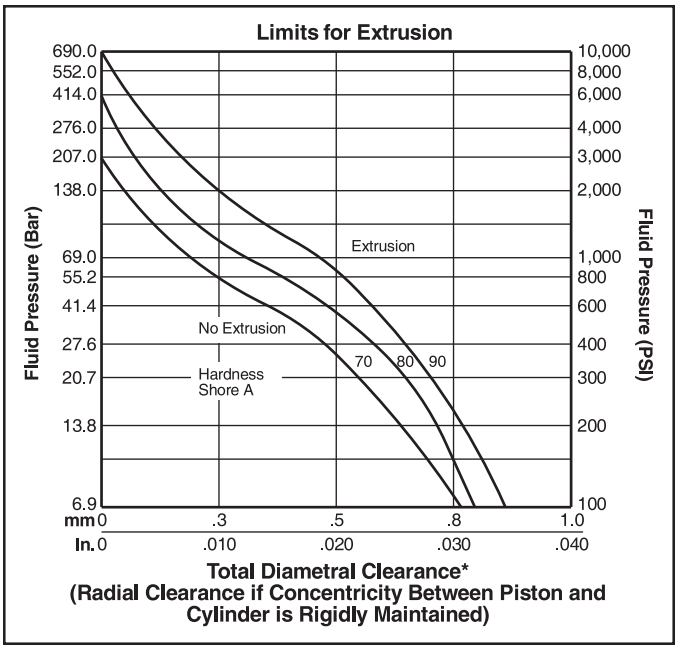
Figure 1: Limits for Extrusion Based on Original Data



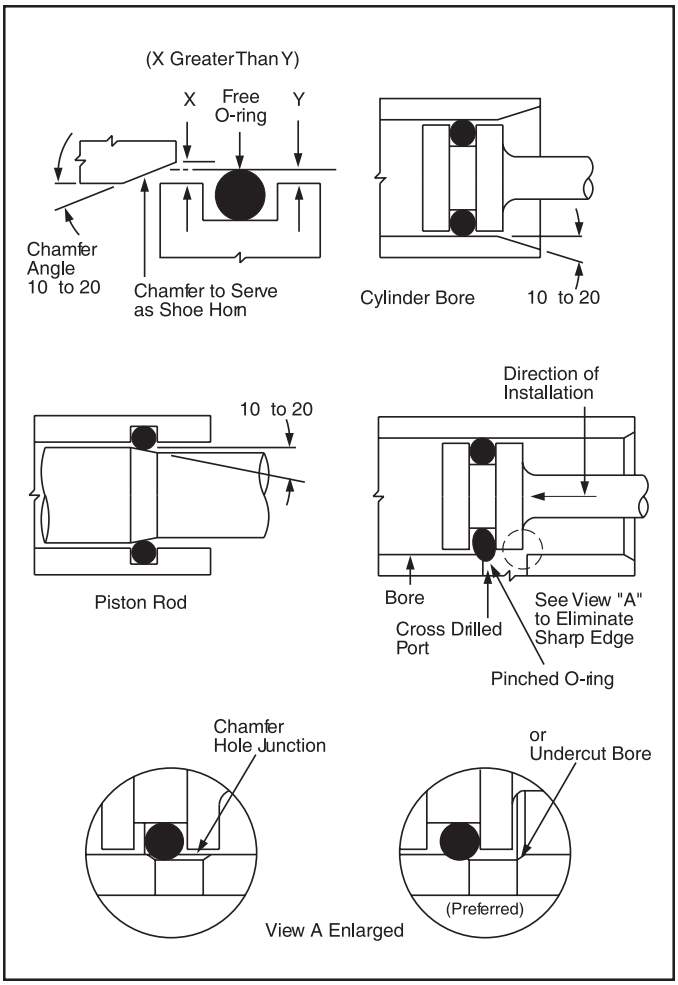
* Reduce the clearance shown by 50% when using silicone or fluorosilicone elastomers.

Assembly

Assembly must be made with care so that the O-Ring is properly placed in the groove and it is not damaged as the gland is closed. Some of the more important design features to insure this are:

1. ID stretch as installed in groove not more than 5% because more stretch will shorten the life of most O-Ring materials. Also, see Figure 3 for the flattening effect produced by stretch.
2. ID expansion to reach groove (during assembly) should not exceed 100%. For very small diameter O-Rings, it may be necessary to exceed this. If so, one should allow sufficient time for the O-Ring to return to its normal diameter before closing the gland.
3. O-Ring should not be twisted. Twist during installation will readily occur with O-Rings having a large ratio of ID to cross-section diameter.
4. O-Rings should never be forced over sharp corners, threads, keyways, slots, splines, ports or other sharp edges. If impossible to avoid by part design, then thimbles, supports or other arrangements must be used. See Figure 2.
5. Closure of the gland must not pinch the O-Ring at the groove corners.
6. Gland closure should be accomplished by straight longitudinal movement – rotary or oscillatory motion is undesirable since it may cause bunching, or cut the seal.

Figure 2: Proper Designs for Installation of O-Rings



Stretch

When an O-Ring is stretched, its cross-section is reduced and flattened. When the inside diameter is stretched more than two or three percent, the gland depth must be reduced to retain the necessary squeeze on the reduced and flattened section. The “observed” curve in Figure 3 indicates how much the compression diameter is reduced. The necessary percent of squeeze should be applied to this corrected compression diameter, reducing the gland depth below the dimensions shown in the design charts.

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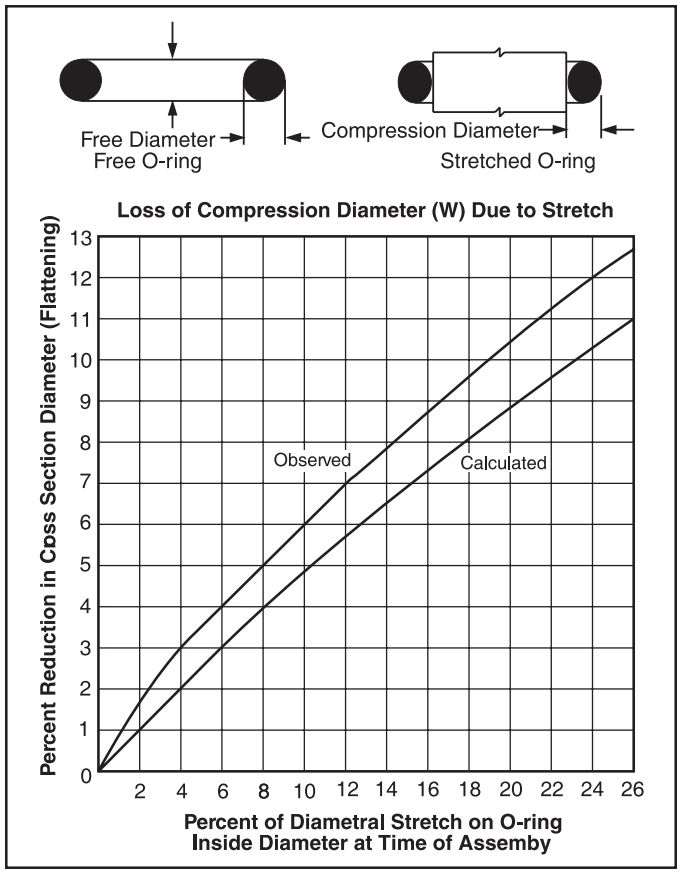
O-Rings: A Definition – *continued*

Figure 3: Loss of Compression Diameter (W) Due to Stretch



The "observed" curve is reproduced by courtesy of the Research Laboratories of General Motors Corporation at the General Motors Technical Center in Warren, Michigan. This curve is based on a statistical analysis of a much larger volume of experimental data than has been available previously.

In the stretched condition, an O-Ring cross section is no longer circular. It is often necessary to compensate for the loss in squeeze resulting from the reduced "compression diameter." Dimensional changes in the "free diameter" do not affect the seal.

Empirical formulas for observed curve:

0 to 3% Inside Dia. Stretch: $Y = -0.005 + 1.19X - 0.19X^2 - 0.001X^3 + 0.008X^4$

3 to 25% Inside Dia. Stretch: $Y = .56 + .59X - .0046X^2$

Where X = percent stretch on inside diameter (i.e. for 5% stretch, X = 5)

Y = percent reduction in cross section diameter.

The calculated curve is based on the assumption that the O-Ring section remains round and the volume does not change after stretching.

$$\text{Formula: } Y = 100\left(1 - \frac{10}{\sqrt{100 + X}}\right)$$

Extra stretch may be necessary when a non-standard bore or rod diameter is encountered. In male gland (piston type) assemblies of large diameter, the recommended stretch is so slight that the O-Ring may simply sag out of the groove. There is then the danger of pinching if the O-Ring enters the bore "blind," i.e. in a location where the seal cannot be watched and manually guided into the bore. For large diameter assemblies of this kind, it is well to use an O-Ring one size smaller than indicated, but then the gland depth must be reduced as indicated above because the stretch may approach five percent.

An assembled stretch greater than five percent is not recommended because the internal stress on the O-Ring causes more rapid aging. Over five percent stretch may sometimes be used, however, if a shorter useful life is acceptable.

Of the commonly used O-Ring seal elastomers, the reduction in useful life is probably greatest with nitrile materials. Therefore, where high stretch is necessary, it is best to use ethylene propylene, fluorocarbon, polyurethane or neoprene, whichever material has the necessary resistance to the temperatures and fluids involved.

O-Ring Compression Force

The force required to compress each linear inch of an O-ring seal depends principally on the shore hardness of the O-Ring, its cross-section, and the amount of compression desired. Even if all these factors are the same, the compressive force per linear inch for two rings will still vary if the rings are made from different compounds or if their inside diameters are different. The anticipated load for a given installation is not fixed, but is a range of values. The values obtained from a large number of tests are expressed in the bar charts of Figures 4 through 8. If the hardness of the compound is known quite accurately, the table for O-Ring compression force, Table 1 may be used to determine which portion of the bar is most likely to apply.

Table 1: O-Ring Compression Force

DUROMETER RANGE	DIAMETER	COMPRESSION LOAD
Less than nominal	Less than 25.4 mm (1")	Middle third of range
Less than nominal	Over 25.4 mm (1")	Lower half of range
Over nominal	Less than 25.4 mm (1")	Upper third of range
Over nominal	Over 25.4 mm (1")	Upper half of range

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Figure 4: .070 Cross-Section

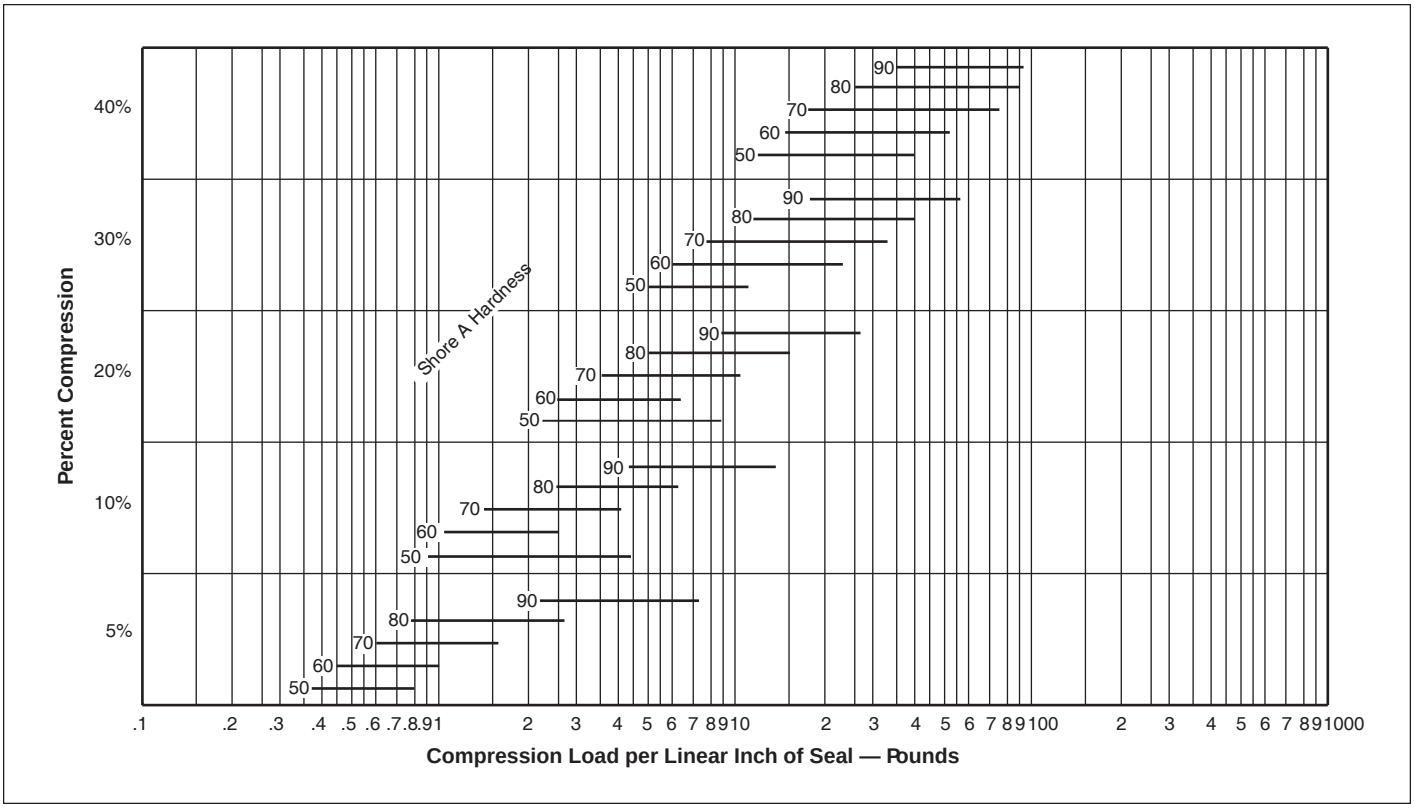

Figure 5: .103 Cross-Section

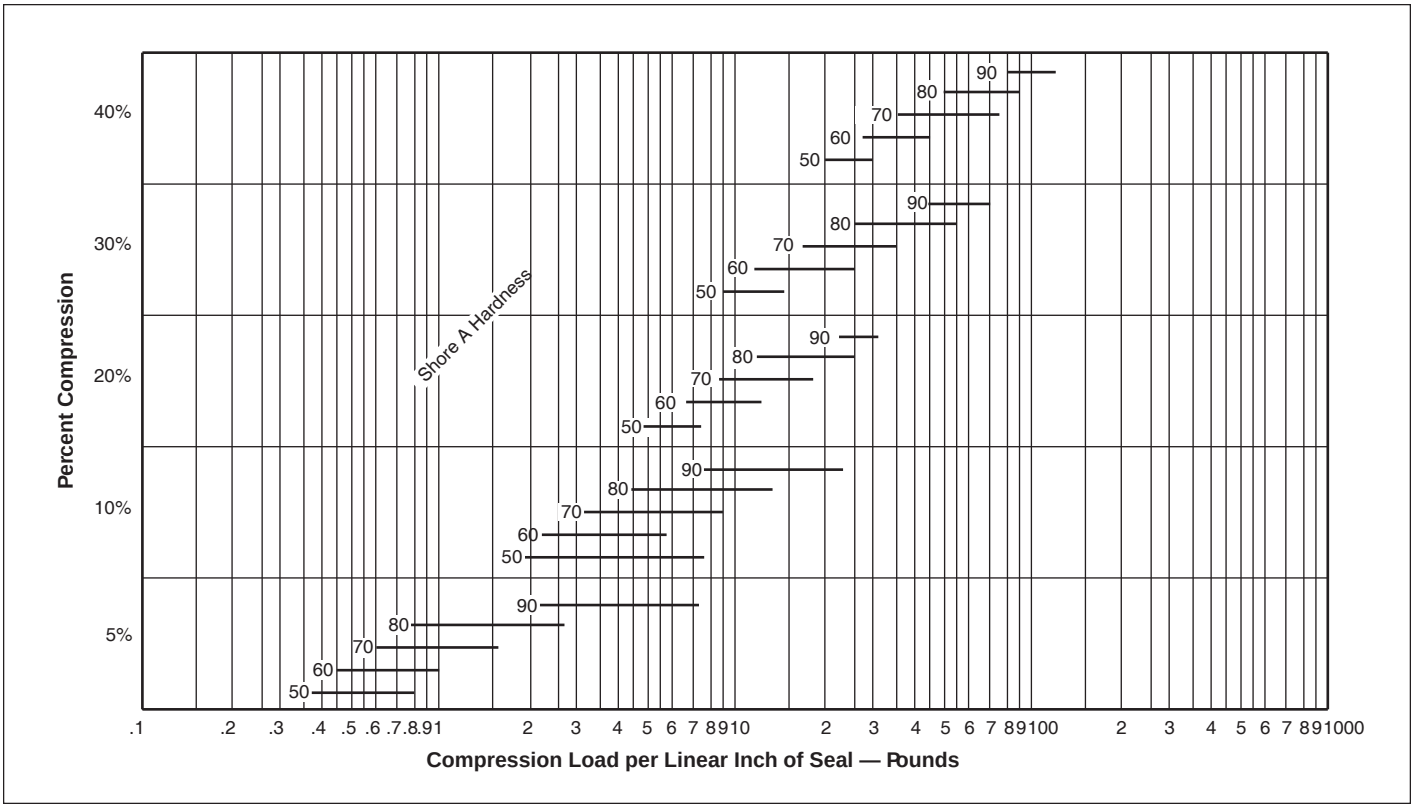

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Figure 6: .139 Cross-Section

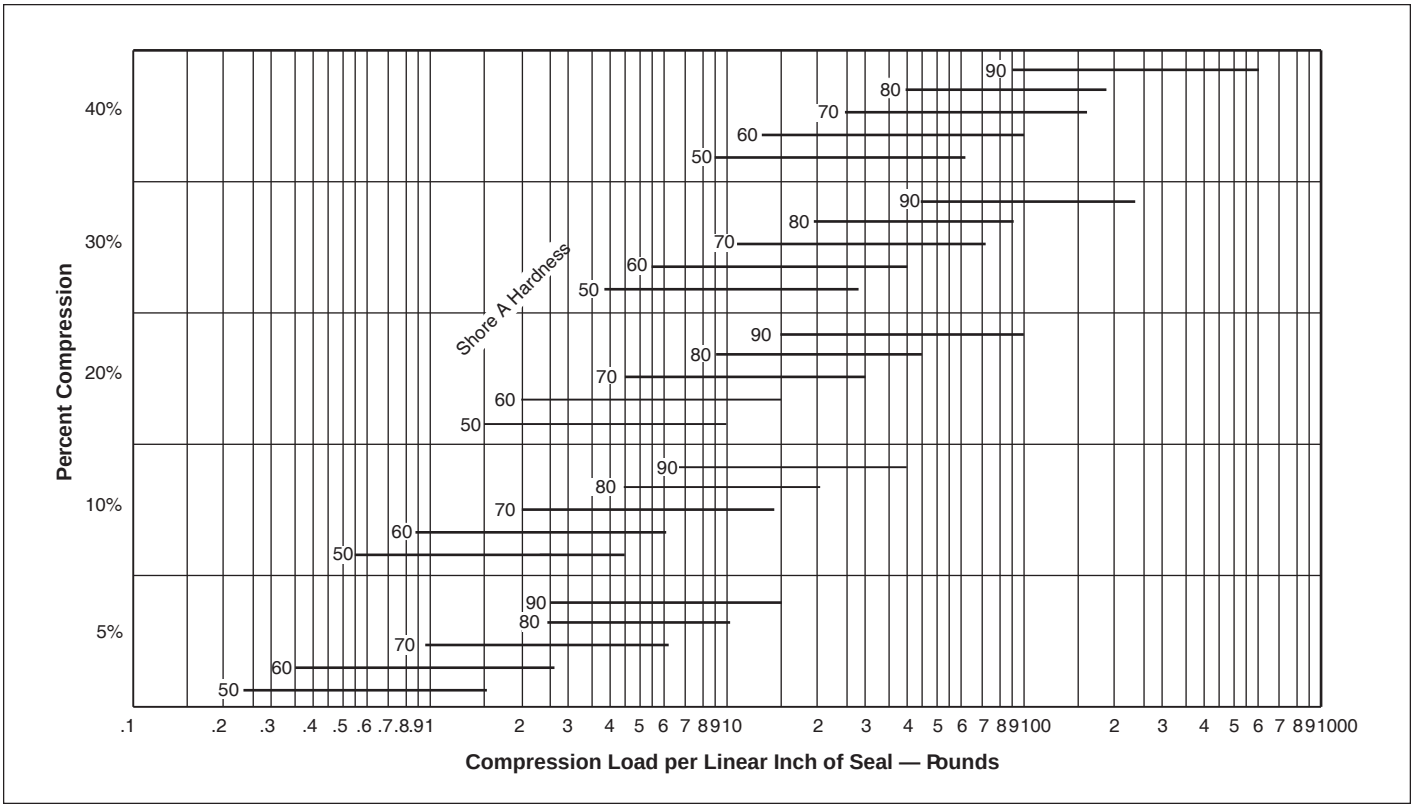

Figure 7: .210 Cross-Section

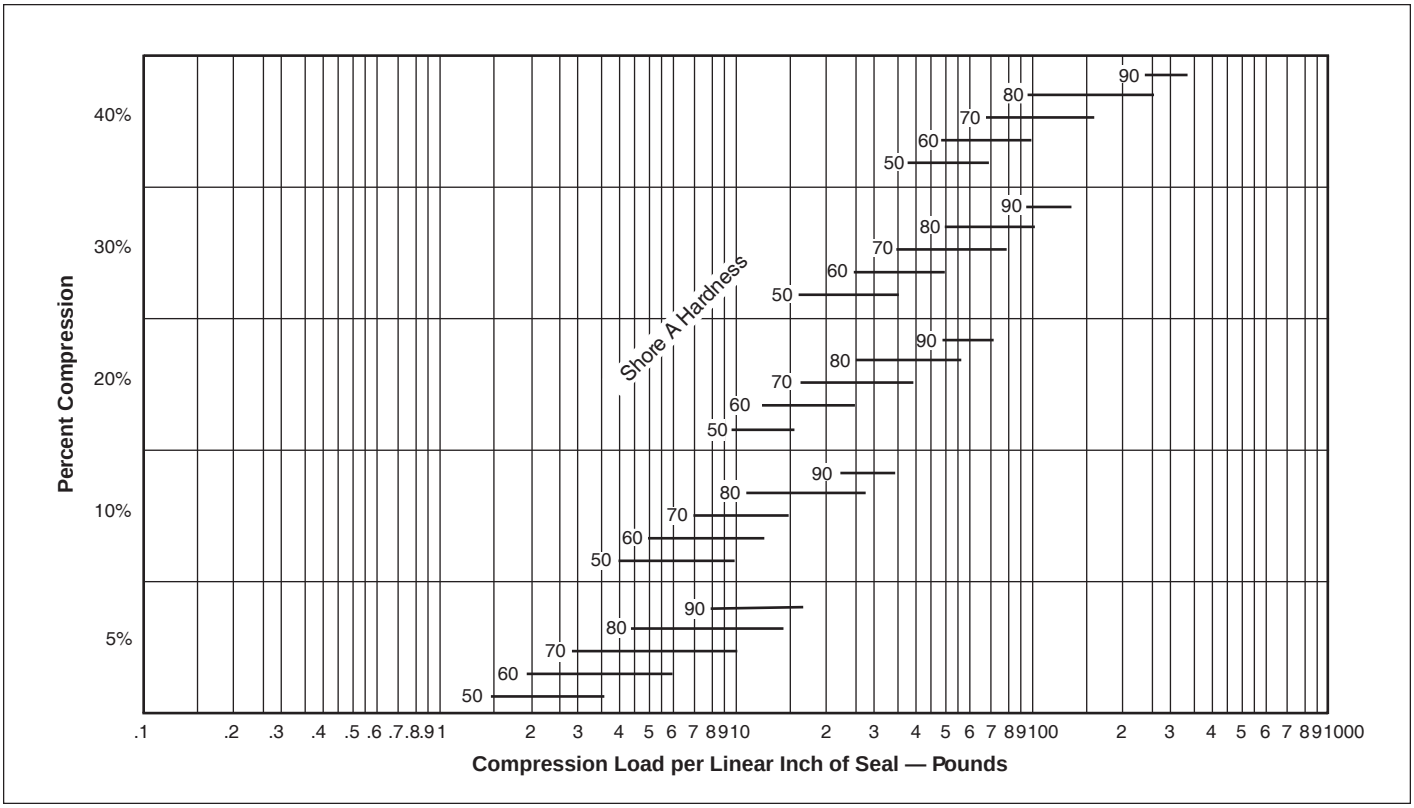

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Figure 8: .275 Cross-Section

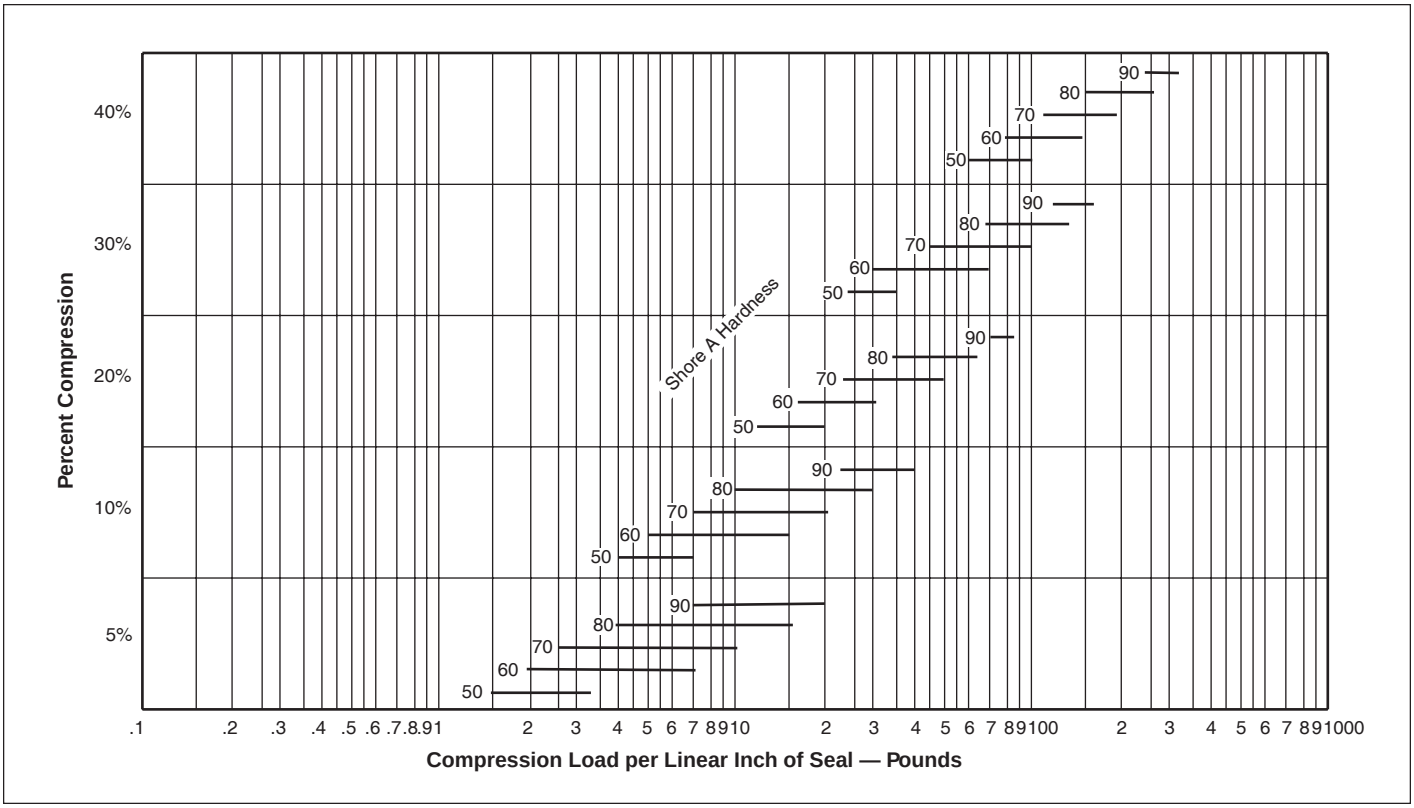

Table 2: Comparison of Seal Types

Type	Applications		Periodic Adjustment Required	Moving Friction	Tolerances Required (Moving Seals)	Gland Adapters Required	Space Require-ments
	Static	Moving					
O-Ring	X	X	No	Medium	Close	No	Small
T-Seal	X	X	No	Medium	Fairly Close	No	Small
U-Packing	—	X	No	Low	Close	No	Small
V-Packing	—	X	Yes	Medium	Fairly Close	Yes	Large
Cup Type Packing	—	X	No	Medium	Close	Yes	Medium
Flat Gasket	X	—	Yes	—	—	No	Large
Compression or Jam Packing	X	X	Yes	High	Fairly Close	Yes	Large

Figure 9: Temperature Range for Common Elastomeric Materials

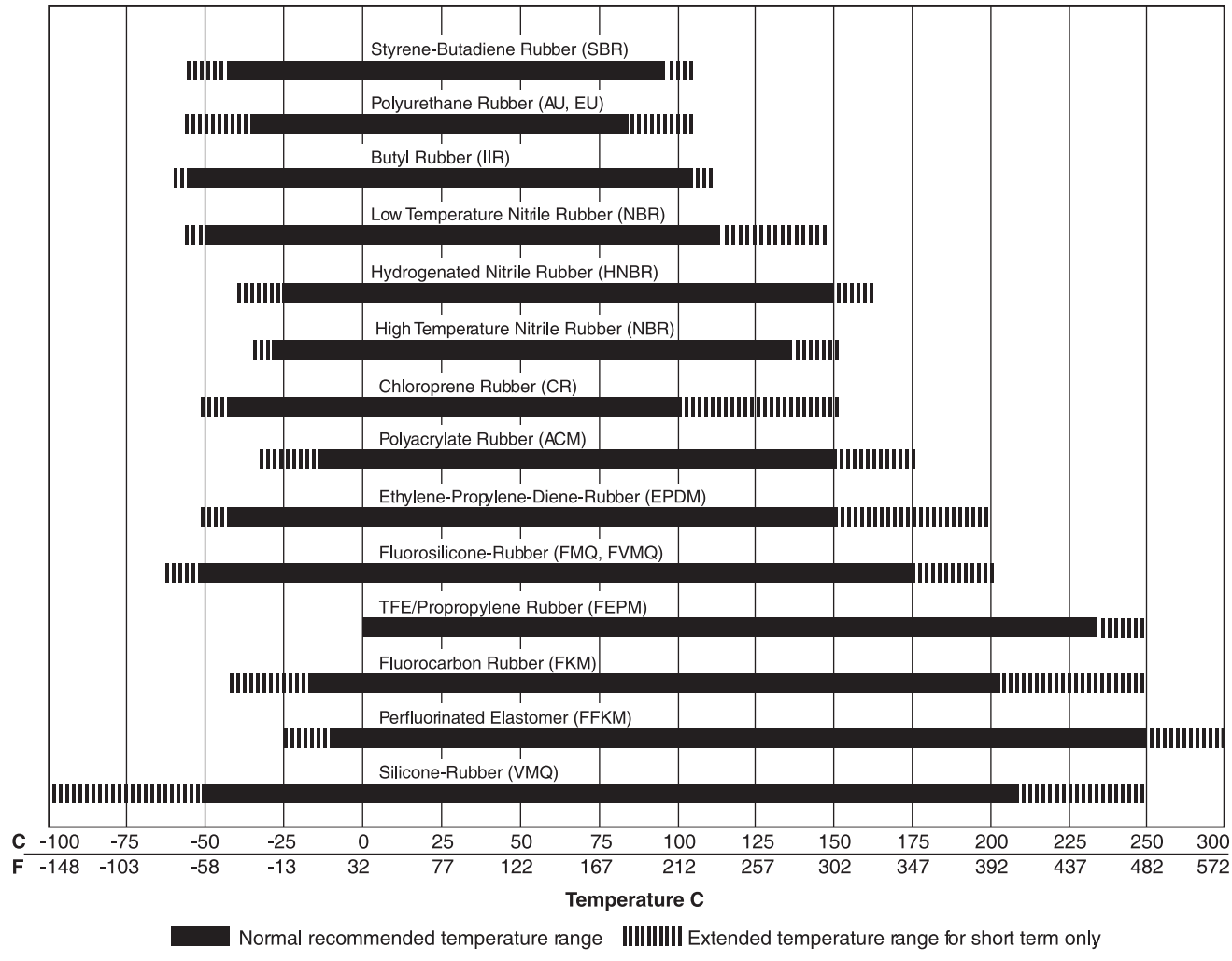

Table 3: Comparison of Elastomers in a Compatible Contact Medium and Maximum Allowable Temperatures

COMPOUND DIN/ISO 1629	LUBRICATION WITH MINERAL OIL BASE	WATER	AIR
NBR	110°C (230°F)	70°C (158°F)	90°C (194°F)
High Temperature NBR	120°C (248°F)	100°C (212°F)	100°C (212°F)
FKM	200°C (392°F)[1)]	120°C (248°F)[2)]	200°C (392°F)
EPDM	not compatible	150°C (302°F) 200°C (392°F)[5)]	150°C (302°F)
VMQ	150°C (302°F)[1)]	100°C (212°F)	210°C (410°F)
FMQ	175°C (347°F)[1)]	100°C (212°F)	175°C (347°F)
ACM	150°C (302°F)[1)]	—[3)]	150°C (302°F)
CR	100°C (212°F)	80°C (176°F)[4)]	90°C (194°F)

1) At these temperatures lubricants degrade after a short time.
2) Special compound.
3) High swelling at room temperature, hydrolysis at high temperatures.
4) Medium to high swelling according to temperature.
5) In water/steam.

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O-Rings: A Definition – *continued*

Original Physical Properties

Original Physical Properties (before exposure to service conditions) are those measurable attributes of an elastomer formulation which define certain physical parameters used in determining the suitability of a given elastomer material for a given class of service. Certain of these properties are also used in quality assurance testing to maintain batch control and assure consistency between individual manufacturing lots of compound. Original Physical Properties are also used in limiting/delimiting rubber specifications. These properties are:

Durometer

Durometer or Hardness is measured in points with a Shore A instrument. Determine the durometer best suited for the application and round off (50, 65, 70, 85). A standard ±5 point tolerance is established to allow the vendor a realistic working range and permit normal variations experienced in reading durometer.

Tensile Strength

Determine the minimum tensile strength necessary for the application. Always take into consideration the inherent strength of the elastomers most likely to be used to meet the specification (most silicones have tensile strengths in the range of 34.5 to 62.1 Bar (500 to 900 PSI); therefore, it would be foolhardy to specify a minimum tensile strength requirement of 138 Bar (2,000 PSI) for a silicone material).

Once the minimum tensile strength has been set, multiply it by 1.20 (for example: 69 Bar x 1.20 = 82.8 Bar (1,000 PSI x 1.20 = 1200 PSI)). This is the minimum limit set for tensile strength in the qualification section. It provides for the normal tensile strength variation of ±15% experienced between production batches of a compound.

Elongation

Investigate and determine the maximum amount of stretch a seal must undergo for assembly in the application. Multiply this figure by 1.25 to allow a safety factor and to provide for normal production variation of ±20%.

Modulus

Choose a minimum modulus that will assure a good state of cure, good extrusion resistance, and good recovery from peak loads. Keep in mind the original tensile and elongation figures established in (b.) and (c.). Modulus is directly related to these two properties.

Specific Gravity

A value for specific gravity should not be set in the qualification section of the specification but the value should be reported “as determined.” This value will then be used in the control section.

Resistance To Fluid

The chemical effect of the fluid on the seal is of prime importance. The fluid must not alter the operational characteristics or reduce the life expectancy of the seal significantly. Excessive chemical deterioration of the seal must be avoided. It is easy, however, to be misled on this point. A significant amount of volume shrinkage usually results in premature leakage of any O-Ring seal, whether static or dynamic. On the other hand, a compound that swells excessively in a fluid, or develops a large increase or decrease in hardness, tensile strength, or elongation, will often continue to serve well for a long time as a static seal in spite of such undesirable conditions.

Shelf Life

Specification MIL-Std-1523A has historically been the age control document for O-Rings. It has been cancelled and replaced by ARP 5316.

Table 4: Shelf Life

DESCRIPTION	POLYMER	SHELF LIFE YEARS
CHLOROPRENE RUBBER (NEOPRENE)	CR	15
ACRYLONITIRLE BUTADIENE RUBBER (BUNA-N)	NBR	15
FLUOROCARBON RUBBER	FKM	UNLIMITED
BUTYL RUBBER	IIR	UNLIMITED
ETHYLENE PROPYLENE RUBBER	EPDM	UNLIMITED
SILICONE RUBBER	Q	UNLIMITED
SILICONE RUBBER	VMQ	UNLIMITED
FLUOROSILICONE RUBBER	FVMQ	UNLIMITED
SILICONE RUBBER	PVMQ	UNLIMITED
TETRAFLUOROETHYLENE/PROPYLENE RUBBER	FEPM	UNLIMITED
PERFLUOROELASTOMER	FFKM	UNLIMITED
SILICONE RUBBER	VSI	UNLIMITED
CHLOROSULFONATED POLYETHLYENE RUBBER	CSM	UNLIMITED
FLUOROCARBON RUBBER	KM	UNLIMITED
POLYURETHANE	AU	5
POLYURETHANE	EU	5

***All Elastomers have unlimited shelf life except:**
Nitriles have 15 years
Urethanes have 5 years

Field experience has demonstrated that the storage conditions are much more important in determining the useful life of elastomeric seals than is time.

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Basic O-Ring Elastomers

Following are brief descriptions of commonly used O-Ring elastomers. There are, of course, many other specialized polymers, and Parker has developed formulations on most of them. The compounds listed herein however, account for well over 98% of all O-Ring production.

Acrylonitrile-Butadiene (NBR)

Nitrile rubber (NBR) is the general term for acrylonitrile butadiene terpolymer. The acrylonitrile content of nitrile sealing compounds varies considerably (18 to 50%) and influences the physical properties of the finished material. The higher the acrylonitrile content, the better the resistance to oil and fuel. At the same time, elasticity and resistance to compression set is adversely affected. In view of these opposing realities, a compromise is often drawn and a medium acrylonitrile content is selected. NBR has good mechanical properties when compared with other elastomers and high wear resistance. NBR is not resistant to weathering and ozone.

Heat Resistance:
- Up to 100°C (212°F) with shorter life at 121°C (250°F).

Cold Flexibility:
- Depending on individual compound, between -34°C (-30°F) and -57°C (-70°F).

Chemical Resistance:
- Aliphatic hydrocarbons (propane, butane, petroleum oil, mineral oil and grease, diesel fuel, fuel oils) vegetable and mineral oils and greases.
- HFA, HFB and HFC fluids.
- Dilute acids, alkali and salt solutions at low temperatures.
- Water (special compounds up to 100°C (212°F).

Not Compatible With:
- Fuels of high aromatic content (for flex fuels a special compound must be used).
- Aromatic hydrocarbons (benzene).
- Chlorinated hydrocarbons (trichlorethylene).
- Polar solvents (ketone, acetone, acetic acid, ethylene-ester).
- Strong acids.
- Brake fluid with glycol base.
- Ozone, weather and atmospheric aging.

Carboxylated Nitrile (XNBR)

Carboxylated Nitrile or XNBR is a special type of nitrile polymer that exhibits enhanced tear and abrasion resistance. For this reason, XNBR based materials are often specified for dynamic applications such as rod seals and rod wipers.

Heat Resistance:
- Up to 100°C (212°F) with shorter life at 121°C (250°F).

Cold Flexibility:
- Depending on individual compound, between -18°C (0°F) and -48°C (-55°F).

Chemical Resistance:
- Aliphatic hydrocarbons (propane, butane, petroleum oil, mineral oil and grease, Diesel fuel, fuel oils) vegetable and mineral oils and greases.
- HFA, HFB and HFC fluids.
- Many diluted acids, alkali and salt solutions at low temperatures.
- Water (special compounds up to 100°C (212°F).

Not Compatible With:
- Fuels of high aromatic content (for flex fuels a special compound must be used).
- Aromatic hydrocarbons (benzene).
- Chlorinated hydrocarbons (trichlorethylene).
- Polar solvents (ketone, acetone, acetic acid, ethylene-ester).
- Strong acids.
- Brake fluid with glycol base.
- Ozone, weather and atmospheric aging.

Ethylene Acrylate (AEM)

Ethylene acrylate is a mixed polymer of ethylene and methyl acrylate with the addition of a small amount of carboxylated curing monomer. Ethylene acrylate rubber is not to be confused with ethyl acrylate rubber (ACM).

Heat Resistance:
- Up to 149°C (300°F) with shorter life up to 163°C (325°F).

Cold Flexibility:
- Between -29°C and -40°C (-20°F and -40°F).

Chemical Resistance:
- Ethylene acrylate has high resistance to ozone and oxygen attack. Compatibility with mineral oil is not as good as with ACM compounds.

Ethylene Propylene Rubber (EPM, EPDM)

EPM is a copolymer of ethylene and propylene. Ethylene-propylene-diene rubber (EPDM) is produced using a third monomer and is particularly useful when sealing phosphate-ester hydraulic fluids and in brake systems that use fluids having a glycol base.

Heat Resistance:
- Up to 121°C (250°F) (max. 204°C (400°F) in water and/or steam.

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Cold Flexibility:
- Down to approximately -57°C (-70°F).

Chemical Resistance:
- Hot water and steam up to 149°C (300°F) with special compounds up to 204°C (400°F).
- Brake fluids on glycol base up to 149°C (+300°F).
- Many organic and inorganic acids.
- Cleaning agents, soda and potassium alkalis.
- Hydraulic fluids based on phosphate-ester (HFD-R).
- Silicone oil and grease.
- Many polar solvents (alcohols, ketones, esters).
- Skydrol 500 and 7000.
- Ozone, aging and weather resistant.

Not Compatible With:
- Mineral oil products (oil, greases and fuels).

Butyl Rubber (IIR)

Butyl (isobutylene, isoprene rubber, IIR) is produced by many companies in different types and varies widely in isoprene content. Isoprene is necessary for proper vulcanization. Butyl has a very low permeability rate and good electrical properties.

Heat Resistance:
- Up to approximately 121°C (250°F).

Cold Flexibility:
- Down to approximately -59°C (-75°F).

Chemical Resistance:
- Hot water and steam up to 121°C (250°F).
- Brake fluids with glycol base.
- Many acids (see Fluid Compatibility Tables).
- Salt solutions.
- Polar solvents, eg alcohols, ketones and esters.
- Hydraulic fluids based on poly-glycol (HFC fluids) and phosphate-ester bases (HFD-R fluids).
- Silicone oil and grease.
- Skydrol 500 and 7000.
- Ozone, aging and weather resistant.

Not Compatible With:
- Mineral oil and grease.
- Fuels.
- Chlorinated hydrocarbons.

Butadiene Rubber (BR)

Polybutadiene (BR) is mostly used in combination with other rubbers to improve cold flexibility and wear resistance. BR is primarily used in the tire industry, for some drive belts and conveyor belts and does not lend itself as a sealing compound.

Chlorobutyl Rubber (CIIR)

Chlorobutyl (CIIR) is produced by chlorinating butyl polymer. Its chloride content is approximately 1.1% to 1.3%. Apart from the properties of butyl rubber (IIR), chlorobutyl (CIIR) shows improved compression set properties and can be compounded with other materials.

Chloroprene Rubber (CR)

Chloroprene was the first synthetic rubber and exhibits generally good ozone, aging and chemical resistance. It has good mechanical properties over a wide temperature range.

Heat Resistance:
- Up to approximately 121°C (250°F).

Cold Flexibility:
- Down to approximately -40°C (-40°F).

Chemical Resistance:
- Paraffin base mineral oil with low DPI e.g. ASTM oil No. 1.
- Silicone oil and grease.
- Water and water solvents at low temperatures.
- Refrigerants.
- Ammonia.
- Carbon dioxide.
- Improved ozone, weathering and aging resistance compared with NBR.

Limited Compatibility:
- Naphthalene based mineral oil (ASTM oils No. 2 & No. 3).
- Low molecular aliphatic hydrocarbons (propane, butane, fuel).

Not Compatible With:
- Aromatic hydrocarbons (benzene).
- Chlorinated hydrocarbons (trichlorethylene).
- Polar solvents (ketones, esters, ethers, acetones).

Chlorosulfonated Polyethylene (CSM)

The ethylene monomer contains additional chlorine and sulfur groups. Chlorine gives the material resistance to flame and mineral oil and also improves the cold flexibility.

Heat Resistance:
- Up to 121°C (250°F).

Cold Flexibility:
- Down to approximately -29°C (-20°F).

Chemical Resistance:
- Many acids.
- Many oxidizing media.
- Silicone oil and grease.
- Water and water solvents.
- Ozone, aging and weathering resistance.

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Basic O-Ring Elastomers – *continued*

Limited Compatibility:
- Low molecular aliphatic hydrocarbons (propane, butane, fuel).
- Mineral oil and grease.
- Limited swelling in aliphatic oils (ASTM oil No. 1).
- High swelling in naphtheme and aromatic base oils (ASTM oils No. 2 & No. 3).
- Polar solvents (acetone, methyl ether, ketone, ethyl acetate, diathyl ether, dioxane).
- Skydrol 500 and 7000.

Not Compatible With:
- Aromatic hydrocarbons (benzene).
- Chlorinated hydrocarbons (trichlorethylene).

Epichlorohydrin (CO, ECO)

Epichlorohydrin is available in two types: the homopolymer (CO) and the copolymer (ECO). Both CO and ECO have good resistance to mineral oils, fuels and ozone. The high temperature resistance is good. Compression set and the tendency to corrode metal sealing faces increase at 150°C (302°F). ECO has a good cold flexibility. CO has a high resistance to gas permeability.

Heat Resistance:
- Up to approximately 135°C (275°F).

Cold Flexibility:
- Down to approximately -40°C (-40°F).

Chemical Resistance:
- Mineral oil and grease.
- Aliphatic hydrocarbons (propane, butane, fuel).
- Silicone oil and grease.
- Water at room temperature.
- Ozone, aging and weather resistant.

Not Compatible With:
- Aromatic and chlorinated hydrocarbons.
- Ketones and esters.
- Non-flammable hydraulic fluids in groups HFD-R & HFD-S.
- Brake fluids with glycol base.

Fluorocarbon (FKM)

Fluorocarbon (FKM) has excellent resistance to high temperatures, ozone, oxygen, mineral oil, synthetic hydraulic fluids, fuels, aromatics and many organic solvents and chemicals. Low temperature resistance is normally not favorable and for static applications is limited to approximately -26°C (-15°F) although in certain situations it is suitable down to -40°C (-40°F). Under dynamic conditions, the lowest temperature expected is between -15°C and -18°C (5°F and 0°F). Gas permeability is very low and similar to that of butyl rubber. Special FKM compounds exhibit a higher resistance to acids, fuels, water and steam.

Heat Resistance:
- Up to 204°C (400°F) and higher temperatures with shorter life expectancy.

Cold Flexibility:
- Down to -26°C (-15°F) (some to -40°C (-40°F).

Chemical Resistance:
- Mineral oil and grease, low swelling in ASTM oils No. 1 through No. 3.
- Non-flammable hydraulic fuels in the group HFD.
- Silicone oil and grease.
- Mineral and vegetable oil and grease.
- Aliphatic hydrocarbons (fuel, butane, propane, natural gas).
- Aromatic hydrocarbons (benzene, toluene).
- Chlorinated hydrocarbons (trichlorethylene and carbon tetrachloride).
- Fuels, also fuels with methanol content.
- High vacuum.
- Very good ozone, weather and aging resistance.

Fluorosilicone (FVMQ)

FVMQ contains trifluoropropyl groups next to the methyl groups. The mechanical and physical properties are very similar to VMQ. However, FVMQ offers improved fuel and mineral oil resistance but poor hot air resistance when compared with VMQ.

Heat Resistance:
- Up to 177°C (350°F) max.

Cold Flexibility:
- Down to approximately -73°C (-100°F).

Chemical Resistance:
- As for silicone (VMQ), additionally compatible with aromatic mineral oils (ASTM oil No. 3).
- Fuels.
- Low molecular weight aromatic hydrocarbons (benzene, toluene).

Hydrogenated Nitrile (HNBR)

Hydrogenated nitrile is a synthetic polymer that results from the hydrogenation of nitrile rubber (NBR). In this process the molecular “double bonds” in the NBR primary polymer chain undergo a hydrogenation process and therefore the term “hydrogenated nitrile” (HNBR). The allowable temperature range extends to 149°C (300°F) with short periods at higher temperature possible. By following design guidelines effective sealing can be achieved at -32°C (-25°F) for static applications. For dynamic applications however, operating temperatures are limited to above -23°C (-10°F).

HNBR compounds posses superior mechanical characteristics, particularly their high strength. For sealing applications up to approximately 159°C (300°F), this is an advantage as it prevents extrusion and wear.

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Chemical Resistance:
- Aliphatic hydrocarbons.
- Vegetable and animal fats and oils.
- HFA, HFB and HFC fluids.
- Dilute acids, bases and salt solutions at moderate temperatures.
- Water and steam up to 149°C (300°F).
- Ozone, aging and weathering.

Not Compatible With:
- Chlorinated hydrocarbons.
- Polar solvents (ketone and ester).
- Strong acids.

Perfluoroelastomer (FFKM)

The name "perfluoroelastomer" is somewhat misleading. An actual perfluorinated material with a high molecular weight is Polytetrafluoroethylene or PTFE (sold under the I.E. DuPont tradename Teflon®) which has the chemical formula "(CF_2)". The molecular carbon chain is shielded by the chemical inertness of the large bonded fluorine atoms. Perfluoroelastomer is produced by the copolymerization of tetrafluoroethylene (TFE) and a perfluorinated ether, e.g. perfluoromethylvinylether (PMVE).

The differing resistance to volume swell of the different perfluoroelastomers is connected to the perfluorinated ether element, where the side chain can consist of up to four perfluorinated carbon atoms. The extraordinary chemical resistance is partly due to the fluorine atoms shielding the carbon chain, and partially due to the vulcanization system. Parker Seal, in cooperation with a leading polymer manufacturer, has developed several such perfluorinated elastomer materials.

Parker Parofluor™ materials are being developed and manufactured in-house at Parker. In contrast to other perfluoroelastomer suppliers, where a polymer manufacturer will either produce and deliver the ready mixed compound or even supply the final vulcanized part, Parker will process the raw polymer and then manufacture the desired component. This allows the individual specifications of the project to be jointly developed with the customer.

Heat Resistance:
- 232°C to 315°C (450°F to 600°F) depending on compound.

Cold Flexibility:
- -18°C to -26°C (0°F to -15°F).

Chemical Resistance:
- Aliphatic and aromatic hydrocarbons.
- Chlorinated hydrocarbons.
- Polar solvents (acetone, methylethylketone, ethylacetate, diethylethan and dioxane).
- Inorganic and organic acids.
- Water and steam.
- High vacuum with minimal loss in weight.

Not Compatible With:
- Fluorine type media (Refrigerants R11, 12, 13, 113, 114 etc).

Polyacrylate (ACM)

ACM or simply acrylate rubber consists of a base and a curing monomer. Ethyl acrylate rubber has a good resistance to mineral oil, oxygen and ozone also at high temperatures. The water compatibility and cold flexibility of ACM are significantly worse than with NBR.

Heat Resistance:
- Shortened lifetime up to approximately 177°C (350°F).

Cold Flexibility:
- Down to approximately -21°C (-5°F).

Chemical Resistance:
- Mineral oil (engine, gear box, ATF oil).
- Ozone, weather and aging resistance.

Not Compatible With:
- Brake fluid on glycol base.
- Aromatic and chlorinated hydrocarbons.
- Hot water, steam.
- Acids, alkalis, amines.

Polyurethane (AU, EU)

One must differentiate between polyester urethane (AU) and polyether urethane (EU). EU type urethanes exhibit better resistance to hydraulic fluids. Polyurethane elastomers, as a class, have excellent wear resistance, high tensile strength and high elasticity in comparison with any other elastomers. Permeability is good and comparable with butyl.

Heat Resistance:
- Up to approximately 82°C (180°F).

Cold Flexibility:
- Down to approximately -40°C (-40°F).

Chemical Resistance:
- Pure aliphatic hydrocarbons (propane, butane, fuel), impurities (moisture, alcohol, acid or alkaline combinations) can cause chemical attack upon polyurethane compounds.
- Mineral oil and grease (some additives can produce chemical attack upon the compound).
- Silicone oil and grease.
- Water up to 50°C (150°F).
- Ozone and aging resistant.

Not Compatible With:
- Ketones, esters, ethers, alcohol, glycol.
- Hot water, steam, alkalis, amines, acid.

Silicone Rubber (Q, MQ, VMQ, PVMQ)

The term silicone covers a large group of materials in which methyl-vinyl-silicone (VMQ) is often the central ingredient. Silicone elastomers as a group have

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Basic O-Ring Elastomers – *continued*

relatively low tensile strength, poor tear and wear resistance. However, they have many useful properties as well. Silicones have good heat resistance up to 232°C (450°F), good cold flexibility down to -59°C (-75°F) and good ozone and weather resistance as well as good insulating and physiologically neutral properties.

Heat Resistance:
- Up to approximately 204°C (400°F) (special compounds up to 232°C) (450°F).

Cold Flexibility:
- Down to approximately -59°C to -54°C (-75°F to -65°F) with special compounds down to -115°C (-175°F).

Chemical Resistance:
- Engine and transmission oil (eg: ASTM oil No. 1).
- Animal and vegetable oil and grease.
- Brake fluid (non-petroleum base).
- Fire-resistant hydraulic fluid, HFD-R and HFD-S.
- High molecular chlorinated aromatic hydrocarbons (including flame-resistant insulators, & coolant for transformers).
- Water up to 100°C (212°F).
- Diluted salt solutions.
- Ozone, aging and weather resistant.

Not Compatible With:
- Superheated water steam over 121°C (250°F).
- Acids and alkalis.
- Low molecular weight chlorinated hydrocarbons (trichlorethylene).
- Aromatic mineral oil.
- Hydrocarbon based fuels.
- Aromatic hydrocarbons (benzene, toluene).

Styrene-Butadiene (SBR)

SBR probably is better known under its old names Buna S or GRS (government rubber styrene). SBR was first produced under government control between 1930 and 1950 as a replacement for natural rubber. The basic monomers are butadiene and styrene, with styrene content approximately 23.5%. About one third of the world output of SBR is used in tire production. SBR seals are mostly used in seals for non-mineral based brake fluid.

Heat Resistance:
- Up to approximately 107°C (225°F).

Cold Flexibility:
- Down to approximately -57°C (-70°F).

Compatible With:
- Water, alcohol, glycol and certain ketones (acetone).
- Brake fluid with non-mineral oil base.
- Silicone oil and grease.
- Diluted water solutions, weak acids.

Not Compatible With:
- Mineral oils.
- Petroleum greases and fuels.
- Aliphatic hydrocarbons like benzene, toluene, xylol.
- Chlorinated hydrocarbons such as chloroform, trichlorethylene, tetrachloride.
- Oxidizing media like nitric acid, chromic acid, hydrogen peroxide, chlorine, bromine.

Tetrofluoroethylene-Propylene (AFLAS™)

This material is a copolymer of TFE and propylene. Its chemical resistance is excellent across a wide range of aggressive media.

Heat Resistance:
- Up to approximately 232°C (450°F).

Cold Flexibility:
- Down to approximately -4°C (25°F).

Compatible With:
- Caustics, Phosphate Esters, Amines, Engine Oils, Steam, Pulp and Paper Liquors.

Not Compatible With:
- Aromatic Fuels, Ketones, Carbon Tetrachloride.

Table 5: The Most Important Types of Synthetic Rubber, Their Groupings & Abbreviations

CHEMICAL NAME	Abbreviation DIN/ISO 1629	Abbreviation ASTM D1418
M-Group (saturated carbon molecules in main macro-molecule chain):		
Polyacrylate Rubber	ACM	ACM
Ethylene Acrylate	—	AEM
Chlorosulfonated Polyethylene Rubber	CSM	CSM
Ethylene Propylene Diene Rubber	EPDM	EPDM
Ethylene Propylene Rubber	EPDM	EPM
Fluorocarbon Rubber	FPM	FKM
Tetrafluorethylene Propylene Copolymer	FEPM	FEPM
Perfluorinated Elastomer	—	FFKM
O-Group (with oxygen molecules in the main macro-molecule chain):		
Epichlorohydrin Rubber	CO	CO
Epichlorohydrin Copolymer Rubber	ECO	ECO
R-Group (unsaturated hydrogen carbon chain):		
Butadiene Rubber	BR	BR
Chloroprene Rubber	CR	CR
Isobutene Isoprene Rubber (Butyl Rubber)	IIR	IIR
Chlorobutyl Rubber	CIIR	CIIR
Isoprene Rubber	IR	IR
Nitrile Butadiene Rubber	NBR	NBR
Styrene Butadiene Rubber	SBR	SBR
Hydrogenated Nitrile	—	HNBR
Carboxylated Nitrile	XNBR	XNBR
Q-Group (with Silicone in the main chain):		
Fluorosilicone Rubber	FMQ	FVMQ
Methyl Phenyl Silicone Rubber	PMQ	PMQ
Methyl Phenyl Vinyl Silicone Rubber	PMVQ	PVMQ
Methyl Silicone Rubber	MQ	MQ
Methyl Vinyl Silicone Rubber	VMQ	VMQ
U-Group (with carbon, oxygen and nitrogen in the main chain):		
Polyester Urethane	AU	AU
Polyether Urethane	EU	EU

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Table 6:
Properties of Commonly Used Elastomers

P - Poor F - Fair G - Good E - Excellent Elastomer Type (Polymer)	Parker Compound Prefix Letter	Abrasion Resistance	Acid Resistance	Chemical Resistance	Cold Resistance	Dynamic Properties	Electrical Properties	Flame Resistance	Heat Resistance	Impermeability	Oil Resistance	Ozone Resistance	Set Resistance	Tear Resistance	Tensile Strength	Water/Steam Resistance	Weather Resistance
AFLAS™ (TFE/Prop)	V	GE	E	E	P	G	E	E	E	G	E	E	G	PF	FG	GE	E
Butadiene	D	E	FG	FG	G	F	G	P	F	F	P	P	G	GE	E	FG	F
Butyl	B	FG	G	E	G	F	G	P	G	E	P	GE	FG	G	G	G	GE
Chlorinated Polyethylene	K	G	F	FG	PF	G	G	GE	G	G	FG	E	F	FG	G	F	E
Chlorosulfonated Polyethylene	H	G	G	E	FG	F	F	G	G	G	F	E	F	G	F	F	E
Epichlorohydrin	Y	G	FG	G	GE	G	F	FG	FG	GE	E	E	PF	G	G	F	E
Ethylene Acrylic	A	F	F	FG	G	F	F	P	E	E	F	E	G	F	G	PF	E
Ethylene Propylene	E	GE	G	E	GE	GE	G	P	E	G	P	E	GE	GE	GE	E	E
Fluorocarbon	V	G	E	E	PF	GE	F	E	E	G	E	E	GE	F	GE	FG	E
Fluorosilicone	L	P	FE	E	GE	P	E	G	E	P	G	E	GE	P	F	F	E
Isoprene	I	E	FG	FG	G	F	G	P	F	F	P	P	G	GE	E	FG	F
Natural Rubber	R	E	FG	FG	G	E	G	P	F	F	P	P	G	GE	E	FG	F
Neoprene	C	G	FG	FG	FG	F	F	G	G	G	FG	GE	F	FG	G	F	E
HNBR	N/K	G	E	FG	G	GE	F	P	E	G	E	G	GE	FG	E	E	G
Nitrile or Buna N	N	G	F	FG	G	GE	F	P	G	G	E	P	GE	FG	GE	FG	F
Perfluorinated Fluoroelastomer	V/FF	P	E	E	PF	F	E	E	E	G	E	E	G	PF	FG	GE	E
Polyacrylate	A	G	P	P	P	F	F	P	E	E	E	E	F	FG	F	P	E
Polysulfide	T	P	P	G	G	F	F	P	P	E	E	E	P	P	F	F	E
Polyurethane	P	E	P	FG	G	E	FG	P	F	G	G	E	F	GE	E	P	E
SBR or Buna S	G	G	F	FG	G	G	G	P	FG	F	P	P	G	FG	GE	FG	F
Silicone	S	P	FG	GE	E	P	E	F	E	P	FG	E	GE	P	P	F	E

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Parker O-Ring Compounds & Specifications

Parker O-Ring Compounds & Fluid Media Tables

It is not our intention to discuss the chemistry of compound formulation here, but rather to direct the user's attention to the extensive fluid media tables contained in this section. By selecting the appropriate fluid medium in the tables, you will also find a suitable Parker O-Ring compound to satisfy your design requirements assuming the temperature of the application is within the service temperature range of the selected material. You will see that these tables are very easy to use. However, in the event that you cannot find a Parker O-Ring compound to suit your precise requirements, please contact your nearest Zatkoff location.

More specific information on many fluids and special environments is available. One final note, whenever possible, try to specify a "standard" Parker compound. These compounds are usually in stock, and will often save you time and money waiting for production of a special compound. You can obtain more information on currently available Parker standard compounds from your nearest Zatkoff location.

Testing Your Compound Selection

We cannot overstate the importance of thorough testing, under actual service conditions, any Parker O-Ring material selected for use with your application. While we do recommend specific O-Ring compounds for use with a particular fluid, there are simply too many variables involved to make such a recommendation absolute. Therefore, it is the customers sole responsibility to perform sufficient testing to insure proper and safe performance of any Parker O-Ring in their application.

Ordering a Parker O-Ring

The Parker compound number is shown in column 2 of the fluid compatibility tables and must be specified along with the Parker part number in order to obtain the correct O-Ring. A complete Parker part number consists of the size number followed by the compound number.

Example: 2-010 N0674-70

A request for this part number would call for an O-Ring with an I.D. of .239 +.005 and a cross-sectional diameter of .070 +.003 manufactured of N0674-70, an industrial grade nitrite elastomer having a durometer hardness of 70 +5 Shore A.

Parker 2-Series and 3-Series are industry standards. Complete dimensional information on the entire Parker 2-Series O-Ring sizes begins on page 1-112 of this manual.

Parker 5-Series O-Rings are non-standard sizes for special applications.

In the event that you specify a military series part number such as AS3582, the listing of the Parker compound number is not necessary as only approved compounds for that series may be used.

Wynn's Numbering System

Parker Hannifin acquired Wynn's International, parent company of Wynn's Precision and Goshen Rubber, in July 2000. As a result, some Wynn's products and materials were folded into the Parker O-Ring Division's offering.

The Wynn's compound numbering system is in the process of being phased out; the old number has been noted in parentheses (XXXXX) whenever applicable.

A Word About Durometer

This is simply a measurement of relative hardness (or softness) of various elastomers. In simple terms, the lower the number, the softer the material. Most O-Rings have a Shore A Durometer of between 60 and 75. For specifications which require increased resistance to compression set and extrusion, Parker O-Rings with Shore A hardness of 90 or higher are available.

How To Order O-Rings & Other Parts Made with Military (MS) or Aerospace (AMS) Specification Material

For O-Rings and other parts that are to be made with military or aerospace specification material, specify the following on the order.

1. **Size:** For O-Rings, specify the Parker size number from size tables of this catalog (example: 2-214).
2. **Material:** Specify the Parker compound number and the specification for the material to be used to make the part (example: N0304-75 or AMS-P-25732C).
3. **Packaging:** Specify the packaging specification if the parts are to be packaged according to a particular specification. If no packaging specification is listed, parts will be bulk packaged.
4. **Documentation:** Specify any conformance documentation that is required. This documentation may be (i) certificate of conformance that material used to make the part meets material requirements of the referenced specification, (ii) certificate showing preproduction control batch information test results, or (iii) certificate showing end product conformance test results.

Parts ordered in this way will be supplied (i) with materials that meet material specifications referenced, (ii) with testing as described in referenced specification, (iii) with dimensions and tolerances set forth in this catalog, and (iv) with bulk packaging, or packaging according to any packaging specifications separately referenced on the order. Althouth testing will be performed, test results or other conformance documentation will not be provided unless requested in writing on the order at the time the order was placed.

Design Considerations

The design charts of page 1-25 through 1-55 provide a reasonable basis for calculating O-Ring seal glands. In each instance, the gland detail is given for each standard O-Ring cross-section (.070", .103", .139", .210", .275"). Suggested surface finishes and formula are also given in the drawings. Although specific O-Ring sizes and accompanying dimensions for rod, piston tube, or plug sizes are not listed, these dimensions can be obtained by referring to the size charts (based on O-Ring mean installed stretch). Bore sizes can be obtained by referring to the suggested diametral clearance gap.

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Table 7: O-Ring Material Offering Guide

Parker O-Ring Compound Numbering Systems

Note: There are two types of nomenclature used to reference Parker O-Ring products. See tables below for description of these types.

TYPE I		
N	**0674**	**-70**
Polymer Code (Single Letter)	Sequence Number (four digits)	Durometer Indicator (two digits)

TYPE II			
A	**A**	**150**	**-70**
Polymer Code (Single Letter)	Special Property Description (Single Letter)	Sequence Number (three digits)	Durometer Indicator (two digits)

Polymer Code

A	Polyacrylate	L	Fluorosilicone
B	Butyl	N	Nitrile (Buna N) and HNBR
C	Neoprene (Chloroprene)	P	Polyurethane
E	Ethylene Propylene	S	Silicone
F	Parofluor Ultra™	V	Fluorocarbon, Aflas®, Hifluor™, Parofluor™
H	Hifluor™		
K	HNBR	Z	Exotic Polymers

Special Property Description		Durometer Indicator (Hardness)		
A	General Purpose	-40	40 ±5	Shore A Durometer
B	Low Compression Set	-45	45 ±5	Shore A Durometer
E	Ethylene Acrylate	-50	50 ±5	Shore A Durometer
F	Fuel Resistant or Fully Fluorinated	-55	55 ±5	Shore A Durometer
		-60	60 ±5	Shore A Durometer
G	Higher Fluorine Content	-65	65 ±5	Shore A Durometer
J	NSF / FDA / WRAS Approvals	-70	70 ±5	Shore A Durometer
		-75	75 ±5	Shore A Durometer
L	Internally Lubed	-80	80 ±5	Shore A Durometer
M	Mil/ AMS Specifications	-85	85 ±5	Shore A Durometer
P	Low Temperature Flexible or (AFLAS®)	-90	90 ±5	Shore A Durometer
		-95	95 ±5	Shore A Durometer
W	Non-Black Compound			
X	Carboxylated			

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
POLYACRYLATE (ACM)			
ACM (acrylic rubber) has good resistance to mineral oil, oxygen and ozone. The water compatibility and cold flexibility of ACM are considerably worse than with NBR.			
A1111-70	Good Low Temp	-40 to 325	BLACK
AA150-70 (12307)	Engines & Transmissions	-5 to 350	BLACK
AA154-75 (12358)	Engines & Transmissions	-5 to 350	BLACK
ETHYLENE ACRYLATE (AEM)			
Ethylene acrylate is a mixed polymer of ethylene, methyl acrylate and a small amount of carboxylated cure-site monomer. Developed as a lower-temperature version of Polyacrylate, but swells slightly more. Polymer is sold under the tradename VAMAC®.			
AE152-70 (12897)	Transmissions	-40 to 325	BLACK
AE153-75 (12917)	Transmissions, Internally Lubed	-40 to 325	BLACK
BUTYL RUBBER (IIR)			
Butyl rubber (isobutylene-isoprene rubber or IIR) has a very low permeability rate and good electrical properties, but poor short-term rebound.			
B0318-70	AMS 3238	-75 to 250	BLACK
B0612-70	Vacuum, General Purpose	-75 to 250	BLACK
B1167-80	Vacuum, General Purpose	-75 to 250	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

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Zatkoff SEALS & PACKINGS

Table 7 continued: O-Ring Material Offering Guide

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
POLYCHLOROPRENE RUBBER (CR) Also known by the tradename Neoprene, polychloroprene was the first synthetic rubber and exhibits generally good ozone, aging, and chemical resistance. It has good mechanical properties over a wide temperature range.			
C0267-50	MIL-G-1149 Ty I Cl I AMS 3208, Low Temp.	-60 to 250	BLACK
C0518-60	General Purpose	-35 to 225	BLACK
C0557-70	Drive Belt	-35 to 250	BLACK
C0873-70	General Purpose	-35 to 225	BLACK
C0944-70	General Purpose	-35 to 250	RED
C1124-70	AMS-R-6855C Cl 2, Gr 70 AMS 3209, Low Temp.	-60 to 250	BLACK
C1276-70	Low Compression Set	-35 to 250	BLACK
CL172-70 (2347)	Internally Lubed	-35 to 225	BLACK
C1278-80	Low Compression Set	-35 to 250	BLACK
CB173-80 (2598)	Good Retained Resilience	-35 to 250	BLACK
ETHYLENE PROPYLENE RUBBER (EPM, EPR, EPDM) EPM (EPR) is a copolymer of ethylene and propylene. EPDM is a terpolymer of ethylene, propylene, and a diene third monomer used for cross-linking.			
E1100-50	General Purpose	-70 to 250	BLACK
EA454-50 (3575)	UL Listed	-70 to 250	BLACK
E1157-60	General Purpose	-70 to 250	BLACK
E1561-60	NSF 61, KTW, WRAS	-70 to 250	BLACK
EB151-60 (3806)	Good Low Temp	-70 to 250	BLACK
E0751-65	Drive Belt Applications	-70 to 250	BLACK
E0603-70	General Purpose	-70 to 250	BLACK
E0667-70	Auto Disc Brakes	-70 to 250	BLACK
E0803-70	General Purpose	-70 to 250	BLACK
E1022-70	Internally Lubed, Brakes	-70 to 250	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
EPM, EPR, EPDM - continued			
E1028-70	FDA	-70 to 250	BLACK
E1244-70	NSF 61, Internally Lubed	-70 to 250	BLACK
E1257-70	NSF 61, Chloramine Resistant	-70 to 250	BLACK
E1549-70	NSF 61, WRAS, KTW	-70 to 250	BLACK
E1570-70	NSF 61, Internally Lubed	-70 to 250	BLACK
E1571-70	NSF 61	-70 to 250	BLACK
E1583-70	NSF 61, Internally Lubed	-70 to 250	BLACK
E3609-70	NSF51, NSF 61, WRAS, KTW, FDA, USP Class VI	-70 to 250	BLACK
EB164-70 (3817)	General Purpose	-70 to 250	BLACK
EB173-70 (3217)	NSF 61, Internally Lubed	-70 to 250	BLACK
EB152-70 (3407)	General Purpose	-70 to 250	BLACK
EB165-70 (3477)	Steam, High Temp Water	-70 to 250	BLACK
EB153-75 (3297)	Heavy Duty Coolants	-70 to 250	BLACK
E0692-75	Steam, High Temp Water	-70 to 250	BLACK
E0740-75	Nuclear Applications	-70 to 250	BLACK
EJ150-75 (3077)	FDA, USP Class VI	-70 to 250	BLACK
EB155-80 (3478)	Low Compression Set	-70 to 250	BLACK
EJ151-80 (3958)	NSF 61, WRAS, KTW	-70 to 250	BLACK
E0515-80	MIL-P-82744	-70 to 250	BLACK
E0540-80	General Purpose	-70 to 250	BLACK
E0893-80	General Purpose	-70 to 250	PURPLE
E1267-80	NAS 1613	-70 to 250	BLACK
E0652-90	General Purpose, Back-Up Rings	-60 to 250	BLACK
E0962-90	Excellent Steam to 500° F, ED Resistant	-60 to 250	BLACK

ETHYLENE PROPYLENE CAN TYPICALLY BE USED AT 300 - 400° F IN A COMPATIBLE FLUID. FOR SPECIFIC INFORMATION, CONSULT A PARKER APPLICATIONS ENGINEER.

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

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Table 7 continued: O-Ring Material Offering Guide

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
FLUOROSILICONE (FVMQ)			
Fluorosilicone is a silicone polymer chain with fluorinated side-chains for improved oil and fuel resistance. The mechanical and physical properties are very similar to those of silicone.			
LM151-50 (11645)	General Pupose	-100 to 350	BLUE
LM152-60 (11646)	General Purpose	-100 to 350	BLUE
L1223-60	AMS-R-25988, TY 1, CL I, Gr 60, AMS 3325	-100 to 350	BLUE
LM153-70 (11647)	General Purpose	-100 to 350	BLUE
L1120-70	AMS-R-25988, TY I, CL I, GR 70, UL listed	-100 to 350	BLUE
LM154-75 (11837)	General Purpose	-90 to 350	BLUE
L1077-75	AMS-R-25988, TY I,CL III,GR 75	-90 to 350	BLUE
LM155-80 (11648)	General Purpose	-90 to 350	BLUE
L1218-80	AMS-R-25988, TY I, CL I, GR 80	-90 to 350	BLUE
L1186-80	PTFE Loaded	-85 to 350	RUST
ACRYLONITRILE-BUTADIENE (NBR)			
Nitrile rubber (NBR) is the general term for acrylonitrile-butadiene terpolymer. The acrylonitrile content of nitrile sealing compounds varies considerably (18 to 50%.) Polymers with higher ACN content exhibit less swell in gasoline and aromatic solvents, while lower ACN polymers exhibit better compression set and low temperature flexibility. Polymer is also called Buna-N.			
N0545-40	AMS 3201	-45 to 225	BLACK
NB100-40 (1454)	General Purpose	-45 to 225	BLACK
N0299-50	AMS 3205, UL listed	-55 to 225	BLACK
NA192-50 (8305)	General Purpose	-55 to 225	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
NBR - continued			
NL151-50 (8315)	Internally Lubed	-55 to 225	BLACK
NA150-60 (8306)	General Purpose	-55 to 225	BLACK
N0406-60	AMS-R-6855 CL 1, CL 1, GR 60	-40 to 225	BLACK
N0525-60	AMS 3212, AMS 3220	-25 to 250	BLACK
N1219-60	NSF 51, FDA	-30 to 225	BLACK
NF162-65 (1106)	Fuel Resistant, UL Listed	-25 to 250	BLACK
N0506-65	AMS 7271	-70 to 180	BLACK
NX352-70 (7727)	Carboxylated	-25 to 250	BLACK
NJ253-70 (7077)	FDA	-35 to 212	BLACK
NF153-70 (7657)	Fuel Resistant, SAE 120R1 Class II	-35 to 180	BLACK
NA151-70 (8307)	General Purpose	-30 to 250	BLACK
NL153-70 (8317)	Internally Lubed	-30 to 250	BLACK
NA153-70 (8497)	Automotive Applications	-30 to 250	BLACK
47-071	AMS-R-7362	-60 to 180	BLACK
N0103-70	Low Temp.	-55 to 225	BLACK
N0287-70	Synthetic Lubricant Resistant, AMS 7272	-35 to 250	BLACK
N0497-70	Low Swell, SAE 120R1 CL II UL listed	-35 to 212	BLACK
N0602-70	General Purpose, AMS-P-5315, Low Temp	-70 to 180	BLACK
N0674-70	General Purpose MIL-G-21569, Cl I, UL listed	-30 to 250	BLACK
N0757-70	NSF 61, UL listed	-30 to 225	BLACK
N0818-70	Internally Lubed	-30 to 250	BLACK
N0828-70	Internally Lubed, Low Set	-30 to 225	BLACK
N1069-70	FDA	-30 to 180	BLACK

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COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
NBR - continued			
N1220-70	NSF 51, FDA	-30 to 225	BLACK
N1470-70	General Purpose	-40 to 225	BLACK
N1499-70	General Purpose, UL	-30 to 250	BLACK
N1510-70	NSF 61	-30 to 225	BLACK
N1517-70	NSF 61	-30 to 225	BLACK
N1527-70	UL Listed	-30 to 225	BLACK
NB103-75 (1527)	Low Compression Set	-30 to 225	BLACK
NW163-75 (40601)	Internally Lubed	-30 to 225	RUST
NM156-75 (7377)	Good Low Temp	-65 to 225/250	BLACK
N0304-75	AMS-P-25732	-65 to 225/250	BLACK
N0508-75	FDA, USDA	-30 to 180	BLACK
N0756-75	AMS-P-83461	-65 to 250/275	BLACK
N0951-75	High Temp, Low Compression Set	-25 to 275	BLACK
N1500-75	Low Swell, UL Listed, Fuel applications	-35 to 212	BLACK
N1565-75	UL Listed	-30 to 225	BLACK
N1591-75	UL Listed	-30 to 225	BLACK
NA155-80 (7538)	Abrasion Resistant	-25 to 250	BLACK
N0750-80	Carboxylated	-25 to 250	BLACK
N1090-85	"ELF" Pneumatic, Carboxylated	-25 to 225	BLACK
NA156-90 (8309)	General Purpose	-25 to 225	BLACK
NB107-90 (1929)	Extrusion Resistant	-25 to 225	BLACK
N0300-90	Back Up Rings	-40 to 180	BLACK
N0507-90	AMS-P-5510, Low Temp	-65 to 180	BLACK
N0552-90	General Purpose	-30 to 250	BLACK
N0702-90	Low Compression Set	-30 to 275	BLACK
N1210-90	Low Comp Set, Ext. Res.	-30 to 275	BLACK
N1444-90	Parbaks only	-30 to 250	BLACK
N1490-90	General Purpose	-30 to 250	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
HYDROGENATED NITRILE (HNBR, HSN)			
Hydrogenated nitrile was developed as an air-resistant variant of nitrile rubber. In HNBR, the carbon-carbon double bonds in the main polymer chain are saturated with hydrogen atoms in a process called "hydrogenation" that improves the material's thermal stability and oxidation resistance.			
KB190-50 (21705)	Automotive Applications	-25 to 300/325	BLACK
KA170-55 (21105)	High Swell, UL Listed	-25 to 300/325	BLACK
KB181-60 (21926)	Diesel Applications	-25 to 300/325	BLACK
N1173-70	General Purpose	-25 to 300/325	BLACK
N1195-70	Refrigerants	-25 to 300/325	GREEN
N1206-70	Low Temperature	-40 to 300/325	GREEN
N1239-70	Refrigerants	-25 to 300/325	RED
KB153-70 (21337)	Automotive Applications	-25 to 300/325	BLACK
KW157-70 (21607)	Refrigerants	-25 to 300/325	GREEN
KB161-70 (21377)	High Temp Hydraulics	-25 to 300/325	BLACK
KA182-75 (21207)	High Swell, Auto Applications	-25 to 300/325	BLACK
KA174-75 (21107)	75 Duro, General Purpose	-25 to 300/325	BLACK
N1231-80	Explosive Decompression	-25 to 300/325	BLACK
KB162-80 (21378)	High Temp Hydraulics	-25 to 300/325	BLACK
KB163-90 (21379)	High Temp Hydraulics	-25 to 300/325	BLACK
POLYURETHANE (AU, EU)			
Polyurethane elastomers have excellent wear resistance, high tensile strength and high elasticity in comparison with any other elastomers. Permeability is good and comparable with butyl. Millable urethanes should not be confused with thermoplastic urethanes, which are generally harder, less flexible, and have slightly better wear resistance.			
P0642-70	Drive Belt Applications, Millable Type	-40 to 180	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

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Table 7 continued: O-Ring Material Offering Guide

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
SILICONE RUBBER (VMQ, PVMQ) Silicone elastomers have relatively low tensile strength, poor tear and wear resistance. Silicones also possess good insulating properties and tend to be physiologically neutral.			
S0469-40	AMS 3301	-75 to 400	RUST
S0802-40	FDA	-60 to 400	WHITE
SM150-40 (11354)	FDA	-60 to 400	RUST
S0595-50	AMS 3302	-70 to 400	RUST
S0899-50	ZZ-R-765 CL 1a,1b,2a,2b GR 50, AMS 3345	-103 to 400	RUST
SM151-50 (11355)	FDA, AMS 3302, UL	-70 to 400	RUST
S0317-60	FDA, USDA	-103 to 450	RUST
S0613-60	ZZ-R-765 Cl 2b, Gr 60, AMS 3303	-60 to 450	RUST
SM152-60 (11356)	AMS 3303, UL, FDA	-60 to 450	RUST
SB160-65 (11486)	Coolant Applications	-60 to 450	RUST
S0383-70	ZZ-R-765 Cl 1a, 1b, Gr 70, AMS 3337	-175 to 400	RUST
S0455-70	High Temperature	-65 to 450/500	RUST
S0604-70	ZZ-R-765 Cl 2a, 2b, Gr 70 AMS 3304, AMS 3357 MIL-G-21569	-65 to 450	RUST
S1138-70	FDA	-60 to 400	RUST
S1224-70	ZZ-R-765 Cl 2a, 2b, Gr 70 AMS 3304, AMS 3357 MIL-G-21569	-65 to 450	RUST
SM153-70 (11357)	UL Listed, FDA	-60 to 450	RUST
SB174-70 (11227)	General Purpose	-60 to 450	RUST
SA166-70 (11507)	General Purpose	-60 to 450	RUST
SB161-70 (11707)	Low Compression Set	-60 to 450	RUST
S0355-75	AMS 7267, FDA, USDA	-60 to 450	RUST
S0614-80	ZZ-R-765 Cl 2a, 2b Gr 80, AMS 3305	-65 to 450	RUST

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
FLUOROCARBON (FKM, FPM) Fluorocarbon (FKM) has excellent resistance to high temperatures and a broad range of chemicals. Permeability and compression set are excellent.			
V0986-50	General Purpose	-15 to 400	BROWN
V0763-60	General Purpose	-15 to 400	BROWN
V0769-60	General Purpose	-15 to 400	BLACK
VA150-65 (19356)	General Purpose	-15 to 400	BLACK
V1262-65	Low Swell - Flex Fuel Blends UL listed	-15 to 400	BLACK
V0494-70	Acid Resistant	-15 to 400	BLACK
V0680-70	FDA, USDA, NSF 51	-15 to 400	RED
V0834-70	Acid Resistant, Steam	-15 to 400	BLACK
VW153-75 (16207)	General Purpose	-15 to 400	BROWN
VA203-75 (16737)	Extrusion Resistant, Diesel Fuel Injectors	-15 to 400	BLACK
VW173-75 (19457)	Automotive Applications	-15 to 400	GREEN
VB184-75 (19487)	Transmission Applications	-15 to 400	BLACK
VG183-75 (19657)	Low Temp./"GLT Type"	-40 to 400	BLACK
VB153-75 (19717)	Good Compression Set, Fuels	-15 to 400	BLACK
VG162-75 (19727)	Good Fuel Resistance	-15 to 400	BLACK
V0747-75	AMS-R-83248, TY I, CL I AMS 7276, UL listed	-15 to 400	BLACK
V0835-75	AMS-R-83485, "GLT Type"	-40 to 400	BLACK
V0848-75	PTFE Loaded	-15 to 400	BLACK
V0884-75	General Purpose, UL listed	-15 to 400	BROWN
V1163-75	"GFLT Type", UL listed	-35 to 400	BLACK
V1164-75	Low Set, AMS 7276, AMS-R-83248, TY I, CL I	-15 to 400	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

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Table 7 continued: O-Ring Material Offering Guide

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
FKM, FPM - continued			
V1226-75	Low Set, AMS 7276, UL listed AMS-R-83248, TY I, CL I	-15 to 400	BROWN
V1260-75	Very Chemically Resistant "Viton Extreme" Type	-15 to 400	BLACK
V1263-75	Low Swell - Flex Fuel Blends UL listed	-15 to 400	BLACK
V1436-75	General Purpose, UL Listed	-15 to 400	BLACK
V1475-75	General Purpose	-15 to 400	BLACK
V1476-75	General Purpose	-15 to 400	BROWN
VA151-75 (19357)	General Purpose, UL	-15 to 400	BLACK
VA163-80 (19318)	Internally Lubed	-15 to 400	BLACK
V0965-80	Low Swell, "GF Type"	-15 to 400	BLACK
V0709-90	AMS-R-83248, TY I, Cl II AMS 7259	-15 to 400	BLACK
V0894-90	General Purpose	-15 to 400	BROWN
V1264-90	Low Swell - Flex Fuel Blends, UL listed	-15 to 400	BLACK
V1411-90	General Purpose	-15 to 400	BLACK
V1412-90	General Purpose	-15 to 400	BROWN
VA153-90 (19359)	General purpose	-15 to 400	BLACK
VW155-90 (16129)	General Purpose	-15 to 400	GREEN
V1238-95	Extrusion Resistant Explosive Decompression	-15 to 400	BLACK
VA154-95 (16949)	Extrusion Resistant	-15 to 400	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

COMPOUND NO.	RECOMMENDED FOR	TEMP. RANGE (Degrees° F)	COLOR
TETRAFLUOROETHYLENE - PROPYLENE (AFLAS™) This material is a copolymer of TFE and propylene. Its chemical resistance is excellent across a wide range of aggressive media. Polymer is sold under the tradename Aflas™.			
V1006-75	General Purpose	25 to 450	BLACK
VP101-80 (20018)	General Purpose	25 to 450	BLACK
VP102-80	Good Compression Set Resistance	15 to 450	BLACK
V1041-85	ED Resistant	15 to 450	BLACK
VP103-90 (20019)	Extrusion Resistant	25 to 450	BLACK
HIGHLY FLUORINATED ELASTOMER (HiFluor) Hifluor is Parker's tradename for high performance fluoroelastomers – materials that "bridge the gap" between traditional fluorocarbon and perfluoroelastomer.			
V3819-75	Chemically Resistant, Low Compression Set	-15 to 400	BLACK
V8534-90	Chemically Resistant, Extrusion Resistant	-15 to 400	BLACK

Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.

Hifluor™ is a trademark of Parker Hannifin Corporation.

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Table 8: Compound Selections for Commonly Used SAE & ASTM Specifications

This table is in accordance with the 1980 revision of ASTM D2000, which requires that minimum tensile strength indications shall be expressed in SI units (Megapascals). The "M" prefix in these callouts signifies this fact, and the requirement is shown in the 6th and 7th characters of each specification (excluding the "ASTM D2000"). For example, in the specification number M2BC614, the "14" indicates that the tensile strength of the material shall not fall below 14 MPa. To convert this value to PSI (pounds per square inch), multiply by 145. In this example, the equivalent is 104.1 Bar (2030 PSI) .

ASTM D2000-97 SPECIFICATION	ASTM D735-58/SAE J14 SPECIFICATION	PARKER COMPOUND NO.
M2AA708 A13 EA14 F17		E0603-70
M2AA810 A13 EA14 F17 Z1 (Purple)		E0893-80
M2AA810 A13 EA14 F17	$R810BF_2$	E0515-80
M2AA810 A13 EA14 F17	$R810BF_2$	E0540-80
M2AA907 A13 EA14 F17		E0652-90
M2BC510 A14 B14 EO14 EO34 F17	$SC515BE_1E_3F_2$	C0267-50
M3BC614 A14 B14 EO14 EO34 F17	$SC615BE_1E_3F_1$	C0518-70
M3BC710 A14 B14 EP14 EO34	$SC715BE_3F_1$	C0873-70
M2BE510 A14 B14 EO14 EO34 F17		C0267-50
M2BE614 A14 B14 EO14 EO34 F17		C0518-60
M3BE710 A14 B14 EO14 EO34		C0873-70
M2BF714 B34 EO14 EO34		N0674-70
M2BG410 B34 EA14 EF11 EF21 EO14 EO34	$SB415BE_1E_3F_1$	N0545-40
M5BG410 A14 B34 EO14 EO34		N0545-40
M2BG510 B14 EA14 EF11 EF21 EO14 EO34 F17	$SB515BE_1E_3F_2$	N0299-50
M2BG510 B14		N0299-50
M2BG608 B34 EA14 EO14 F17 Z1 (65 ± 5 Type A Durometer)	$SB712BE_1F_2$	N0506-65
M2BG614 B34 EA14 EF11 EF21 EO14 EO34 F17	$SB620BE_1F_1$	N0525-60
M2BG708 EA14 EF11 EF21 EO14 EO34 F17		N0602-70
M2BG708 EF11 EF21 EO34 F17		47-071
M5BG710 A14 B14		N0497-70
M2BG710 B14 B34 EA14 EF11 EF21		N0497-70
M2BG714 B14 B34 EA14 EF11 EF21 EO14 EO34	$SB715BE_1E_3F_1$	N0674-70
M(5)BG714 A14 B14 B34 EO14 EO34		N0103-70
M2BG714 B14 B34 EA14 EF11 EF21 EO34 F17	$SB715BE_1E_3F_2$	N0103-70
M4BG721 B14 EO14 EO34		P0642-70
M7BG810 EA14 EF11 EF21 EO14 EO34 Z1 (75 ± 5 Type A Durometer) Z2 (1)		N0951-75
M7BG810 EA14 EF11 EO14 EO34 F16 Z1 (75 ± 5 Type A Durometer)	$SB708E_1E_3F_2$	N0304-75
M7BG910 B14 EA14 EF11 EF21 EO14 EO34 F16	$SB915E_1E_3$	N0507-90
M2BG910 B14 EA14 EF21 EO14 EO34	$SB915BE_1E_3$	N0552-90
M4CA714 A25 B35 EA14 F17 G21		E0803-70
M2CH608 A25 B34 F17 Z1 (65 ± 5 Type A Durometer)		N0506-65
M3CH708 A25 EO16 E036		N0497-70
M2CH708 A25 EO35 F17		47-071
M3CH714 A25 B34 EO16 EO36		N0674-70
M3CH810 A25 EO16 Z1 (70 ± 5 Type A Durometer) Z2 (1)		N0951-75
M3CH810 A25 EO16 Z1 (75 ± 5 Type A Durometer)		N0304-75
M3CH910 B34 EO16 EO36		N0552-90
M3DA810 A26 B36 EA14		E0540-80
M2FK606 A19 EA36		L1223-60
M2GE405 A19 B37 EA14 EO16 EO36 F19 G11		S0469-40
M3GE503 A19 B37 EA14 EO16 EO36 F19 G11	$TA507BE_1E_3F_2$	S0595-50
M3GE603 A19 B37 EA14 EO16 EO36 F19 G11	$TA605BE_1E_3F_2$	S0613-60
M7GE705 A19 B37 EA14 EO16 EO36 F19 G11	$TA705BE_1E_3F_2$	S0455-70
A7GE705 A19 B37 EA14 EO16 EO36 F19 G11	$TA705BE_1E_3F_2$	S1224-70
M6GE803 A19 B37 EA14 EO16 EO36 F19 G11	$TA805BE_1E_3F_2$	S0614-80
M2HK710 A1 - 10 B37 B38 EF31 EO78 F15 Z1 (75 ± 5 Type A Durometer)		V1164-75
M2HK710 A1 - 10 B37 B38 EF31 EO78 F15 Z1 (75 ± 5 Type A Durometer) Z2 (Brown)		V1226-75
M4HK710 A1 - 11 B38 EF21 EO78 Z1 (75 ± 5 Type A Durometer)		V1164-75
M4HK710 A1 - 11 B38 EF21 EO78 Z1 (75 ± 5 Type A Durometer) Z2 (Brown)		V1226-75
M3HK910 A1 - 10 B37 EF31 EO78		V0709-90
M3HK910 A1 - 10 B37 B38 EF31 EO78 Z1 (Brown)		V0894-90
M5HK910 A1 - 11 B38 EF31 EO78 F15		V0709-90
M5HK910 A1 - 11 B38 EF31 EO78 F15 Z1 (Brown)		V0894-90
SAE 120R1 Class 2		N0497-70
SAE J515 Type 1		N0552-90
SAE J515 Type 2		E0652-90

Prefix (grade) numbers and suffix letters in parenthesis are technically "not permitted", but nevertheless, they describe a property of the material. Explanations in parenthesis apply to the Z suffix letters.
(1) Compression Set = 20% max. after 70 hours at 125°C when tested on plied discs per ASTM D395.

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Table 9: Aerospace Materials

AMS(1) and NAS(2) Rubber Specification Descriptions

RUBBER SPECS	PARKER COMPOUND	DUROMETER	DESCRIPTION TITLE
AMS3201	N0545-40	35-45	Dry Heat Resistance
AMS3205	N0299-50	45-55	Low Temperature Resistance
AMS3208	C0267-50	45-55	Weather Resistant, Chloroprene Type
AMS3209	C1124-70	65-75	Weather Resistant, Chloroprene Type
AMS3212	N0525-60	55-65	Aromatic Fuel Resistant
AMS3220	N0525-60	55-65	General Purpose, Fluid Resistant
AMS3238	B0318-70	65-75	Phosphate-Ester Resistant, Butyl Type
AMS3301	S0469-40	35-45	Silicone, General Purpose
AMS3302	S0595-50	45-55	Silicone, General Purpose
AMS3303	S0613-60	55-65	Silicone, General Purpose
AMS3304	S1224-70	65-75	Silicone, General Purpose
	S0604-70		
AMS3305	S0614-80	75-85	Silicone, General Purpose
AMS3325	L1223-60	55-65	Fluorosilicone Rubber, Fuel and
	LM152-60		Oil Resistant
AMS3337	S0383-70	65-75	Silicone, Extreme Low Temperature
			Resistant
AMS3345	S0899-50	45-55	Silicone Rubber
AMS3357	S1224-70	65-75	Silicone Rubber, Lubricating Oil,
	S0604-70		Compression Set Resistant
AMS7257	V8545-75,	70-80	Sealing Rings, Perfluorocarbon,
	FF200-75		High Temperature Resistant
AMS7259	V0709-90	85-95	High Temp, Fluid Resistant, Very
Low			
			Compression Set FKM
AMS7267	S0355-75	70-80	Silicone, Heat Resistant, Low
			Compression Set
AMS7271	N0506-65	60-70	Fuel and Low Temperature Resistant

(1) Aerospace Material Specification issued by the Society of Automotive Engineers, Inc.
(2) National Aerospace Standard issued by Aerospace Industries Association of America, Inc.

AMS(1) and NAS(2) Rubber Specification Descriptions

RUBBER SPECS	PARKER COMPOUND	DUROMETER	DESCRIPTION TITLE
AMS7272	N0287-70	65-75	Synthetic Lubricant Resistant
AMS7276	V1164-75	70-80	High Temp. Fluid Resistant, Very Low
	V1226-75		Compression Set FKM
	V0747-75		
NAS1613	E1267-80,	75-85	Packing, O-ring, Phosphate
			Ester Resistant
AMS-P-5315	N0602-70	65-75	Packing O-ring, Hydrocarbon Fuel
			Resistant
AMS-P-5510	N0507-90	85-95	Gasket, Straight Thread Tube Fitting
			Boss
AMS-R-6855	N0406-60,	55-75	Synthetic Rubber Sheets, Strips,
	C1124-70		Molded or Extruded Shapes,
			Synthetic Oil Resistant
AMS-R-7362	47-071	65-75	Rubber, Sheet, Molded and Extruded
			Shapes, Synthetic Oil Resistant
AMS-P-25732	N0304-75	70-80	Packing, Preformed, Petroleum
			Hydraulic Fluid Resistant,
			Limited Performance
AMS-R-25988	L1223-60,	55-85	Rubber, Fluorosilicone
	L1120-70,		Elastomer, Oil and Fuel Resistant
	L1218-80,		
	L1077-75		
	LM152-60		
	LM153-70		
	LM154-75		
	LM155-80		
AMS-R-83248	V1164-75,		
	V1226-75,		
	V0747-75	70-95	Rubber, Fluorocarbon Elastomer, High
	V0709-90		Temperature Fluid and Compression
			Set Resistant
AMS-P-83461	N0756-75	70-80	Packings, Preformed, Petroleum
			Hydraulic Fluid Resistant,
			Improved Performance
AMS-R-83485	V0835-75	70-80	Rubber, Fluorocarbon Elastomer,
			Improved Performance at
			Low Temperatures

(1) Aerospace Material Specification issued by the Society of Automotive Engineers, Inc.
(2) National Aerospace Standard issued by Aerospace Industries Association of America, Inc.

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O-Ring Material Offering Guide

Table 10: Military Rubber Specifications

Note: In compliance with the Federal Acquisition Streamlining Act (FASA), most of these specifications are being revised to AMS specifications. For the most current information, contact the O-Ring Division.

RUBBER SPECS	PARKER COMPOUND	DESCRIPTION
ZZ-R-765E		Rubber, Silicone
Class	**Grade**	**Temperature Range(1)**
1a. 1b. 2a. 2b.	50	S0899-50 - 103 to 437°F (-75 to 225°C) Low and High Temperature Resistant, Low Compression Set
1a. 1b	70	S0383-70 - 103 to 437°F (-75 to 225°C) Low Temperature Resistant, Low Compression Set
2a. 2b	80	S0614-80 - 80 to 437°F (-62 to 225°C) High Temperature Resistant, Low Compression Set
2a. 2b	70	S1224-70 - S0604-70 80 to 437°F (-62 to 225°C) High Temperature Resistant, Low Compression Set
MIL-G-1149C - Type I Class 1		Gasket Materials, Synthetic Rubber, 50 and 65 Durometer Hardness (-20 to 212°F) (-29 to 100°C) (1) C0267-50
MIL-R-3533B - Type I Grade B		Rubber, Synthetic; Sheet, Strip and Molded (-20 to 158°F) (-29 to 70°C) (1) N0602-70
MIL-P-5315B -		Packing, O-ring, Hydrocarbon Fuel Resistant (Jet Fuels) (Military O-ring series MS29512 and MS29513) N0602-70 (-65 to 160°F) (-54 to 71°C)
MIL-P-5510C -		Gasket, Straight Thread Tube Fitting Boss (MIL-H-5606 Petroleum Based Hydraulic Fluid) N0507-90 (-45 to 160°F) (-43 to 71°C)(1) (Military O-ring series MS28778)
MIL-R-6855D -		Synthetic Rubber Sheets, Strips, Molded or Extruded Shapes (-65 to 212°F) (-54 to 100°C)(1)
Class 1	Grade 60	N0406-60 Fuel and Petroleum Oil Resistant
Class 2 Type B	Grade 70	C1124-70 Petroleum Oil, Weather and Ozone Resistant

(1) These temperatures are limits for particular tests required by the specifications, but they do not necessarily represent operating temperature limits.

RUBBER SPECS	PARKER COMPOUND	DESCRIPTION
MIL-R-7362D - Types I, II	47-071	Rubber, Sheet, Molded and Extruded Shapes, Synthetic Oil Resistant (AMS3021) Synthetic, Di-Ester Base Lubricant (-65 to 275°F) (-54 to 135°C)(1) (Military O-ring series MS29561 and WAS617)
MIL-G-21569B - Class I	N0674-70	Gaskets, Cylinder Liner Seal, Synthetic (Room temperature to 194°F) (RT to 90°C)
Class II	S0604-70	
MIL-P-25732C -		Packing, Preformed, Petroleum Hydraulic Fluid Resistant (MIL-H-5606)
	N0304-75	Petroleum Base Hydraulic Fluid (-65 to 275°F) (-54 to 135°C)(1) (Military O-ring series MS28775)
MIL-R-25988 -		Rubber Fluorosilicone Elastomer, Oil and Fuel Resistant (MIL-H-5606 Petroleum Base) Hydraulic Fluid, Fuel, Air (-90 to 350°F) (-68 to 176°C)(1)
Type 1, Class 1, Grade 60/3		L1223-60, LM152-60
Type 1, Class 1, Grade 70/1		L1120-70, LM153-70
Type 1, Class 1, Grade 80/4		L1218-80, LM155-80
Type 1, Class 3, Grade 75/2		L1077-75, LM154-75
MIL-P-82744 -		Packing, Preformed, Otto Fuel Compatible (-65 to 250°F) (-54 to 121°C) E0515-80
MIL-R-83248C, Type I -		Rubber, Fluorocarbon Elastomer, High Temperature Fluid and Compression Set Resistant (-15 to 400°F) (-5 to 105°C)
Class I		V0747-75, V1164-75, V1226-7
Class 2		V0709-90
MIL-R-83485	Grade 80	V0835-75 Rubber, fluorocarbon Elastomer, Improved performance @ low Temp
MIL-P-83461B -		Packings, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance
	N0756-75	(-65 to 275°F) (-54 to 135°C)(1)

(1) These temperatures are limits for particular tests required by the specifications, but they do not necessarily represent operating temperature limits.

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Zatkoff SEALS & PACKINGS

Table 11: Compounds for Hydraulic Fluids

Temp. Range	O-Ring Compounds
High-Water-Base Fluids (95-5 Fluids)	
4°C to 49°C (40°F to 120°F)	N0674-70, nitrile E0540-80, Ethylene propylene
Hydrocarbon Base Hydraulic Fluids (including petroleum base)	
-54°C to 149°C (-65°F to 300°F)	-34°C to 121°C (-30°F to 250°F), N0674-70, nitrile -29°C to 135°C (-20°F to 275°F), N0951-75, nitrile -54°C to 135°C (-65°F to 275°F), N0756-75, nitrile -26°C to 204°C (-15°F to 400°F), V1164-75, fluorocarbon -26°C to 204°C (-15°F to 400°F), V1226-75, fluorocarbon
Phosphate Esters	
Aircraft types (alkyl phosphate esters)	
-54°C to 149°C (-65°F to 300°F)	E1267-80, Ethylene propylene (NAS1613) E0692-75, ethylene propylene
Industrial types (aryl phosphate esters)	
-34°C to 93°C (-30°F to 200°F)	E0540-80, Ethylene propylene V1164-75, fluorocarbon V1226-75, fluorocarbon
Phosphate Ester-Petroleum Oil Blends	
-1°C to 100°C (30°F to 212°F)	V1164-75, fluorocarbon V1226-75, fluorocarbon
Silicate Esters	
-54°C to 288°C (65°F to 550°F)	-26°C to 204°C (-15°F to 400°F), V1164-75, fluorocarbon -26°C to 204°C (-15°F to 400°F), V0884-75, fluorocarbon -54°C to 149°C (65°F to 300°F), C0873-70, neoprene
Silicone Hydraulic Fluids	
38°C to 288°C (-100°F to 550°F)	38°C to 177°C (-100°F to 350°F), L1120-70 fluorosilicone (static only) -54°C to 149°C (-65°F to 300°F), E0540-80, Ethylene propylene -26°C to 204°C (-15°F to 400°F), V1164-75, fluorocarbon -26°C to 204°C (-15°F to 400°F), V1226-75, fluorocarbon (brown Chromassure)
Water-Glycol	
-18°C to 60°C (0°F to 140°F) (But wider range as a coolant)	E0540-80, Ethylene propylene N0674-70, nitrile (limited life as dynamic seal anticipated above 43°C (110°F)) N0951-75, nitrile (for higher temperature coolant use)
Water-in-Oil Emulsions ("Invert" emulsions)	
-12°C to 49°C (10°F to 120°F)	N0674-70, nitrile

NOTE: Due to variations in each type of fluid, and the many variables possible in the application of O-Rings, these compound listings are intended only as general guides. Users must test under their own operating conditions to determine the suitability of any compound in a particular application.

Table 12: Compounds for Use Against Lexan(1) Surfaces

Ethylene Propylene	Fluorocarbon
EJ150-75	V0680-70
E0692-75 (marginal)	V0747-75
E0515-80 (marginal)	V0709-90 (marginal)
Nitrile	**Neoprene**
N0602-70	C0267-50
N0674-70	C0557-70
N0304-75	**Polyurethane**
N0508-75	P0642-70
N0951-75	**Silicone**
N0506-65 (marginal)	S0317-60
47-071 (marginal)	S0469-40
N0552-90 (marginal)	S0604-70

(1) General Electric Trademark
NOTE: Some of these compounds may no longer be available.

Table 13: Compound Recommendation for Refrigerants

FLUORINATED HYDROCARBONS REFRIGERANT (R)	ASTM D1418	PARKER
11	NBR	N0674-70
12	CR	C0873-70
12 and ASTM oil no. 2 (mixed 50:50)	FKM	V1164-75
12 and Suniso 4G (mixed 50:50)	FKM	V1164-75
13	CR	C0873-70
13 B1	CR	C0873-70
14	CR	C0873-70
21	CR	C0873-70
22	CR	C0873-70
22 and ASTM oil no. 2 (mixed 50:50)	CR	C0873-70
31	CR	C0873-70
32	CR	C0873-70
112	FKM	V1164-75
113	CR	C0873-70
114	CR	C0873-70
114 B2	CR	C0873-70
115	CR	C0873-70
134a	CR	C0873-70
502	CR	C0873-70
BF (R112)	FKM	V1164-75
C318	CR	C0873-70
K-152a	CR	C0873-70
K-142b	CR	C0873-70
MF (R11)	NBR	N0674-70
PCA (R113)	CR	C0873-70
TF (R113)	CR	C0873-70

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Table 14: Underwriters Laboratories Approved Services*

CODE	A Fire Extinguishing Agents	B Gasoline	C Gasoline/Alcohol Blends*	D Naptha or Kerosene	E MPS Gas	F MFG or Natural Gas	G Diesel Fuel, Fuel Oil, Lubricating Oil	H Heated Fuel Oil	I Anhydrous Ammonia	J LP-Gas	L Laundry Detergents	M Dishwashing Detergents	Suitable for use in UL 1081	Suitable for use in UL262 applications	Suitable for UL25 gasket applications	Dry Chemical, Carbon Dioxide, Water
EA454-50 (3575)											■	■				
EB152-70 (3407)											■	■				
KA170-50 (21105)											■	■				
L1120-70		■	■	■		■	■	■		■						
N0299-50													■			
N0497-70		■	■	■		■	■			■						
N0674-70	■			■		■	■	■	■	■						■
N0757-70														■		
N1499-70	■			■		■	■			■						■
N1500-75		■	■	■		■	■			■						
N1591-75 (67357)		■	■	■		■	■			■					■	
NF162-65 (1106)		■	■	■		■	■	■		■						
N1565-75 (67027)	■	■	■	■	■	■	■			■						
N1527-70 (67147)				■		■	■		■	■						
SM151-50 (11355)											■	■				
SM152-60 (11356)											■	■				
SM153-70 (11357)											■	■				
V0747-75		■		■		■	■	■		■						
VA151-75 (19357)		■		■		■	■	■		■						
V0884-75		■	■	■			■									
V1163-75		■	■	■		■	■			■						
V1226-75		■	■	■			■									
V1262-65		■	■	■			■									
V1263-75		■	■	■			■									
V1264-90		■	■	■			■									
V1436-75		■		■		■	■	■		■						

* Contact factory for additional information regarding specific ratios of alcohol (methyl and/or ethyl) and gasoline.

FDA, USDA, USP Approved Compounds

The Food and Drug Administration (FDA) has established a list of rubber compounding ingredients which tests have indicated are neither toxic nor carcinogenic. Rubber compounds produced entirely from those ingredients and which also pass the FDA extraction tests are said to "meet the FDA requirements." The FDA does not approve rubber compounds. It is the responsibility of the manufacturer to compound food grade materials from the FDA list of ingredients and establish whether they pass the necessary extraction requirements.

Similar standards are established by the United States Department of Agriculture (USDA).

Additional requirements have been imposed upon seal manufacturers regarding food and beverage service. Parker has developed several materials that are certified to Food and Beverage Standard. In critical medical applications, seals often must be made from an even "cleaner" list of ingredients. The U.S. Pharmacopoeia (USP) Class VI outlines requirements for system toxicity and intracutaneous toxicity for these "cleaner" compounds. The USP Class VI compounds must be made from ingredients with clear histories of biocompatibility that meet tighter requirements for leachates.

Typical applications for our FDA, USDA materials are disposable medical devices, surgical instruments and medical fluid dispensing components, as well as a wide variety of food and beverage handling equipment. The type of approval/certification required generally rests with the end customer's regulatory expectations for the specific application.

Table 15:

PARKER COMPOUND	POLYMER	HARD-NESS	COLOR	TEMP RANGE (° F)	SERVICE
EJ150-75 (3077)	EPDM	75	Black	-70 to 250	FDA
E3629-70	EPDM	70	Black	-70 to 250	FDA**, USP Class VI
E1028-70	EPDM	70	Black	-70 to 250	FDA
V8545-75	FFKM	75	Black	5 to 572	FDA**
V8562-75	FFKM	75	White	5 to 572	FDA**
FF200-75	FFKM	75	Black	5 to 608	FDA**
FF350-75	FFKM	75	White	5 to 600	FDA**, USP Class VI
FF500-75	FFKM	75	Black	5 to 525	FDA**
V0680-70	FKM	70	Red	-15 to 400	FDA
HF351-65	FKM	65	Translucent	-15 to 400	FDA**, USP Class VI
NJ253-70 (7077)	NBR	70	Black	-35 to 212	FDA
N1219-60	NBR	60	Black	-30 to 225	FDA
N1220-70	NBR	70	Black	-30 to 225	FDA
N1069-70	NBR	70	Black	-30 to 180	FDA
N0508-75	NBR	75	Black	-30 to 180	FDA
S0802-40	VMQ	40	White	-60 to 400	FDA
S0317-60	VMQ	60	Rust	-103 to 450	FDA, USP Class VI
S1138-70	VMQ	70	Rust	-60 to 400	FDA
SM150-40 (11354)	VMQ	40	Rust	-60 to 400	FDA
SM151-50 (11355)	VMQ	50	Rust	-70 to 400	FDA
SM152-60 (11356)	VMQ	60	Rust	-60 to 450	FDA
SM153-70 (11357)	VMQ	70	Rust	-60 to 450	FDA
S0355-75	VMQ	75	Rust	-60 to 450	FDA
S1538-55	VMQ	55	Translucent	-60 to 450	FDA, USP Class VI

* Note: Compound numbers in (XXXXX) are the obsolete Wynn's Precision compound numbering system.
** Meets extraction requirements.

Table 16: Fungus Tests on Compounds

Fungus testing per MIL-STD-810D, Method 508.3

NON-NUTRIENT TO FUNGUS GROWTH			SUPPORTS FUNGUS GROWTH
Butyl B0612-70 **Neoprene** C0365-45 C0873-70 C1124-70 **Ethylene Propylene** E0692-75 E0740-75 E0515-80 E0540-80 **Buna S** G0244-70	**Nitrile** N0545-40 N0299-80 N0406-60 N0525-60 N0506-65 47-071 N0103-70 N0497-70 N0602-70 N0674-70 N0818-70 N0304-75 N0951-75 N0507-90 N0552-90	**Silicone** S0595-80 S0317-60 S0613-60 S0455-70 S0604-70 S0355-75 S0614-80 **Fluorocarbon** V0680-70 V0747-75 V1164-75 V0709-90 **Fluorosilicone** L1120-70	**Polyacrylate** A1107-70 **Neoprene** C0267-50 **Ethylene Propylene** E0603-70 E0652-90 **Nitrile** N1069-70 N0756-75 **Polyurethane** P0642-70 P0648-90

NOTE: Some of these compounds may no longer be available.

O-Ring Material Offering Guide

Table 17: NSF 61 Approved Compounds

NSF 61 - Drinking Water System Components - is the nationally recognized health effects standard for all devices, components and materials which contact drinking water. Parker's O-Ring Division has developed several materials that are certified to NSF 61. Many of these materials are approved for use in the United Kingdom (WRAS), and Germany (KTW) as well as North America.

NSF International - is an industry regulating agency that was established in 1944. Recognized by ANSI (American National Standards Institute), NSF maintains qualification standards and criteria for a wide range of products, including potable water components and delivery systems.

PARKER COMPOUND	POLYMER	HARD-NESS	WATER CONTACT TEMP	SERVICE
E1583-70 (63017)	EPDM	70	Commercial Hot **	NSF 61 Internally lubricated, ideal for high volume applications
E1561-60 (63446)	EPDM	60	Commercial Hot **	NSF 61, WRAS, KTW, ideal for high volume applications
E1549-70 (63447)	EPDM	70	Commercial Hot **	NSF 61, WRAS, KTW, excellent compression set resistance, ideal for high volume applications
E1570-70	EPDM	70	Commercial Hot **	NSF 61 Internally lubricated
E1571-70	EPDM	70	Commercial Hot **	NSF 61
E1244-70	EPDM	70	Commercial Hot **	NSF 61 Internally lubricated
E1257-70	EPDM	70	Commercial Hot **	NSF 61 Chloramine Resistant
E3609-70	EPDM	70	Commercial Hot **	NSF 61, WRAS, KTW, excellent compression set resistance
EJ151-80 (3958)	EPDM	80	Commercial Hot **	NSF 61, WRAS, KTW
N1517-70	Nitrile	70	Commercial Hot **	NSF 61
N1510-70 (67997)	Nitrile	70	Commercial Hot **	NSF 61
N0757-70	Nitrile	70	Cold Water***	NSF 61

* NSF 61 listed materials given a commercial hot water rating are also certified for cold water
** Commercial Hot = Tested at 82° C (180° F) (Commercial Hot)
*** Cold Water = Tested at 23° C (73.4° F)

Table 18: Weight Loss of Elastomer Materials in Vacuum

Test Samples: Approximately .0075"Thick
Time: 336 Hours (Two Weeks)
Vacuum Level: Approximately 1 x 10-6 Torr
Temperature: Ambient (Approximately 70°)

POLYMER TYPE	PERCENT WEIGHT LOSS	POLYMER TYPE	PERCENT WEIGHT LOSS	POLYMER TYPE	PERCENT WEIGHT LOSS
Butyl	.18	Fluorosilicone	.28	Silicone	.03
Neoprene	.13	Fluorosilicone	.25	Silicone	.03
Ethylene Propylene	.39	Nitrile	1.06	Fluorocarbon	.07
Ethylene Propylene	.92	Nitrile	1.06	Fluorocarbon	.07
Ethylene Propylene	.76	Polyurethane			

NOTE: Varying weight loss figures within the same polymer family represent different formulations or compounds made from that base polymer.

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Table 19: Rating of Families & Types of Viton® (Fluorocarbon) by Performance Parameter

	Viton Family					
	A	**B**	**F**	**GLT**	**GBLT**	**GFLT**
Polymer Characteristics						
Polymer Type(s)	Di	Ter	Ter/ Tetra	Tetra	Tetra	Tetra
Fluorine Level	66	68	70	65	66	67
Fluids Resistance - Fuels						
Unleaded Gasoline	E	E	E	E	E	E
'Sour' Gasoline (80 PN)	E	E	E	E	E	E
Gasohol - (U. Gas/10% Ethanol)	G	E	E	G	E	E
Unleaded Gasoline/Methanol Blends						
• 5-10% Methanol	G	E	E	G	E	E
• 11-30% Methanol	F	G	E	F	G	E
• >30% Methanol	P-F	G	E	P-F	G	E
Methanol 100%	P	G	E	P	G	E
MTBE 100%	P	P	P	P	P	P
U. Gas/MTBE-Blends/(5-20%)	G-E	E	E	G-E	G-E	E
Permeability						
Unleaded Gasoline	E	E	E	E	E	E
U. Gas/Methanol Blends	F	G	E	F	G	E
Heat Resistance						
To 150° C	E	E	E	E	E	E
To 204° C	E	E	E	E	E	E
To 275° C	F-G	G	F	F	F	F
Compression Set Resistance						
At 150° C	E	E	G-E	E	G-E	E
To 200° C	E	G-E	F-G	G	G	F-G
At –20° C	P-F	P	P	G	G	G
Low Temperature Properties						
Flexibility at 0° C	E	E	F	E	E	E
At –20° C	F	F-P	P	E	G-E	G-E
Static Seal Ability						
At –20° C	G	F-G	P-F	E	E	E
At –40° C	P-F	P	P	G	G	G
Low Temperature Retraction (ASTM D-1329)						
TR-10, °C	–17	–14	–7	–30	–26	–24
O-Ring Leakage Test, °C	–32	–26	–25	–45	–40	–37

Rating Scale: **E** = Excellent, **G** = Good, **F** = Fair, **P** = Poor

Table 21: Engine Applications

Application	Medium	Temperature Range °C (°F)	Compounds ASTM D1418	Compounds Parker
Motor oil Oil Filter	SAE-Oils	-35°C to 110°C (-31°F to 230°F)	NBR	N0674-70
		-30°C to 120°C (-22°F to 248°F)	NBR	N0951-75
		-25°C to 200°C (-13°F to 392°F)	FKM	V1164-75
Wet Cylinders (Diesel)	Water/ Oil	-30°C to 100°C (-22°F to 212°F)	NBR	N0951-75
		-25°C to 120°C (-13°F to 248°F)	FKM	V1164-70
Air-Filter	Air/ Fuel	-35°C to 90°C (-31°F to 194°F)	NBR	N0674-70
		-60° to 210° (140°F to 410°F)	VMQ	S1224-70

Table 20: Data on Radiation Resistant Compounds

Compound	Polymer	Comp. Set at 10^7 Rads[1]	Max. Temp.[2]	Steam & Water Resistance	Silicone Fluid Resistance
S0604-70	Silicone	20.0%	204°C (400°F)	Poor	Poor
N0674-70	Nitrile	24.3%	149°C (300°F)	OK to 49°C (120°F)	Good
N0741-75	Nitrile	24.3%	149°C (300°F)	OK to 49°C (120°F)	Good
E0740-75	Ethylene Propylene	28.6%	177°C (350°F)	Good	Good
S0455-70	Silicone (Hi Temp)	31.4%	177°C (350°F)	Poor	Poor
E0515-80	Ethylene Propylene	46.6%	149°C (300°F)	Good	Good
P0642-70	Polyurethane	55.2%	82°C (180°F)	Poor	Good
V0747-75	Fluorocarbon	66.7%	204°C (400°F)	Poor	Good

[1] Compression set after exposure to 10^7 rads of gamma radiation at room temperature. The lower values are preferred. If over 40%, use only at lower dosage level.
[2] Temperature at which .139 cross section ring takes a 90% compression set after 1000 hours when not exposed to radiation or fluids.
NOTE: Some of these compounds may no longer be available.

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Zatkoff SEALS & PACKINGS

Fluorosilicone (FVMQ) and Nitrile (NBR) Materials

Table 22: Parker Fuel Systems Sealing Solutions

FVMQ Compounds	L7230-60	L1120-70	L7891-70	L7232-70	L1186-80
Parker Seal Division	*JBL*	*ORD*	*JBL*	*JBL*	*ORD*
Typical Temperature Range (Fahrenheit)	-100 to 350	-100 to 350	-100 to 350	-100 to 350	-100 to 350
Compound Color	Blue	Blue	White	Green	Red
Original Physical Properties					
Shore A Hardness, ASTM D2240	60	69	74	68	81
Tensile Strength, MPa, ASTM D412 Die C	6.0	6.1	7.7	6.7	7.4
Elongation, %, ASTM D412 Die C	249	160	198	190	145
Heat Aged, 70 hours @ 392F, ASTM D573					
pts. Shore A change	-3	+1	+4	-11	+1
% Tensile Strength change	-5	+5	-12	-8	-3
% Elongation change	-10	-3	-8	+2	-6
Compression set, 22 hours @ 437F, ASTM D395 Method B, Solid Buttons					
% Permanent Set	25	17	30	30	6
Fluid Resistance, ASTM Reference Fuel C, 70 hours @ Room Temp., ASTM D471					
pts. Shore A change	-6	-14	-6	-8	-11
% Tensile Strength change	-30	-1	-16	-19	-5
% Elongation change	-40	-20	-19	-27	-15
% Volume change	+30.0	+22.0	+21.0	+20.0	+20.0
Fluid Resistance, Blends of ASTM Reference Fuel C and Methanol, 70 hours @ Room Temp., % Volume Change per ASTM D471					
100% ASTM Ref. Fuel C	+30.0	+22.0	+21.0	+20.0	+20.0
80/20 Fuel C/Methanol	+16.0	+25.0	+26.2	+31.6	+22.0
UL 157 Recognized for:					
Lower Temperature (C)/Upper Temperature (C)		-54/60			
Gasoline		Yes			
Gasoline/Alcohol Blends		Yes			
Naptha or Kerosene		Yes			
Manufactured Gas or natural gas		Yes			
Liquefied Petroleum gas		Yes			
Suitable for 0-30 percent ethanol/gasoline blends		Yes			
Suiteable for 85 percent methanol/gasoline blends		Yes			
Special Features					
PTFE Reinforced					Yes
Improved Abrasion Resistance					Yes

NBR Compounds	N0497-70	N0674-70	N1500-75
Parker Seal Division	*ORD / JBL*	*ORD / JBL*	*ORD / JBL*
Typical Temperature Range (Fahrenheit)	-35 to 212	-35 to 250	-30 to 212
Compound Color	Black	Black	Black
Original Physical Properties			
Shore A Hardness, ASTM D2240	72	71	75
Tensile Strength, MPa, ASTM D412 Die C	12.0	17.1	11.5
Elongation, %, ASTM D412 Die C	369	335	250
100% Modulus, MPa, ASTM D412 Die C	3.9	3.2	4.9
Heat Aged, 70 hours @212F, ASTM D573			
pts. Shore A change	+7	+6	+6
% Tensile Strength change	+10	+7	+18
% Elongation change	-25	-24	-19
Compression set, 22 hours @ 212F, ASTM D395 Method B, Solid Buttons			
% Permanent Set	9	13	9
Fluid Resistance, ASTM Reference Fuel A, 70 hours @ Room Temp., ASTM D471			
pts. Shore A change	+1	+3	+1
% Tensile Strength change	-3	+6	+7
% Elongation change	-2	-15	+4
% Volume change	-1.0	-2.4	+0.8
Fluid Resistance, ASTM Reference Fuel B, 70 hours @ Room Temp., ASTM D471			
pts. Shore A change	-14	-21	-12
% Tensile Strength change	-15	-28	-9
% Elongation change	-8	-15	-16
% Volume change	+16.2	+28.9	+16.4
Fluid Resistance, Blends of ASTM Reference Fuel C and Methanol, 70 hours @ Room Temp., % Volume Change per ASTM D471			
100% ASTM Ref. Fuel C	+24.0	+42.0	+18.0
80/20 Fuel C/Methanol	+48.0	+58.0	+33.0
UL 157 Recognized for:			
Lower Temperature (C)/Upper Temperature (C)	-40/60	-40/60	-37/60
Gasoline	Yes	No	Yes
Gasoline/Alcohol Blends	Yes	No	Yes
Naptha or Kerosene	Yes	Yes	Yes
Manufactured Gas or natural gas	Yes	Yes	Yes
Liquefied Petroleum gas	Yes	Yes	Yes
Suitable for 0-30 percent ethanol/gasoline blends	Yes	No	Yes

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Fluorocarbon (FKM) Materials

Table 22 continued: Parker Fuel Systems Sealing Solutions

FKM Compounds	V1262-65	V7261-75	V1263-75	V0747-75	V1163-75	V884-75
Parker Seal Division	***ORD / JBL***	***JBL***	***ORD / JBL***	***ORD / JBL***	***ORD / JBL***	***ORD / JBL***
Mole % Fluorine	69	66	69	66	68	66
Material Type	NEW	A	NEW	A	GFLT	A
Typical Temperature Range (Fahrenheit)	-15 TO 400	-15 TO 400	-15 TO 400	-15 TO 400	-35 TO 400	-15 TO 400
Compund Color	Black	Black	Black	Black	Black	Brown
Original Physical Properties						
Shore A Hardness, ASTM D2240	65	75	75	76	76	75
Tensile Strength, MPa, ASTM D412 Die C	11.0	11.7	12.4	15.2	11.7	15.2
Elongation, %, ASTM D412 Die C	323	203	325	152	228	150
100% Modulus, MPa, ASTM D412 Die C	2.3	5.4	3.3	7.2	5.4	7.9
Heat Aged, 70 hours @ 482F, ASTM D573						
pts. Shore A change	0	+2	+2	+2	0	+1
% Tensile Strength change	-5	-11	-18	-15	+5	-6
% Elongation change	+5	-2	-4	+3	-7	+7
Compression set, 22 hours @ 392F, ASTM D395 Method B, Plied Discs						
% Permanent Set	12	20	14	12	20	13
Fluid Resistance, ASTM Reference Fuel C, 70 hours @ Room Temp., ASTM D471						
pts. Shore A change	-4	-5	-1	-4	-4	-9
% Tensile Strength change	-11	-9	-4	-21	-19	-22
% Elongation change	-6	-3	-2	+1	-4	-6
% Volume change	+1.5	+3.0	+1.3	+3.6	+3.1	+12.0
Fluid Resistance, Blends of ASTM Reference Fuel C and Methanol, 70 hours @ Room Temp., % Volume Change per ASTM D471						
90/10 Fuel C/Methanol	+5.9	+19.0	+5.3	+25.7	+11.2	+25.0
50/50 Fuel C/Methanol	+7.7	+48.0	+8.0	+68.6	+16.0	+70.0
100% Methanol	+3.8	+62.0	+3.3	+103.1	+10.3	+98.0
Compression set, 1000 hours @ 392F, ASTM D395 Method B and ASTM D1414, 0.070" Cross Section O-Rings. Not applicable to JBL products.						
% Permanent Set	54		49	45	93	63
UL 157 Recognized for, -40C to +60C						
Gasoline	Yes		Yes	Yes	Yes	
Gasoline/Methanol Blends, Full range of Methanol	Yes		Yes	No	No	
Naphtha or Kerosene	Yes		Yes	Yes	Yes	
Diesel Fuel	Yes		Yes	Yes	Yes	

FKM Compounds	V0835-75	V0965-80	V7754-80	V7112-90	V1264-90
Parker Seal Division	***ORD / JBL***	***ORD***	***JBL***	***JBL***	***ORD / JBL***
Mole % Fluorine	65	70	66	65	69
Material Type	GLT	GF	A	A	NEW
Typical Temperature Range (Fahrenheit)	-40 TO 400	-15 TO 400	-15 TO 400	-15 TO 400	-15 TO 400
Compund Color	Black	Black	Black	Black	Black
Original Physical Properties					
Shore A Hardness, ASTM D2240	76	81	77	86	91
Tensile Strength, MPa, ASTM D412 Die C	12.6	17.6	14.5	15.9	12.4
Elongation, %, ASTM D412 Die C	165	300	207	133	229
100% Modulus, MPa, ASTM D412 Die C	6.8	7.7	7.3	12.4	6.0
Heat Aged, 70 hours @ 482F, ASTM D573					
pts. Shore A change	+3	+2	+1	+1	+1
% Tensile Strength change	+20	-10	-14	-12	-11
% Elongation change	-5	-8	+7	-8	+6
Compression set, 22 hours @ 392F, ASTM D395 Method B, Plied Discs					
% Permanent Set	13	18	30	25	18
Fluid Resistance, ASTM Reference Fuel C, 70 hours @ Room Temp., ASTM D471					
pts. Shore A change	-3	-1	-5	-3	-1
% Tensile Strength change	-18	-5	-15	-17	+1
% Elongation change	-15	-3	-11	-7	+6
% Volume change	+3.6	+1.0	+1.3	-2.4	+1.0
Fluid Resistance, Blends of ASTM Reference Fuel C and Methanol, 70 hours @ Room Temp., % Volume Change per ASTM D471					
90/10 Fuel C/Methanol	+27.0	+3.8	+4.0	+26.0	+4.0
50/50 Fuel C/Methanol	+70.0	+5.7	+6.0	+73.0	+5.5
100% Methanol	+127.0	+2.1	+4.0	+100.0	+2.7
Compression set, 1000 hours @ 392F, ASTM D395 Method B and ASTM D1414, 0.070" Cross Section O-Rings. Not applicable to JBL products.					
% Permanent Set	85	84			60
UL 157 Recognized for, -40C to +60C					
Gasoline					Yes
Gasoline/Methanol Blends, Full range of Methanol					Yes
Naphtha or Kerosene					Yes
Diesel Fuel					Yes

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Zatkoff SEALS & PACKINGS

Parker - Your complete source for fuel system sealing solutions...

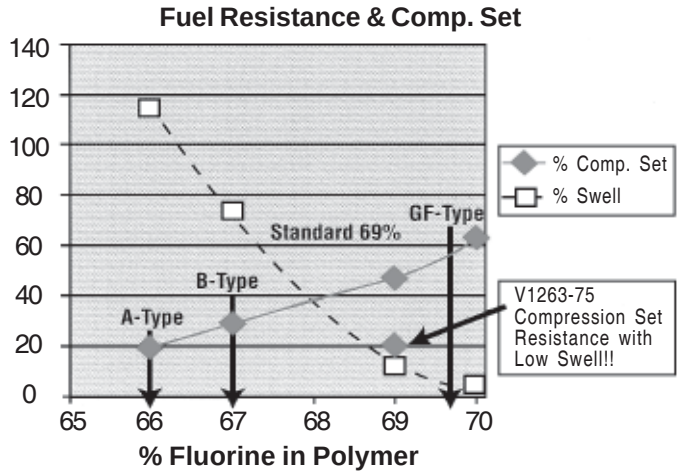
The Parker Seal O-Ring and JBL Divisions together offer a comprehensive range of seal materials for demanding fuel system applications. Parker offers nitrile, fluorosilicone, and fluorocarbon rubber compounds for both current and next-generation fuel applications, with or without UL recognition. Extensive flex fuel test data has been developed to illustrate the effects of hydrocarbon blends with oxygenates such as methanol, ethanol and MTBE. Parker's broad material offering, design capability and product offering of O-Rings, extruded and cut disks, lathe cut seals, and engineered shapes are capable of meeting your most demanding fuel system sealing applications.

The increased use of oxygenates in hydrocarbon fuels is the next extension of improved octane performance with reduced emissions. The first major reduction of emissions occurred in the 1970's with elimination of lead based octane-boosting additives in gasoline. The lead based chemicals were replaced with aromatic hydrocarbons such as toluene and xylene, which presented fuel system seal designers with a major challenge. Parkers's material development efforts accommodated this early change, and our recent efforts assure that Parker wil remain a leading innovator in material technology for the fuel handling market. More recently, oxygenates such as methanol, ethanol, and MTBE have been utilized to offer improved octane performance with reduced emissions of toxic nitrogen oxides and reduced carbon monoxide emissions. The use of oxygenates in fuel continues to pose serious challenges to the seal industry.

New FKM Materials Provide Low Fuel Swell and Low Compression Set

Normally, standard (A-type) 66% fluorine copolymer based FKM compounds like Parker's V0747-75 perform exceptionally well in hydrocarbon fuels, but swell excessively in fuels containing high levels of methanol, MTBE, or other oxygenates. As the fuel mixture approaches pure methanol, A-type FKM's swell to more than double their original size. The conventional solution to this problem has been for engineers to use higher fluorine-level GF-type FKM polymers. While this solves the fuel swell problem, compression set resistance is compromised.

Parker's material development efforts have resulted in three new production fluorocarbon compunds, V1262-65, V1263-75, and V1264-90, which combine the enhanced fuel resistance of GF polymers with the compression set resistance of A-type FKM's. No longer do fuel system equipment manufacturers need to sacrifice compression set for the required fuel resistance. The compression set and fuel resistance balance is shown in the diagram below.



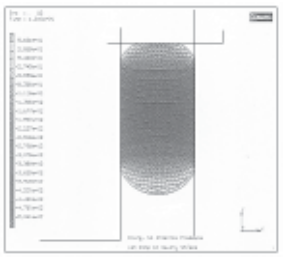
Generally, as fluorine content increases, fuel resistance improves while compression set resistance decreases. The new materials (V1262-65, V1263-75, and V1264-90) improve compression set with comparable fuel resistance of the 69% fluorine polymer.

Compression set = 70 hours @ 200C, 2-214 size O-Rings
% Swell = 70 hours @ Room Temp. in methanol

Full Offering of Materials and Seal Geometries

Along with the new FKM materials, Parker also offers fuel system materials made from nitriles, fluorocarbons, fluorosilicones and our Hifluor and Parofluor™ for the ultimate solvent resistance. Fuel system sealing solutions are available in standard and custom size O-Rings, extruded and cut seals, and engineered shapes.

Parker Seal also offers extensive non-linear finite element analysis (FEA) capability to solve sealing problems prior to design and fabrication. Parker not only has the solution of materials and seal geometries, we also have the analytical and technical support capabilites to solve demanding applications.



Typical fuel systems sealing applications include:
Swivels, Sensors, Fuel Tanks, Break-Away Swivels, Nozzle Seals, Fuel Pumps, Valves, Fuel Filters, Poppets, Fuel Lines, Flow Meters, Underground Storage Sytems, Fuel Injectors, Enhanced Vapor Recovery Systems, and Bulk Transportation Systems.

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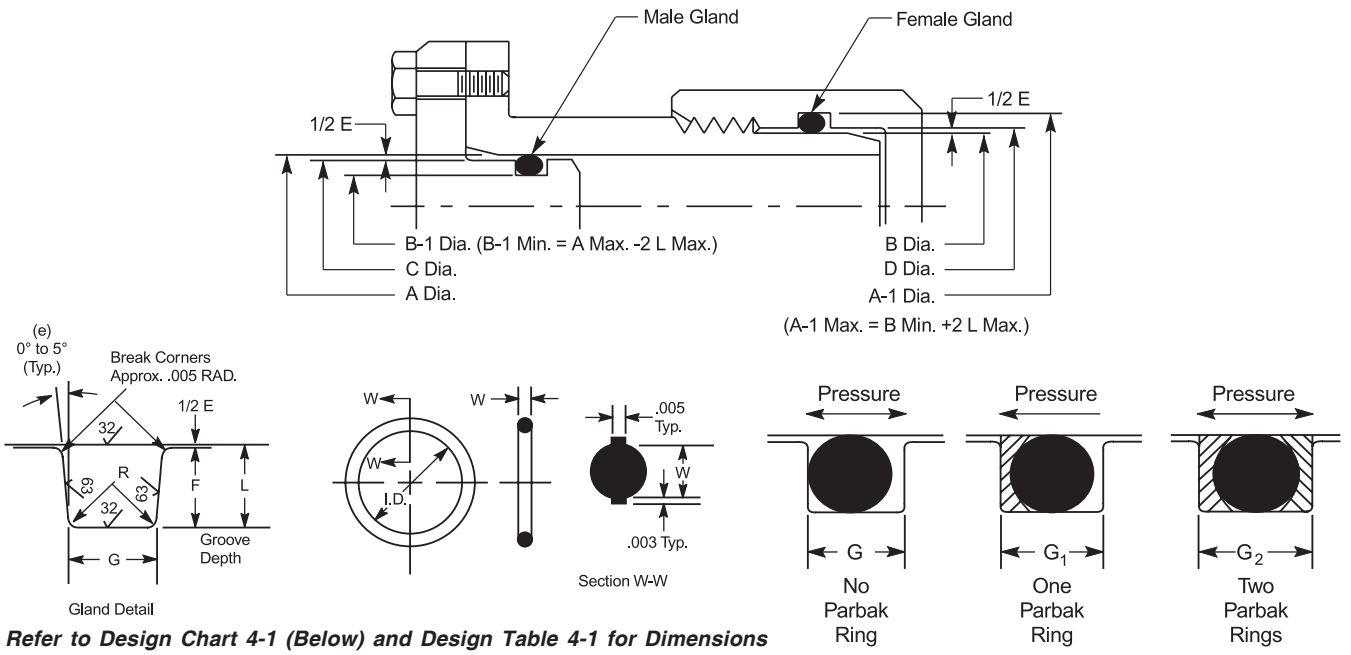
Design Chart 4-1: Industrial Static Seal Glands



Refer to Design Chart 4-1 (Below) and Design Table 4-1 for Dimensions

Design Chart 4-1: For Industrial O-Ring Static Seal Glands

O-Ring 2-Size AS568B-	W Cross-Section		L Gland Depth	Squeeze		E(a) Diametral Clearance	G Groove Width			R Groove Radius	Max. Eccentricity (b)
	Nominal	Actual		Actual	%		No Parbak Ring (G)	One Parbak Ring (G_1)	Two Parbak Rings (G_2)		
004 - 050	1/16	.070 ±.003	.050 - .052	.015 - .023	22 - 32	.002 - .005	.093 - .098	.138 - .143	.205 - .210	.005 - .015	.002
102 - 178	3/32	.103 ±.003	.081 - .083	.017 - .025	17 - 24	.002 - .005	.140 - .145	.171 - .176	.238 - .243	.005 - .015	.002
201 - 284	1/8	.139 ±.004	.111 - .113	.022 - .032	16 - 23	.003 - .006	.187 - .192	.208 - .213	.275 - .280	.010 - .025	.003
309 - 395	3/16	.210 ±.005	.170 - .173	.032 - .045	15 - 21	.003 - .006	.281 - .286	.311 - .316	.410 - .415	.020 - .035	.004
425 - 475	1/4	.275 ±.006	.226 - .229	.040 - .055	15 - 20	.004 - .007	.375 - .380	.408 - .413	.538 - .543	.020 - .035	.005

(a) Clearance (extrusion gap) must be held to a minimum consistent with design requirements for temperature range variation.
(b) Total indicator reading between groove and adjacent bearing surface.
(c) Reduce maximum diametral clearance 50% when using silicone or fluorosilicone O-Rings.
(d) For ease of assembly, when Parbaks are used, gland depth may be increased up to 5%.

Design Guide 4-1: Guide For Design Table 4-1

If Desired Dimension Is Known For	Select Closest Dimension In Column	Read Horizontally In Column	To Determine Dimension For
Bore Dia. Male Gland	A	B-1	Groove Dia. (Male Gland)
		C	Plug Dia. (Male Gland)
		G	Groove Width
Plug Dia. Male Gland	C	A	Bore Dia. (Male Gland)
		B-1	Groove (Male Gland)
		G	Groove Width
Tube OD Female Gland	B	A-1	Groove Dia. (Female Gland)
		D	Throat Dia. (Female Gland)
		G	Groove Width
Throat Dia.	D	A-1	Groove Dia. (Female Gland)
		B	Tube OD (Female Gland)
		G	Groove Width

Design Chart 4-1 provides the basis for calculating gland dimensions. For standard O-Ring sizes, these dimensions have been calculated and are listed in Design Table 4-1. The procedures for the use of Design Table 4-1 are outlined here.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.†

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
2-001	.029	.004	.040	.109	.105	.101		.040	.044		* .103	.042	.055
002	.042	.004	.050	.142	.138	.132	.002	.053	.059	.002	* .136	.055	.070
003	.056	.004	.060	.176	.172	.162		.067	.077		* .170	.069	.083
004	.070	.005		.210	.206	.181		.081	.106		* .204	.083	
005	.101	.005		.241	.237	.212		.112	.137		* .235	.114	
006	.114	.005		.254	.250	.225		.125	.150		* .248	.127	
007	.145	.005		.285	.281	.256		.156	.181		* .279	.158	
008	.176	.005		.316	.312	.287		.187	.212		* .310	.189	
009	.208	.005		.348	.343	.318		.218	.243		* .341	.220	
010	.239	.005		.379	.375	.350		.250	.275		* .373	.252	
011	.301	.005		.441	.437	.412		.312	.337		* .435	.314	
012	.364	.005		.504	.500	.475		.375	.400		* .498	.377	
013	.426	.005		.566	.562	.537		.437	.462		.560	.439	
014	.489	.005		.629	.625	.600		.500	.525		.623	.502	
015	.551	.007		.691	.687	.662		.562	.587		.685	.564	
016	.614	.009		.754	.750	.725		.625	.650		.748	.627	
017	.676	.009		.816	.812	.787		.687	.712		.810	.689	
018	.739	.009		.879	.875	.850		.750	.775		.873	.752	
019	.801	.009		.941	.937	.912		.812	.837		.935	.814	
020	.864	.009		1.004	1.000	.975		.875	.900		.998	.877	
021	.926	.009		1.066	1.062	1.037		.937	.962		1.060	.939	.093
022	.989	.010	.070	1.129	1.125	1.100	.002	1.000	1.025	.002	1.123	1.002	+.005
023	1.051	.010	±.003	1.191	1.187	1.162		1.062	1.087		1.185	1.064	-.000
024	1.114	.010		1.254	1.250	1.225		1.125	1.150		1.248	1.127	
025	1.176	.011		1.316	1.312	1.287		1.187	1.212		1.310	1.189	
026	1.239	.011		1.379	1.375	1.350		1.250	1.275		1.373	1.252	
027	1.301	.011		1.441	1.437	1.412		1.312	1.337		1.435	1.314	
028	1.364	.013		1.504	1.500	1.475		1.375	1.400		1.498	1.377	
029	1.489	.013		1.629	1.625	1.600		1.500	1.525		1.623	1.502	
030	1.614	.013		1.754	1.750	1.725		1.625	1.650		1.748	1.627	
031	1.739	.015		1.879	1.875	1.850		1.750	1.775		1.873	1.752	
032	1.864	.015		2.004	2.000	1.975		1.875	1.900		1.998	1.877	
033	1.989	.018		2.129	2.125	2.100		2.000	2.025		2.123	2.002	
034	2.114	.018		2.254	2.250	2.225		2.125	2.150		2.248	2.127	
035	2.239	.018		2.379	2.375	2.350		2.250	2.275		2.373	2.252	
036	2.364	.018		2.504	2.500	2.475		2.375	2.400		2.498	2.377	
037	2.489	.018		2.629	2.625	2.600		2.500	2.525		2.623	2.502	
038	2.614	.020		2.754	2.750	2.725		2.625	2.650		2.748	2.627	
039	2.739	.020		2.879	2.875	2.850		2.750	2.775		2.873	2.752	
040	2.864	.020		3.004	3.000	2.975		2.875	2.900		2.998	2.877	
041	2.989	.024		3.129	3.125	3.100		3.000	3.025		3.123	3.002	
042	3.239	.024		3.379	3.375	3.350		3.250	3.275		3.373	3.252	
043	3.489	.024		3.629	3.625	3.600		3.500	3.525		3.623	3.502	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
044	3.739	.027		3.879	3.875	3.850		3.750	3.775		3.873	3.752	
045	3.989	.027	.070	4.129	4.125	4.100	.002	4.000	4.025	.002	4.123	4.002	.093
046	4.239	.030	±.003	4.379	4.375	4.350		4.250	4.275		4.373	4.252	+.005
047	4.489	.030		4.629	4.625	4.600		4.500	4.525		4.623	4.502	-.000
048	4.739	.030		4.879	4.875	4.850		4.750	4.775		4.873	4.752	
049	4.989	.037		5.129	5.125	5.100		5.000	5.025		5.123	5.002	
050	5.239	.037		5.379	5.375	5.350		5.250	5.275		5.373	5.252	
102	.049	.005		.255	.247	.224		.062	.085		* .245	.064	
103	.081	.005		.287	.278	.256		.094	.116		* .276	.095	
104	.112	.005		.318	.310	.287		.125	.148		* .308	.127	
105	.143	.005		.349	.342	.318		.156	.180		* .340	.158	
106	.174	.005		.380	.374	.349		.187	.212		* .372	.189	
107	.206	.005		.412	.405	.381		.219	.243		* .403	.221	
108	.237	.005		.443	.437	.412		.250	.275		* .435	.252	
109	.299	.005		.505	.500	.474		.312	.338		* .498	.314	
110	.362	.005		.568	.562	.537		.375	.400		* .560	.377	
111	.424	.005		.630	.625	.599		.437	.463		* .623	.439	
112	.487	.005		.693	.687	.662		.500	.525		* .685	.502	
113	.549	.007		.755	.750	.724		.562	.588		* .748	.564	
114	.612	.009		.818	.812	.787		.625	.650		.810	.627	
115	.674	.009		.880	.875	.849		.687	.713		.873	.689	
116	.737	.009		.943	.937	.912		.750	.775		.935	.752	
117	.799	.010		1.005	1.000	.974		.812	.838		.998	.814	
118	.862	.010		1.068	1.062	1.037		.875	.900		1.060	.877	.140
119	.924	.010	.103	1.130	1.125	1.099	.002	.937	.963	.002	1.123	.939	+.005
120	.987	.010	±.003	1.193	1.187	1.162		1.000	1.025		1.185	1.002	-.000
121	1.049	.010		1.255	1.250	1.224		1.062	1.088		1.248	1.064	
122	1.112	.010		1.318	1.312	1.287		1.125	1.150		1.310	1.127	
123	1.174	.012		1.380	1.375	1.349		1.187	1.213		1.373	1.189	
124	1.237	.012		1.443	1.437	1.412		1.250	1.275		1.435	1.252	
125	1.299	.012		1.505	1.500	1.474		1.312	1.338		1.498	1.314	
126	1.362	.012		1.568	1.562	1.537		1.375	1.400		1.560	1.377	
127	1.424	.012		1.630	1.625	1.599		1.437	1.463		1.623	1.439	
128	1.487	.012		1.693	1.687	1.662		1.500	1.525		1.685	1.502	
129	1.549	.015		1.755	1.750	1.724		1.562	1.588		1.748	1.564	
130	1.612	.015		1.818	1.812	1.787		1.625	1.650		1.810	1.627	
131	1.674	.015		1.880	1.875	1.849		1.687	1.713		1.873	1.689	
132	1.737	.015		1.943	1.937	1.912		1.750	1.775		1.935	1.752	
133	1.799	.015		2.005	2.000	1.974		1.812	1.838		1.998	1.814	
134	1.862	.015		2.068	2.062	2.037		1.875	1.900		2.060	1.877	
135	1.925	.017		2.131	2.125	2.099		1.937	1.963		2.123	1.939	
136	1.987	.017		2.193	2.187	2.162		2.000	2.025		2.185	2.002	
137	2.050	.017		2.256	2.250	2.224		2.062	2.088		2.248	2.064	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Zatkoff SEALS & PACKINGS

Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
138	2.112	.017		2.318	2.312	2.287		2.125	2.150		2.310	2.127	
139	2.175	.017		2.381	2.375	2.349		2.187	2.213		2.373	2.189	
140	2.237	.017		2.443	2.437	2.412		2.250	2.275		2.435	2.252	
141	2.300	.020		2.506	2.500	2.474		2.312	2.338		2.498	2.315	
142	2.362	.020		2.568	2.562	2.537		2.375	2.400		2.560	2.377	
143	2.425	.020		2.631	2.625	2.599		2.437	2.463		2.623	2.439	
144	2.487	.020		2.693	2.687	2.662		2.500	2.525		2.685	2.502	
145	2.550	.020		2.756	2.750	2.724		2.562	2.588		2.748	2.564	
146	2.612	.020		2.818	2.812	2.787		2.625	2.650		2.810	2.627	
147	2.675	.022		2.881	2.875	2.849		2.687	2.713		2.873	2.689	
148	2.737	.022		2.943	2.937	2.912		2.750	2.775		2.935	2.752	
149	2.800	.022		3.006	3.000	2.974		2.812	2.838		2.998	2.814	
150	2.862	.022		3.068	3.062	3.037		2.875	2.900		3.060	2.877	
151	2.987	.024		3.193	3.187	3.162		3.000	3.025		3.185	3.002	
152	3.237	.024		3.443	3.437	3.412		3.250	3.275		3.435	3.252	
153	3.487	.024		3.693	3.687	3.662		3.500	3.525		3.685	3.502	
154	3.737	.028	.103	3.943	3.937	3.912	.002	3.750	3.775	.002	3.935	3.752	.140
155	3.987	.028	±.003	4.193	4.187	4.162		4.000	4.025		4.185	4.002	+.005
156	4.237	.030		4.443	4.437	4.412		4.250	4.275		4.435	4.252	-.000
157	4.487	.030		4.693	4.687	4.662		4.500	4.525		4.685	4.502	
158	4.737	.030		4.943	4.937	4.912		4.750	4.775		4.935	4.752	
159	4.987	.035		5.193	5.187	5.162		5.000	5.025		5.185	5.002	
160	5.237	.035		5.443	5.437	5.412		5.250	5.275		5.435	5.252	
161	5.487	.035		5.693	5.687	5.662		5.500	5.525		5.685	5.502	
162	5.737	.035		5.943	5.937	5.912		5.750	5.775		5.935	5.752	
163	5.987	.035		6.193	6.187	6.162		6.000	6.025		6.185	6.002	
164	6.237	.040		6.443	6.437	6.412		6.250	6.275		6.435	6.252	
165	6.487	.040		6.693	6.687	6.662		6.500	6.525		6.685	6.502	
166	6.737	.040		6.943	6.937	6.912		6.750	6.775		6.935	6.752	
167	6.987	.040		7.193	7.187	7.162		7.000	7.025		7.185	7.002	
168	7.237	.045		7.443	7.437	7.412		7.250	7.275		7.435	7.252	
169	7.487	.045		7.693	7.687	7.662		7.500	7.525		7.685	7.502	
170	7.737	.045		7.943	7.937	7.912		7.750	7.775		7.935	7.752	
171	7.987	.045		8.193	8.187	8.162		8.000	8.025		8.185	8.002	
172	8.237	.050		8.443	8.437	8.412		8.250	8.275		8.435	8.252	
173	8.487	.050		8.693	8.687	8.662		8.500	8.525		8.685	8.502	
174	8.737	.050		8.943	8.937	8.912		8.750	8.775		8.935	8.752	
175	8.987	.050		9.193	9.187	9.162		9.000	9.025		9.185	9.002	
176	9.237	.055		9.443	9.437	9.412		9.250	9.275		9.435	9.252	
177	9.487	.055		9.693	9.687	9.662		9.500	9.525		9.685	9.502	
178	9.737	.055		9.943	9.937	9.912		9.750	9.775		9.935	9.752	
201	.171	.005	.139	.449	.437	.409		.187	.215		* .434	.190	.187
202	.234	.005	±.004	.512	.500	.472	.002	.250	.278	.002	* .497	.253	+.005
203	.296	.005		.574	.562	.534		.312	.340		* .559	.315	-.000

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
204	.359	.005		.637	.625	.597		.375	.403		.622	.378	
205	.421	.005		.699	.687	.659		.437	.465		.684	.440	
206	.484	.005		.762	.750	.722		.500	.528		.747	.503	
207	.546	.007		.824	.812	.784		.562	.590		.809	.565	
208	.609	.009		.887	.875	.847		.625	.653		.872	.628	
209	.671	.009		.949	.937	.909		.687	.715		.934	.690	
210	.734	.010		1.012	1.000	.972		.750	.778		.997	.753	
211	.796	.010		1.074	1.062	1.034		.812	.840		1.059	.815	
212	.859	.010		1.137	1.125	1.097		.875	.903		1.122	.878	
213	.921	.010		1.199	1.187	1.159		.937	.965		1.184	.940	
214	.984	.010		1.262	1.250	1.222		1.000	1.028		1.247	1.003	
215	1.046	.010		1.324	1.312	1.284		1.062	1.090		1.309	1.065	
216	1.109	.012		1.387	1.375	1.347		1.125	1.153		1.372	1.128	
217	1.171	.012		1.449	1.437	1.409		1.187	1.215		1.434	1.190	
218	1.234	.012		1.512	1.500	1.472		1.250	1.278		1.497	1.253	
219	1.296	.012		1.574	1.562	1.534		1.312	1.340		1.559	1.315	
220	1.359	.012	.139	1.637	1.625	1.597	.002	1.375	1.403	.002	1.622	1.378	.187
221	1.421	.012	±.004	1.700	1.687	1.659		1.437	1.465		1.684	1.440	+.005
222	1.484	.015		1.762	1.750	1.722		1.500	1.528		1.747	1.503	-.000
223	1.609	.015		1.887	1.875	1.847		1.625	1.653		1.872	1.628	
224	1.734	.015		2.012	2.000	1.972		1.750	1.778		1.997	1.753	
225	1.859	.015		2.137	2.125	2.097		1.875	1.903		2.122	1.878	
226	1.984	.018		2.262	2.250	2.222		2.000	2.028		2.247	2.003	
227	2.109	.018		2.387	2.375	2.347		2.125	2.153		2.372	2.128	
228	2.234	.020		2.512	2.500	2.472		2.250	2.278		2.497	2.253	
229	2.359	.020		2.637	2.625	2.597		2.375	2.403		2.622	2.378	
230	2.484	.020		2.762	2.750	2.722		2.500	2.528		2.747	2.503	
231	2.609	.020		2.887	2.875	2.847		2.625	2.653		2.872	2.628	
232	2.734	.024		3.012	3.000	2.972		2.750	2.778		2.997	2.753	
233	2.859	.024		3.137	3.125	3.097		2.875	2.903		3.122	2.878	
234	2.984	.024		3.262	3.250	3.222		3.000	3.028		3.247	3.003	
235	3.109	.024		3.387	3.375	3.347		3.125	3.153		3.372	3.128	
236	3.234	.024		3.512	3.500	3.472		3.250	3.278		3.497	3.253	
237	3.359	.024		3.637	3.625	3.597		3.375	3.403		3.622	3.378	
238	3.484	.024		3.762	3.750	3.722		3.500	3.528		3.747	3.503	
239	3.609	.028		3.887	3.875	3.847		3.625	3.653		3.872	3.628	
240	3.734	.028		4.012	4.000	3.972		3.750	3.778		3.997	3.753	
241	3.859	.028		4.137	4.125	4.097		3.875	3.903		4.122	3.878	
242	3.984	.028		4.262	4.250	4.222		4.000	4.028		4.247	4.003	
243	4.109	.028		4.387	4.375	4.347		4.125	4.153		4.372	4.128	
244	4.234	.030		4.512	4.500	4.472		4.250	4.278		4.497	4.253	
245	4.359	.030		4.637	4.625	4.597		4.375	4.403		4.622	4.378	
246	4.484	.030		4.762	4.750	4.722		4.500	4.528		4.747	4.503	
247	4.609	.030		4.887	4.875	4.847		4.625	4.653		4.872	4.628	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
248	4.734	.030		5.012	5.000	4.972		4.750	4.778		4.997	4.753	
249	4.859	.035		5.137	5.125	5.097		4.875	4.903		5.122	4.878	
250	4.984	.035		5.262	5.250	5.222		5.000	5.028		5.247	5.003	
251	5.109	.035		5.387	5.375	5.347		5.125	5.153		5.372	5.128	
252	5.234	.035		5.512	5.500	5.472		5.250	5.278		5.497	5.253	
253	5.359	.035		5.637	5.625	5.597		5.375	5.403		5.622	5.378	
254	5.484	.035		5.762	5.750	5.722		5.500	5.528		5.747	5.503	
255	5.609	.035		5.887	5.875	5.847		5.625	5.653		5.872	5.628	
256	5.734	.035		6.012	6.000	5.972		5.750	5.778		5.997	5.753	
257	5.859	.035		6.137	6.125	6.097		5.875	5.903		6.122	5.878	
258	5.984	.035		6.262	6.250	6.222		6.000	6.028		6.247	6.003	
259	6.234	.040		6.512	6.500	6.472		6.250	6.278		6.497	6.253	
260	6.484	.040		6.762	6.750	6.722		6.500	6.528		6.747	6.503	
261	6.734	.040		7.012	7.000	6.972		6.750	6.778		6.997	6.753	
262	6.984	.040		7.262	7.250	7.222		7.000	7.028		7.247	7.003	
263	7.234	.045		7.512	7.500	7.472		7.250	7.278		7.497	7.253	
264	7.484	.045		7.762	7.750	7.722		7.500	7.528		7.747	7.503	
265	7.734	.045	.139	8.012	8.000	7.972	.002	7.750	7.778	.002	7.997	7.753	.187
266	7.984	.045	±.004	8.262	8.250	8.222		8.000	8.028		8.247	8.003	+.005
267	8.234	.050		8.512	8.500	8.472		8.250	8.278		8.497	8.253	-.000
268	8.484	.050		8.762	8.750	8.722		8.500	8.528		8.747	8.503	
269	8.734	.050		9.012	9.000	8.972		8.750	8.778		8.997	8.753	
270	8.984	.050		9.262	9.250	9.222		9.000	9.028		9.247	9.003	
271	9.234	.055		9.512	9.500	9.472		9.250	9.278		9.497	9.253	
272	9.484	.055		9.762	9.750	9.722		9.500	9.528		9.747	9.503	
273	9.734	.055		10.012	10.000	9.972		9.750	9.778		9.997	9.753	
274	9.984	.055		10.262	10.250	10.222		10.000	10.028		10.247	10.003	
275	10.484	.055		10.762	10.750	10.722		10.500	10.528		10.747	10.503	
276	10.984	.065		11.262	11.250	11.222		11.000	11.028		11.247	11.003	
277	11.484	.065		11.762	11.750	11.722		11.500	11.528		11.747	11.503	
278	11.984	.065		12.262	12.250	12.222		12.000	12.028		12.247	12.003	
279	12.984	.065		13.262	13.250	13.222		13.000	13.028		13.247	13.003	
280	13.984	.065		14.262	14.250	14.222		14.000	14.028		14.247	14.003	
281	14.984	.065		15.262	15.250	15.222		15.000	15.028		15.247	15.003	
282	15.955	.075		16.233	16.250	16.222		16.000	16.028		16.247	16.003	
283	16.955	.080		17.233	17.250	17.222		17.000	17.028		17.247	17.003	
284	17.955	.085		18.233	18.250	18.222		18.000	18.028		18.247	18.003	
309	.412	.005		.832	.812	.777		.437	.472		* .809	.440	
310	.475	.005	.210	.895	.875	.840		.500	.535		* .872	.503	.281
311	.537	.007	±.005	.957	.937	.902	.004	.562	.597	.004	* .934	.565	+.005
312	.600	.009		1.020	1.000	.965		.625	.660		.997	.628	-.000
313	.662	.009		1.082	1.062	1.027		.687	.722		1.059	.690	
314	.725	.010		1.145	1.125	1.090		.750	.785		1.122	.753	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
315	.787	.010		1.207	1.187	1.152		.812	.847		1.184	.815	
316	.850	.010		1.270	1.250	1.215		.875	.910		1.247	.878	
317	.912	.010		1.332	1.312	1.277		.937	.972		1.309	.940	
318	.975	.010		1.395	1.375	1.340		1.000	1.035		1.372	1.003	
319	1.037	.010		1.457	1.437	1.402		1.062	1.097		1.434	1.065	
320	1.100	.012		1.520	1.500	1.465		1.125	1.160		1.497	1.128	
321	1.162	.012		1.582	1.562	1.527		1.187	1.222		1.559	1.190	
322	1.225	.012		1.645	1.625	1.590		1.250	1.285		1.622	1.253	
323	1.287	.012		1.707	1.687	1.652		1.312	1.347		1.684	1.315	
324	1.350	.012		1.770	1.750	1.715		1.375	1.410		1.747	1.378	
325	1.475	.015		1.895	1.875	1.840		1.500	1.535		1.872	1.503	
326	1.600	.015		2.020	2.000	1.965		1.625	1.660		1.997	1.628	
327	1.725	.015		2.145	2.125	2.090		1.750	1.785		2.122	1.753	
328	1.850	.015		2.270	2.250	2.215		1.875	1.910		2.247	1.878	
329	1.975	.018		2.395	2.375	2.340		2.000	2.035		2.372	2.003	
330	2.100	.018		2.520	2.500	2.465		2.125	2.160		2.497	2.128	
331	2.225	.018		2.645	2.625	2.590		2.250	2.285		2.622	2.253	
332	2.350	.018		2.770	2.750	2.715		2.375	2.410		2.747	2.378	
333	2.475	.020		2.895	2.875	2.840		2.500	2.535		2.872	2.503	
334	2.600	.020		3.020	3.000	2.965		2.625	2.660		2.997	2.628	
335	2.725	.020		3.145	3.125	3.090		2.750	2.785		3.122	2.753	.281
336	2.850	.020	.210	3.270	3.250	3.215	.004	2.875	2.910	.004	3.247	2.878	+.005
337	2.975	.024	±.005	3.395	3.375	3.340		3.000	3.035		3.372	3.003	-.000
338	3.100	.024		3.520	3.500	3.465		3.125	3.160		3.497	3.128	
339	3.225	.024		3.645	3.625	3.590		3.250	3.285		3.622	3.253	
340	3.350	.024		3.770	3.750	3.715		3.375	3.410		3.747	3.378	
341	3.475	.024		3.895	3.875	3.840		3.500	3.535		3.872	3.502	
342	3.600	.028		4.020	4.000	3.965		3.625	3.660		3.997	3.628	
343	3.725	.028		4.145	4.125	4.090		3.750	3.785		4.122	3.753	
344	3.850	.028		4.270	4.250	4.215		3.875	3.910		4.247	3.878	
345	3.975	.028		4.395	4.375	4.340		4.000	4.035		4.372	4.003	
346	4.100	.028		4.520	4.500	4.465		4.125	4.160		4.497	4.128	
347	4.225	.030		4.645	4.625	4.590		4.250	4.285		4.622	4.253	
348	4.350	.030		4.770	4.750	4.717		4.375	4.410		4.747	4.378	
349	4.475	.030		4.895	4.875	4.840		4.500	4.535		4.872	4.503	
350	4.600	.030		5.020	5.000	4.965		4.625	4.660		4.997	4.628	
351	4.725	.030		5.145	5.125	5.090		4.750	4.785		5.122	4.753	
352	4.850	.030		5.270	5.250	5.215		4.875	4.910		5.247	4.878	
353	4.975	.037		5.395	5.375	5.340		5.000	5.035		5.372	5.003	
354	5.100	.037		5.520	5.500	5.465		5.125	5.160		5.497	5.128	
355	5.225	.037		5.645	5.625	5.590		5.250	5.285		5.622	5.253	
356	5.350	.037		5.770	5.750	5.715		5.375	5.410		5.747	5.378	
357	5.475	.037		5.895	5.875	5.840		5.500	5.535		5.872	5.503	
358	5.600	.037		6.020	6.000	5.965		5.625	5.660		5.997	5.628	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
359	5.725	.037		6.145	6.125	6.090		5.750	5.785		6.122	5.753	
360	5.850	.037		6.270	6.250	6.215		5.875	5.910		6.247	5.878	
361	5.975	.037		6.395	6.375	6.340		6.000	6.035		6.372	6.003	
362	6.225	.040		6.645	6.625	6.590		6.250	6.285		6.622	6.253	
363	6.475	.040		6.895	6.875	6.840		6.500	6.535		6.872	6.503	
364	6.725	.040		7.145	7.125	7.090		6.750	6.785		7.122	6.753	
365	6.975	.040		7.395	7.375	7.340		7.000	7.035		7.372	7.003	
366	7.225	.045		7.645	7.625	7.590		7.250	7.285		7.622	7.253	
367	7.475	.045		7.895	7.875	7.840		7.500	7.535		7.872	7.503	
368	7.725	.045		8.145	8.125	8.090		7.750	7.785		8.122	7.753	
369	7.975	.045		8.395	8.375	8.340		8.000	8.035		8.372	8.003	
370	8.225	.050		8.645	8.625	8.590		8.250	8.285		8.622	8.253	
371	8.475	.050		8.895	8.875	8.840		8.500	8.535		8.872	8.503	
372	8.725	.050		9.145	9.125	9.090		8.750	8.785		9.122	8.753	
373	8.975	.050		9.395	9.375	9.340		9.000	9.035		9.372	9.003	
374	9.225	.055		9.645	9.625	9.590		9.250	9.285		9.622	9.253	
375	9.475	.055		9.895	9.875	9.840		9.500	9.535		9.872	9.503	
376	9.725	.055		10.145	10.125	10.090		9.750	9.785		10.122	9.753	.281
377	9.975	.055	.210	10.395	10.375	10.340	.004	10.000	10.035	.004	10.372	10.003	+.005
378	10.475	.060	±.005	10.895	10.875	10.840		10.500	10.535		10.872	10.503	-.000
379	10.975	.060		11.395	11.375	11.340		11.000	11.035		11.372	11.003	
380	11.475	.065		11.895	11.875	11.840		11.500	11.535		11.872	11.503	
381	11.975	.065		12.395	12.375	12.340		12.000	12.035		12.372	12.003	
382	12.975	.065		13.395	13.375	13.340		13.000	13.035		13.372	13.003	
383	13.975	.070		14.395	14.375	14.340		14.000	14.035		14.372	14.003	
384	14.975	.070		15.395	15.375	15.340		15.000	15.035		15.372	15.003	
385	15.955	.075		16.375	16.375	16.340		16.000	16.035		16.372	16.003	
386	16.955	.080		17.375	17.375	17.340		17.000	17.035		17.372	17.003	
387	17.955	.085		18.375	18.375	18.340		18.000	18.035		18.372	18.003	
388	18.955	.090		19.373	19.375	19.340		19.000	19.035		19.372	19.003	
389	19.955	.095		20.373	20.375	20.340		20.000	20.035		20.372	20.003	
390	20.955	.095		21.373	21.375	21.340		21.000	21.035		21.372	21.003	
391	21.955	.100		22.373	22.375	22.340		22.000	22.035		22.372	22.003	
392	22.940	.105		23.360	23.375	23.340		23.000	23.035		23.372	23.003	
393	23.940	.110		24.360	24.375	24.340		24.000	24.035		24.372	24.003	
394	24.940	.115		25.360	25.375	25.340		25.000	25.035		25.372	25.003	
395	25.940	.120		26.360	26.375	26.340		26.000	26.035		26.372	26.003	
425	4.475	.033		5.025	5.000	4.952		4.500	4.548		4.996	4.504	
426	4.600	.033		5.150	5.125	5.077		4.625	4.673		5.121	4.629	.375
427	4.725	.033	.275	5.275	5.250	5.202	.004	4.750	4.798	.004	5.246	4.754	+.005
428	4.850	.033	±.006	5.400	5.375	5.327		4.875	4.923		5.371	4.879	-.000
429	4.975	.037		5.525	5.500	5.452		5.000	5.048		5.496	5.004	
430	5.100	.037		5.650	5.625	5.577		5.125	5.173		5.621	5.129	
431	5.225	.037		5.775	5.750	5.702		5.250	5.298		5.746	5.254	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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Design Table 4-1: Gland Dimensions For Industrial O-Ring Static Seals, 103.5 Bar (1500 PSI) Max.† – *(continued)*

O-Ring Size	Dimensions				A	A-1		B	B-1		C	D	G†
					Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width
Parker No. 2-	ID	±	W	Mean OD (Ref)	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
432	5.350	.037		5.900	5.875	5.827		5.375	5.423		5.871	5.379	
433	5.475	.037		6.025	6.000	5.952		5.500	5.548		5.996	5.504	
434	5.600	.037		6.150	6.125	6.077		5.625	5.673		6.121	5.629	
435	5.725	.037		6.275	6.250	6.202		5.750	5.798		6.246	5.754	
436	5.850	.037		6.400	6.375	6.327		5.875	5.923		6.371	5.879	
437	5.975	.037		6.525	6.500	6.452		6.000	6.048		6.496	6.004	
438	6.225	.040		6.775	6.750	6.702		6.250	6.298		6.746	6.254	
439	6.475	.040		7.025	7.000	6.952		6.500	6.548		6.996	6.504	
440	6.725	.040		7.275	7.250	7.202		6.750	6.798		7.246	6.754	
441	6.975	.040		7.525	7.500	7.452		7.000	7.048		7.496	7.004	
442	7.225	.045		7.775	7.750	7.702		7.250	7.298		7.746	7.254	
443	7.475	.045		8.025	8.000	7.952		7.500	7.548		7.996	7.504	
444	7.725	.045		8.275	8.250	8.202		7.750	7.798		8.246	7.754	
445	7.975	.045		8.525	8.500	8.452		8.000	8.048		8.496	8.004	
446	8.475	.055		9.025	9.000	8.952		8.500	8.548		8.996	8.504	
447	8.975	.055		9.525	9.500	9.452		9.000	9.048		9.496	9.004	
448	9.475	.055		10.025	10.000	9.952		9.500	9.548		9.996	9.504	
449	9.975	.055		10.525	10.500	10.452		10.000	10.048		10.496	10.000	
450	10.475	.060		11.025	11.000	10.952		10.500	10.548		10.996	10.504	
451	10.975	.060		11.525	11.500	11.452		11.000	11.048		11.496	11.004	
452	11.475	.060		12.025	12.000	11.952		11.500	11.548		11.996	11.504	
453	11.975	.060		12.525	12.500	12.452		12.000	12.048		12.496	12.004	.375
454	12.475	.060	.275	13.025	13.000	12.952	.004	12.500	12.548	.004	12.996	12.504	+.005
455	12.975	.060	±.006	13.525	13.500	13.452		13.000	13.048		13.496	13.004	-.000
456	13.475	.070		14.025	14.000	13.952		13.500	13.548		13.996	13.504	
457	13.975	.070		14.525	14.500	14.452		14.000	14.048		14.496	14.004	
458	14.475	.070		15.025	15.000	14.952		14.500	14.548		14.996	14.504	
459	14.975	.070		15.525	15.500	15.452		15.000	15.048		15.496	15.004	
460	15.475	.070		16.025	16.000	15.952		15.500	15.548		15.996	15.504	
461	15.955	.075		16.505	16.500	16.452		16.000	16.048		16.496	16.004	
462	16.455	.075		17.005	17.000	16.952		16.500	16.548		16.996	16.504	
463	16.955	.080		17.505	17.500	17.452		17.000	17.048		17.496	17.004	
464	17.455	.085		18.005	18.000	17.952		17.500	17.548		17.996	17.504	
465	17.955	.085		18.505	18.500	18.452		18.000	18.048		18.496	18.004	
466	18.455	.085		19.005	19.000	18.952		18.500	18.548		18.996	18.504	
467	18.955	.090		19.505	19.500	19.452		19.000	19.048		19.496	19.004	
468	19.455	.090		20.005	20.000	19.952		19.500	19.548		19.996	19.504	
469	19.955	.095		20.505	20.500	20.452		20.000	20.048		20.496	20.004	
470	20.955	.095		21.505	21.500	21.452		21.000	21.048		21.496	21.004	
471	21.955	.100		22.505	22.500	22.452		22.000	22.048		22.496	22.004	
472	22.940	.105		23.490	23.500	23.452		23.000	23.048		23.496	23.004	
473	23.940	.110		24.490	24.500	24.452		24.000	24.048		24.496	24.004	
474	24.940	.115		25.490	25.500	25.452		25.000	25.048		25.496	25.004	
475	25.940	.120		26.490	26.500	26.452		26.000	26.048		26.496	26.004	

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 4-1 for groove widths where back-up rings must be used.

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

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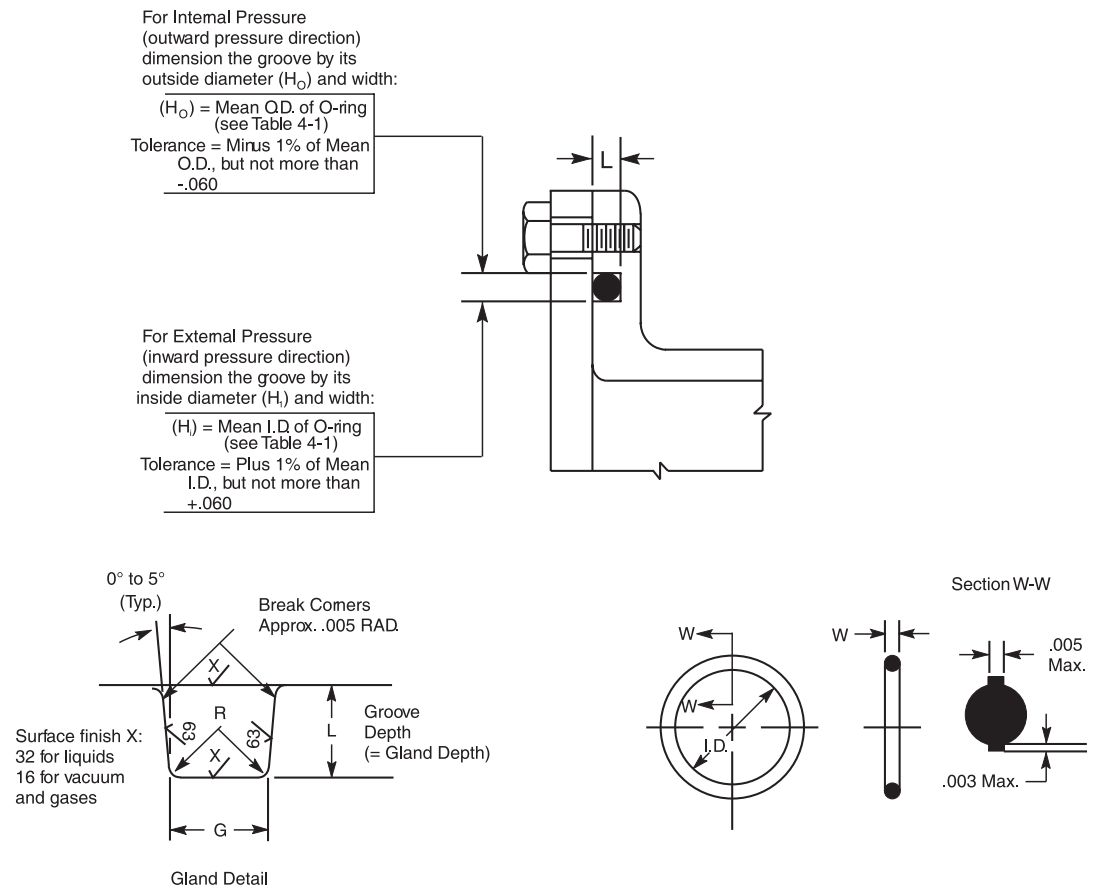
Design Chart 4-2: Face Seal Glands



Design Chart 4-2: For O-Ring Face Seal Glands

(These dimensions are intended primarily for face type O-Ring seals and low temperature applications)

O-Ring 2-Size AS568B-	W Cross-Section		L Gland Depth	Squeeze		G Groove Width		R Groove Radius
	Nominal	Actual		Actual	%	Liquids	Vacuum and Gases	
004 - 050	1/16	.070 ±.003	.050 - .054	.013 - .023	19 - 32	.101 - .107	.084 - .089	.005 - .015
102 - 178	3/32	.103 ±.003	.074 - .080	.020 - .032	20 - 30	.136 - .142	.120 - .125	.005 - .015
201 - 284	1/8	.139 ±.004	.101 - .107	.028 - .042	20 - 30	.177 - .187	.158 - .164	.010 - .025
309 - 395	3/16	.210 ±.005	.152 - .162	.043 - .063	21 - 30	.270 - .290	.239 - .244	.020 - .035
425 - 475	1/4	.275 ±.006	.201 - .211	.058 - .080	21 - 29	.342 - .362	.309 - .314	.020 - .035
Special	3/8	.375 ±.007	.276 - .286	.082 - .108	22 - 28	.475 - .485	.419 - .424	.030 - .045
Special	1/2	.500 ±.008	.370 - .380	.112 - .138	22 - 27	.638 - .645	.560 - .565	.030 - .045

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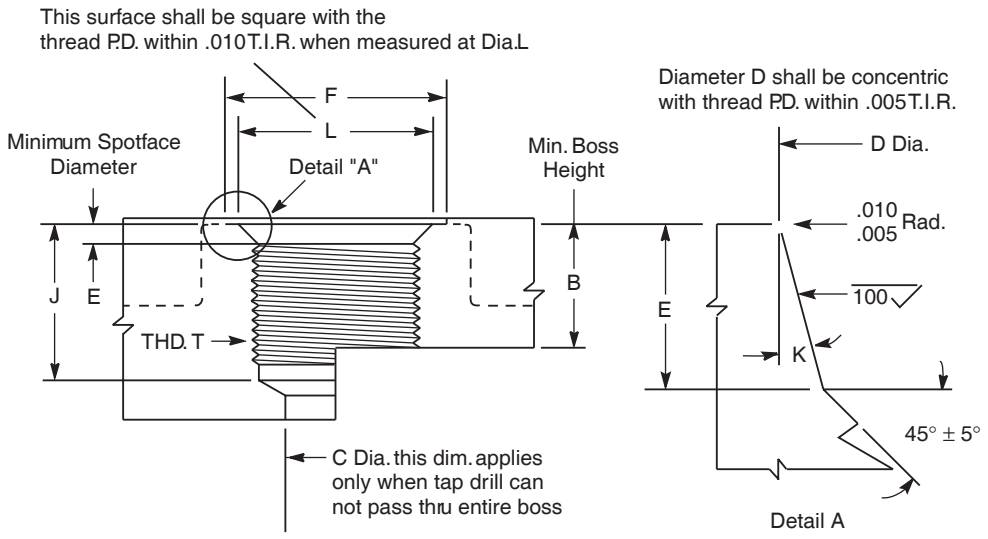
Design Table 4-3: Tube Fitting Boss Seals

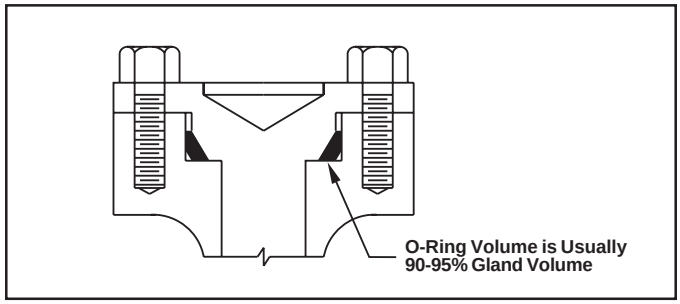


Finished tapered counterbore (Detail A) shall be be free from longitudinal and spiral tool marks. Annular tool marks up to 100 micro-inches maximum will be permissible.

Design Table 4-3: Boss Dimensions For Industrial Straight Thread Tube Fitting O-Ring Gaskets Per SAE J1926 & MS16142

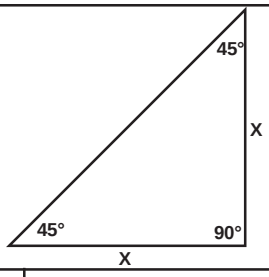
Parker O-Ring Size No.	Actual O-Ring Dimensions W	Actual O-Ring Dimensions ID	Tube OD	Thread T		B Min. Thread Depth	C Min.	D +.005 -.000	E +.015 -.000	F Min.	J Min.	K ±1°	L Min.
3-902	.064 ±.003	.239 ±.005	1/8	5/16-24	UNF-2B	.390	.062	.358	.074	.672	.468	12°	.438
3-903	.064 ±.003	.301 ±.005	3/16	3/8-24	UNF-2B	.390	.125	.421	.074	.750	.468	12°	.500
3-904	.072 ±.003	.351 ±.005	1/4	7/16-20	UNF-2B	.454	.172	.487	.093	.828	.547	12°	.563
3-905	.072 ±.003	.414 ±.005	5/16	1/2-20	UNF-2B	.454	.234	.550	.093	.906	.547	12°	.625
3-906	.078 ±.003	.468 ±.005	3/8	9/16-18	UNF-2B	.500	.297	.616	.097	.969	.609	12°	.688
3-908	.087 ±.003	.644 ±.009	1/2	3/4-16	UNF-2B	.562	.391	.811	.100	1.188	.688	15°	.875
3-910	.097 ±.003	.755 ±.009	5/8	7/8-14	UNF-2B	.656	.484	.942	.100	1.344	.781	15°	1.000
3-912	.116 ±.004	.924 ±.009	3/4	1 1/16-12	UN-2B	.750	.609	1.148	.130	1.625	.906	15°	1.250
3-913	.116 ±.004	.986 ±.010	13/16		UN-2B								
3-914	.116 ±.004	1.047 ±.010	7/8	1 3-16-12	UN-2B	.750	.719	1.273	.130	1.765	.906	15°	1.375
3-916	.116 ±.004	1.171 ±.010	1	1 5/16-12	UN-2B	.750	.844	1.398	.130	1.910	.906	15°	1.500
3-918	.116 ±.004	1.355 ±.012	1 1/8		UN-2B								
3-920	.118 ±.004	1.475 ±.014	1 1/4	1 5/8-12	UN-2B	.750	1.078	1.713	.132	2.270	.906	15°	1.875
3-924	.118 ±.004	1.720 ±.014	1 1/2	1 7/8-12	UN-2B	.750	1.312	1.962	.132	2.560	.906	15°	2.125
3-932	.118 ±.004	2.337 ±.018	2	2 1/2-12	UN-2B	.750	1.781	2.587	.132	3.480	.906	15°	2.750

Figure 10: Crush Installation

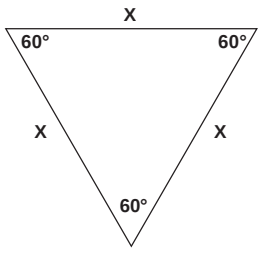


This use of an O-Ring is a variation of the static seal. The O-Ring is crushed into a space having a cross-section different from that of a standard gland – for example, triangular. While it is an effective seal, the O-Ring is permanently deformed and therefore generally considered non-reusable. See Figure 10.

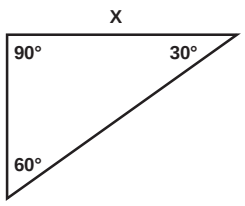
O-Ring Crush Groove Dimensions



C.S.	% FILL		
	80%	85%	90%
	X	X	X
0.070	0.0981	0.095	0.0925
0.103	0.1443	0.140	0.1361
0.139	0.1948	0.189	0.1836
0.210	0.2943	0.286	0.2774
0.275	0.3853	0.374	0.3663
0.375	0.5255	0.510	0.4955



C.S.	% FILL		
	80%	85%	90%
	X	X	X
0.070	0.1054	0.1022	0.0994
0.103	0.1551	0.1505	0.1462
0.139	0.2093	0.2031	0.1973
0.210	0.3162	0.3068	0.2981
0.275	0.4141	0.4017	0.3904
0.375	0.5647	0.5478	0.5324



C.S.	% FILL		
	80%	85%	90%
	X	X	X
0.070	0.0745	0.0723	0.0703
0.103	0.1097	0.1064	0.1034
0.139	0.1480	0.1436	0.1345
0.210	0.2236	0.2169	0.2108
0.275	0.2928	0.2841	0.2761
0.375	0.3993	0.3874	0.3764

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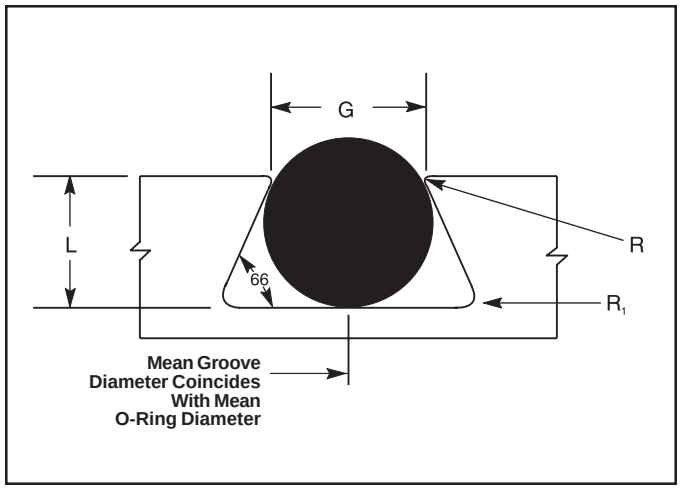
Design Chart 4-4: Dovetail Grooves

It is often necessary to provide some mechanical means for holding an O-Ring in a face seal groove during assembly and maintenance of equipment. An undercut or dovetail groove has proven beneficial in many applications to keep the O-Ring in place. This is an expensive groove to machine, however, and thus should be used only when absolutely necessary.

It should be noted that although this method has been used successfully, it is not generally recommended. The inherent characteristics of the groove design limit the amount of void area. Normally acceptable tolerance extremes, wide service temperature ranges, and fluid media that cause high swell of the elastomer are conditions that cannot be tolerated in this type of groove design.



Design Chart 4-4: For O-Ring Dovetail Grooves

Radius "R" is CRITICAL. Insufficient radius will potentially cause damage to the O-Ring during installation, while excessive radius may contribute to extrusion.

O-Ring Size AS568B-	W Cross-Section		L Gland Depth	Squeeze %	G Gland Width	R	R_1
	Nominal	Actual					
004 - 050	1/16	.070 ±.003	.050 - .052	27	.055 .059	.005	1/64
102 - 178	3/32	.103 ±.003	.081 - .083	21	.083 - .087	.010	1/64
201 - 284	1/8	.139 ±.004	.111 - .113	20	.113 - .117	.010	1/32
309 - 395	3/16	.210 ±.005	.171 - .173	18	.171 - .175	.015	1/32
425 - 475	1/4	.275 ±.006	.231 - .234	16	.231 - .235	.015	1/16
Special	3/8	.375 ±.007	.315 - .319	16	.315 - .319	.020	3/32

NOTE: These design recommendations assume metal-to-metal contact. In special applications, for example in the semiconductor industry, deviation from these recommendations may be necessary. When designing with Parofluor™ elastomers, one should take into consideration that perfluorinated elastomers may require more squeeze than an FKM material to obtain optimum sealing performance. To increase squeeze, modifications of the design recommendations shown above are necessary.

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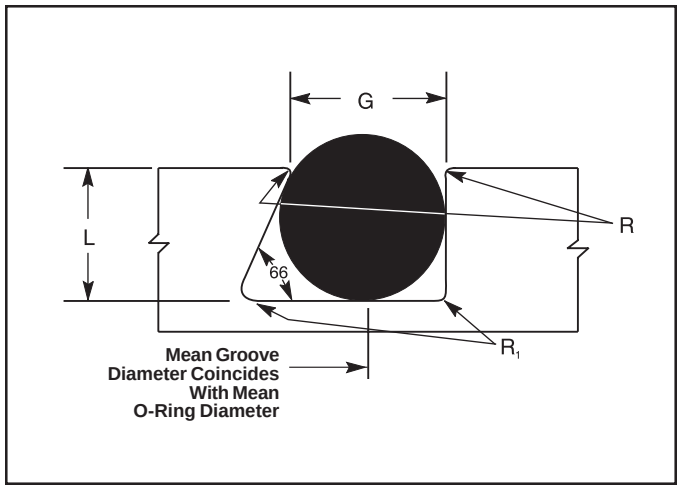
Design Chart 4-5: Half Dovetail Grooves



Design Chart 4-5: For O-Ring Half Dovetail Grooves

Radius "R" is CRITICAL. Insufficient radius will potentially cause damage to the O-Ring during installation, while excessive radius may contribute to extrusion.

O-Ring Size AS568B-	W Cross-Section		L Gland Depth	Squeeze %	G Gland Width	R	R_1
	Nominal	Actual					
004 - 050	1/16	.070 ±.003	.052 - .054	25	.064 - .066	.005	1/64
102 - 178	3/32	.103 ±.003	.083 - .085	19	.095 - .097	.010	1/64
201 - 284	1/8	.139 ±.004	.113 - .115	18	.124 - .128	.010	1/32
309 - 395	3/16	.210 ±.005	.173 - .176	17	.171 - .175	.015	1/32
425 - 475	1/4	.275 ±.006	.234 - .238	15	.255 - .257	.015	1/16
Special	3/8	.375 ±.007	.319 - .323	14	.350 - .358	.020	3/32

NOTE: These design recommendations assume metal-to-metal contact. In special applications, for example in the semiconductor industry, deviation from these recommendations may be necessary. When designing with Parofluor™ elastomers, one should take into consideration that perfluorinated elastomers may require more squeeze than an FKM material to obtain optimum sealing performance. To increase squeeze, modifications of the design recommendations shown above are necessary.

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Friction

O-Rings load a sealing surface due to their own resilience compounded with any system pressure. When the surface to be sealed moves relative to the O-Ring, frictional forces are set up producing two effects: one leads to wear and the other reduces the useful load which a cylinder can transmit.

In dynamic applications difference must be made between break-out and running friction. Break-out friction must be overcome at the beginning of movement and also is known as start-up friction. Once movement is established the frictional forces drop to a lower level and gliding begins. This can be clearly seen in reciprocating cylinders.

The running friction of seals depends on countless factors making a mathematical analysis practically impossible. For this reason it is difficult to make exact statements regarding the level of friction which can be expected. The most important factors are:

Related to the seal:

- Geometrical form including production tolerances and resulting deformation.
- Hardness and surface finish.
- Friction values for dry and lubricated compound.
- Swell and temperature characteristics.

Related to the hydraulic fluid:

- Tendency to build up a lubricating film and its distribution.
- Viscosity and temperature/viscosity relationship.

Related to the working conditions:

- Working pressure.
- Velocity of movement.
- Type of material and surface finish of surfaces.
- Working tolerances.
- Axial loads and wear bands on pistons.

Friction is directly influenced by the seal diameter because the wear-area is greater. The greater the metal surface roughness, the more the contact surface consists of metallic “islands” and therefore again mixed friction occurs.

As in many other areas break-out friction of elastomers is significantly higher than running friction. Apart from compound type and seal geometry, tendency to adhesion, deformation, the down-time and the surface finish play a role in increasing break-out friction. The longer the down-time, the more lubrication is squeezed from between the seal and the running surface resulting in a non-lubricated vacuum. In this condition the level of starting friction approaches that for dry friction and is up to 10 times that found in running friction.

Friction depends on a compound's sliding properties. Hardness and deformation of the seal influence the seal pressure. Specific seal pressure is in general related to, but not strictly proportional, to the system pressure.

The working pressure controls the width of clearance gaps and thereby the thickness of the lubricating film. The result depends on the geometry of the seal. Friction caused by O-Rings increases with increasing pressure. Lip seals are more sensitive to pressure, friction increases quicker than with seals without lip. This shows that the geometry of a seal directly affects the amount of friction.

Friction is proportional to the working pressure and therefore it is necessary to keep seal friction low, especially at low pressures.

Unfortunately, reduction of the sealing force also results in an increased tendency to leakage. This relationship can be modified within certain limits by selection of the seal geometry. Normally the decision must be made between lower friction and high leakage.

Additionally, an unstable seal geometry due to swelling in the medium plays a role. Swelling means increase sealing force and increased friction.

Table 23: Friction Factors (In Order of Importance)

To Increase Friction	Factor	To Decrease Friction
Increase	Unit Load (Squeeze)	Decrease
Increase RMS	Surface Finish (Metal)	Decrease RMS
Increase	Durometer	Decrease
Decrease	Speed of Motion	Increase
Increase	Cross Section of O-Ring	Decrease
Increase	Pressure	Decrease
Omit Lubrication	Lubrication	Use Lubrication
Decrease	Temperature	Increase
Decrease	Groove Width	Increase
Increase	Diameter of Bore or Rod	Decrease
Decrease	Surface Finish (O-Ring)	Increase
Stretch O-Ring	Joule Effect*	Compress O-Ring
Lower Durometer of O-Ring	Coefficient of Friction#	Increase Durometer

* Refer to rotary seals.
# A minor factor and should be ignored in design work other than for ultra high speeds.

Dynamic O-Ring Sealing

O-Ring Glands For Industrial Reciprocating Seals

Design Chart 5-2 provides a reasonable basis for calculating reciprocating O-Ring seal glands. Design Table 5-2, which follows it, contains recommended gland dimensions for the standard AS568B O-Ring sizes.

Procedures for using Design Table 5-2 are outlined in Design Guide 5-2.

Design Guide5-2a: Gland Dimensions For Industrial Reciprocating O-Ring Seals

Groove Diameter (Rod Gland) Tolerance
- – .000 for all sizes
- + .002 for sizes 2-006 through 2-324
- + .004 for sizes 2-325 through 2-460

Groove Diameter (Piston) Tolerance
- + .000 for all sizes
- – .002 for sizes 2-006 through 2-324
- – .004 for sizes 2-325 through 2-460

Design Guide 5-2b: Guide For Design Table 5-2

After selecting gland dimensions, read horizontally to determine proper O-Ring size number. Specify compound.

If Desired Dimension Is Known For	Select Closest Dimension In Column	Read Horizontally In Column	To Determine Dimension For
Bore Dia of Cylinder	A	B-1	Groove Dia of Piston
		C	OD of Piston
		G	Groove Width
OD of Piston	C	A	Bore Dia of Cylinder
		B-1	Groove Dia of Piston
		G	Groove Width
OD of Rod	B	A-1	Groove Dia for Rod
		D	Bore ID for Rod
		G	Groove Width
Bore Dia for Rod	D	A-1	Groove Dia for Rod
		B	OD of Rod
		G	Groove Width

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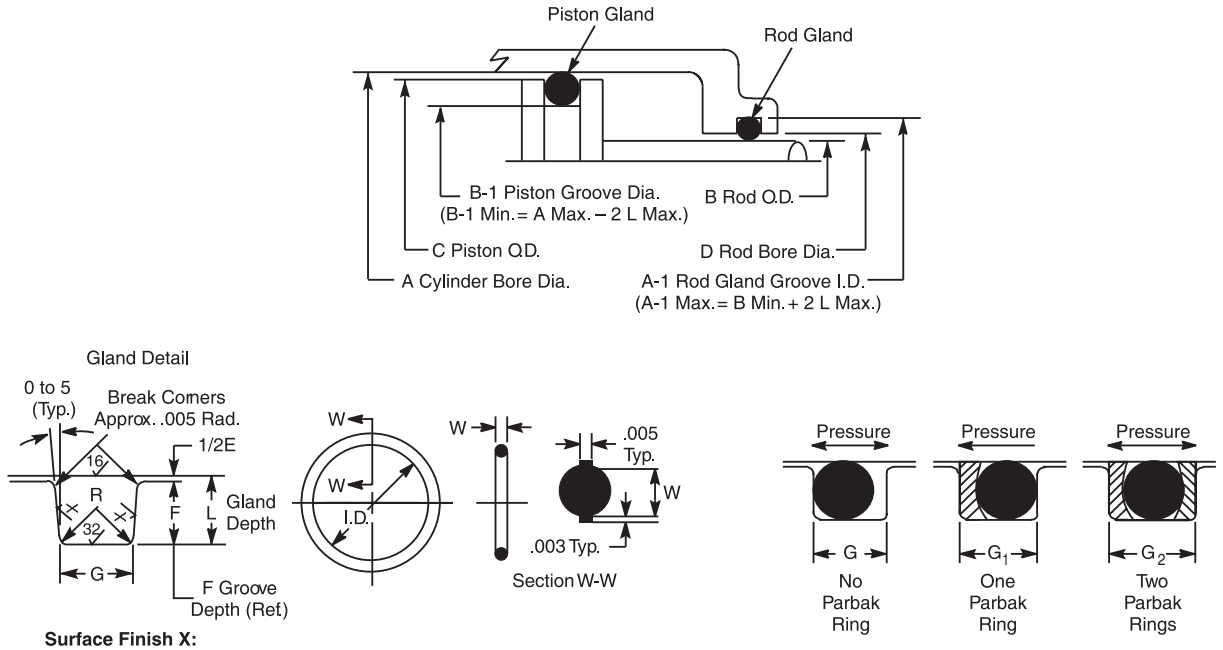
Design Chart 5-2: For Industrial Reciprocating O-Ring Packing Glands



Refer to Design Chart 5-2 (below) and Design Table 5-2 for Dimensions.

Design Chart 5-2: For Industrial Reciprocating O-Ring Packing Glands

O-Ring 2-Size AS568B-	W Cross-Section		L Gland Depth	Squeeze		E(a) Diametral Clearance	G Groove Width			R Groove Radius	Max. Eccen-tricity (b)
	Nominal	Actual		Actual	%		No Parbak Ring (G)	One Parbak Ring (G_1)	Two Parbak Rings (G_2)		
006 - 012	1/16	.070 ±.003	.055 - .057	.010 - .018	15 - 25	.002 - .005	.093 - .098	.138 - .143	.205 - .210	.005 - .015	.002
104 - 116	3/32	.103 ±.003	.088 - .090	.010 - .018	10 - 17	.002 - .005	.140 - .145	.171 - .176	.238 - .243	.005 - .015	.002
201 - 222	1/8	.139 ±.004	.121 - .123	.012 - .022	9 - 16	.003 - .006	.187 - .192	.208 - .213	.275 - .280	.010 - .025	.003
309 - 349	3/16	.210 ±.005	.185 - .188	.017 - .030	8 - 14	.003 - .006	.281 - .286	.311 - .316	.410 - .415	.020 - .035	.004
425 - 460	1/4	.275 ±.006	.237 - .240	.029 - .044	11 - 16	.004 - .007	.375 - .380	.408 - .413	.538 - .543	.020 - .035	.005

(a) Clearance (extrusion gap) must be held to a minimum consistent with design requirements for temperature range variation.
(b) Total indicator reading between groove and adjacent bearing surface.

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Design Table 5-2: Gland Dimensions For Industrial Reciprocating O-Ring Seals, 103.5 Bar (1500 PSI) Max.†

O-Ring Size	Dimensions				A	A-1	B	B-1	C	D	G†
					Bore Dia. (Cylinder)	Groove Dia. (Rod Gland)	OD (Rod)	Groove Dia. *(Piston)	OD (Piston)	Bore Dia. (Rod)	Width Groove
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.002 -.000	+.002 -.000	+.000 -.002	+.000 -.002	+.000 -.001	+.001 -.000	+.005 -.000
006	.114	.005		.254	.249	.234	.124	.139	*.247	.126	
007	.145	.005		.285	.280	.265	.155	.170	*.278	.157	
008	.176	.005		.316	.311	.296	.186	.201	*.309	.188	
009	.208	.005	.070	.348	.343	.328	.218	.233	*.341	.220	.093
010	.239	.005	±.003	.379	.374	.359	.249	.264	*.372	.251	
011	.301	.005		.441	.436	.421	.311	.326	*.434	.313	
012	.364	.005		.504	.499	.484	.374	.389	*.497	.376	
104	.112	.005		.318	.312	.300	.124	.136	*.310	.126	
105	.143	.005		.349	.343	.331	.155	.167	*.341	.157	
106	.174	.005		.380	.374	.362	.186	.198	*.372	.188	
107	.206	.005		.412	.406	.394	.218	.230	*.404	.220	
108	.237	.005		.443	.437	.425	.249	.261	*.435	.251	
109	.299	.005		.505	.499	.487	.311	.323	*.497	.313	
110	.362	.005	.103	.568	.562	.550	.374	.386	*.560	.376	.140
111	.424	.005	±.003	.630	.624	.612	.436	.448	*.622	.438	
112	.487	.005		.693	.687	.675	.499	.511	*.685	.501	
113	.549	.007		.755	.749	.737	.561	.573	*.747	.563	
114	.612	.009		.818	.812	.800	.624	.636	.810	.626	
115	.674	.009		.880	.874	.862	.686	.698	.872	.688	
116	.737	.009		.943	.937	.925	.749	.761	.935	.751	
201	.171	.005		.449	.437	.427	.185	.195	*.434	.188	
202	.234	.005		.512	.500	.490	.248	.258	*.497	.251	
203	.296	.005		.574	.562	.552	.310	.320	*.559	.313	
204	.359	.005		.637	.625	.615	.373	.383	.662	.376	
205	.421	.005		.699	.687	.677	.435	.445	.684	.438	
206	.484	.005		.762	.750	.740	.498	.508	.747	.501	
207	.546	.007		.824	.812	.802	.560	.570	.809	.563	
208	.609	.009		.887	.875	.865	.623	.633	.872	.626	
209	.671	.009		.949	.937	.927	.685	.695	.934	.688	
210	.734	.010		1.012	1.000	.990	.748	.758	.997	.751	
211	.796	.010	.139	1.074	1.062	1.052	.810	.820	1.059	.813	.187
212	.859	.010	±.004	1.137	1.125	1.115	.873	.883	1.122	.876	
213	.921	.010		1.199	1.187	1.177	.935	.945	1.184	.938	
214	.984	.010		1.262	1.250	1.240	.998	1.008	1.247	1.001	
215	1.046	.010		1.324	1.312	1.302	1.060	1.070	1.309	1.063	
216	1.109	.012		1.387	1.375	1.365	1.123	1.133	1.372	1.126	
217	1.171	.012		1.449	1.437	1.427	1.185	1.195	1.434	1.188	
218	1.234	.012		1.512	1.500	1.490	1.248	1.258	1.497	1.251	
219	1.296	.012		1.574	1.562	1.552	1.310	1.320	1.559	1.313	
220	1.359	.012		1.637	1.625	1.615	1.373	1.383	1.622	1.376	
221	1.421	.012		1.699	1.687	1.677	1.435	1.445	1.684	1.438	
222	1.484	.015		1.762	1.750	1.740	1.498	1.508	1.747	1.501	

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 5-2 for groove widths where Parbak rings must be used.

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Design Table 5-2: Gland Dimensions For Industrial Reciprocating O-Ring Seals, 103.5 Bar (1500 PSI) Max.† - *cont.*

O-Ring Size	Dimensions				A	A-1	B	B-1	C	D	G†
					Bore Dia. (Cylinder)	Groove Dia. (Rod Gland)	OD (Rod)	Groove Dia. *(Piston)	OD (Piston)	Bore Dia. (Rod)	Width Groove
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.002 -.000	+.002 -.000	+.000 -.002	+.000 -.002	+.000 -.001	+.001 -.000	+.005 -.000
309	.412	.005		.832	.812	.805	.435	.442	*.809	.438	
310	.475	.005		.895	.875	.868	.498	.505	*.872	.501	
311	.537	.007		.957	.937	.930	.560	.567	*.943	.563	
312	.600	.009		1.020	1.000	.993	.623	.630	.997	.626	
313	.662	.009		1.082	1.062	1.055	.685	.692	1.059	.688	
314	.725	.010		1.145	1.125	1.118	.748	.755	1.122	.751	
315	.787	.010		1.207	1.187	1.180	.810	.817	1.184	.813	
316	.850	.010		1.270	1.250	1.243	.873	.880	1.247	.876	
317	.912	.010		1.332	1.312	1.305	.935	.942	1.309	.938	
318	.975	.010		1.395	1.375	1.368	.998	1.005	1.372	1.001	
319	1.037	.010		1.457	1.437	1.430	1.060	1.067	1.434	1.063	
320	1.100	.012		1.520	1.500	1.493	1.123	1.130	1.497	1.126	
321	1.162	.012		1.582	1.562	1.555	1.185	1.192	1.559	1.188	
322	1.225	.012		1.645	1.625	1.618	1.248	1.255	1.622	1.251	
323	1.287	.012		1.707	1.687	1.680	1.310	1.317	1.648	1.313	
324	1.350	.012		1.770	1.750	1.743 +.004 -.000	1.373	1.380 +.000 -.004	1.747	1.376	
325	1.475	.015		1.895	1.875	1.868	1.498	1.505	1.872	1.501	
326	1.600	.015		2.020	2.000	1.993	1.623	1.630	1.997	1.626	
327	1.725	.015		2.145	2.125	2.118	1.748	1.755	2.122	1.751	
328	1.850	.015		2.270	2.250	2.243	1.873	1.880	2.247	1.876	
329	1.975	.018	.210	2.395	2.375	2.368	1.998	2.005	2.372	2.001	.281
330	2.100	.018	±.005	2.520	2.500	2.493	2.123	2.130	2.497	2.126	
331	2.225	.018		2.645	2.625	2.618	2.248	2.255	2.622	2.251	
332	2.350	.018		2.770	2.750	2.743	2.373	2.380	2.747	2.376	
333	2.475	.020		2.895	2.875	2.868	2.498	2.505	2.872	2.501	
334	2.600	.020		3.020	3.000	2.993	2.623	2.630	2.997	2.626	
335	2.725	.020		3.145	3.125	3.118	2.748	2.755	3.122	2.751	
336	2.850	.020		3.270	3.250	3.243	2.873	2.880	3.247	2.876	
337	2.975	.024		3.395	3.375	3.368	2.998	3.005	3.372	3.001	
338	3.100	.024		3.520	3.500	3.493	3.123	3.130	3.497	3.126	
339	3.225	.024		3.645	3.625	3.618	3.248	3.255	3.622	3.251	
340	3.350	.024		3.770	3.750	3.743	3.373	3.380	3.747	3.376	
341	3.475	.024		3.895	3.875	3.868	3.498	3.505	3.872	3.501	
342	3.600	.028		4.020	4.000	3.993	3.623	3.630	3.997	3.626	
343	3.725	.028		4.145	4.125	4.118	3.748	3.755	4.122	3.751	
344	3.850	.028		4.270	4.250	4.243	3.873	3.880	4.247	3.876	
345	3.975	.028		4.395	4.375	4.368	3.998	4.005	4.372	4.001	
346	4.100	.028		4.520	4.500	4.493	4.123	4.130	4.497	4.126	
347	4.225	.030		4.645	4.625	4.618	4.248	4.255	4.622	4.251	
348	4.350	.030		4.773	4.750	4.743	4.373	4.380	4.747	4.376	
349	4.475	.030		4.895	4.875	4.868	4.498	4.505	4.872	4.501	

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 5-2 for groove widths where Parbak rings must be used.

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Design Table 5-2: Gland Dimensions For Industrial Reciprocating O-Ring Seals, 103.5 Bar (1500 PSI) Max.† - *cont.*

O-Ring Size	Dimensions				A	A-1	B	B-1	C	D	G†
					Bore Dia. (Cylinder)	Groove Dia. (Rod Gland)	OD (Rod)	Groove Dia. *(Piston)	OD (Piston)	Bore Dia. (Rod)	Width Groove
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.002 -.000	+.002 -.000	+.000 -.002	+.000 -.002	+.000 -.001	+.001 -.000	+.005 -.000
425	4.475	.033		5.025	5.002	4.971	4.497	4.528	4.998	4.501	
426	4.600	.033		5.150	5.127	5.096	4.622	4.653	5.123	4.626	
427	4.725	.033		5.275	5.252	5.221	4.747	4.778	5.248	4.751	
428	4.850	.033		5.400	5.377	5.346	4.872	4.903	5.373	4.876	
429	4.975	.037		5.525	5.502	5.471	4.997	5.028	5.498	5.001	
430	5.100	.037		5.650	5.627	5.596	5.122	5.153	5.623	5.126	
431	5.225	.037		5.775	5.752	5.721	5.247	5.278	5.748	5.251	
432	5.350	.037		5.900	5.877	5.846	5.372	5.403	5.873	5.376	
433	5.475	.037		6.025	6.002	5.971	5.497	5.528	5.998	5.501	
434	5.600	.037		6.150	6.127	6.096	5.622	5.653	6.123	5.626	
435	5.725	.037		6.275	6.252	6.221	5.747	5.778	6.248	5.751	
436	5.850	.037		6.400	6.377	6.346	5.872	5.903	6.373	5.876	
437	5.975	.037		6.525	6.502	6.471	5.997	6.028	6.498	6.001	
438	6.225	.040		6.775	6.752	6.721	6.247	6.278	6.748	6.251	
439	6.475	.040		7.025	7.002	6.971	6.497	6.528	6.998	6.501	
440	6.725	.040		7.275	7.252	7.221	6.747	6.778	7.248	6.751	
441	6.975	.040		7.525	7.502	7.471	6.997	7.028	7.498	7.001	
442	7.225	.045	.275	7.775	7.752	7.721	7.247	7.278	7.748	7.251	.375
443	7.475	.045	±.006	8.025	8.002	7.971	7.497	7.528	7.998	7.501	
444	7.725	.045		8.275	8.252	8.221	7.747	7.778	8.248	7.751	
445	7.975	.045		8.525	8.502	8.471	7.997	8.028	8.498	8.001	
446	8.475	.055		9.025	9.002	8.971	8.497	8.528	8.998	8.501	
447	8.975	.055		9.525	9.502	9.471	8.997	9.028	9.498	9.001	
448	9.475	.055		10.025	10.002	9.971	9.497	9.528	9.998	9.501	
449	9.975	.055		10.525	10.502	10.471	9.997	10.028	10.498	10.001	
450	10.475	.060		11.025	11.002	10.971	10.497	10.528	10.998	10.501	
451	10.975	.060		11.525	11.502	11.471	10.997	11.028	11.498	11.001	
452	11.475	.060		12.025	12.002	11.971	11.497	11.528	11.998	11.501	
453	11.975	.060		12.525	12.502	12.471	11.997	12.028	12.498	12.001	
454	12.475	.060		13.025	13.002	12.971	12.497	12.528	12.998	12.501	
455	12.975	.060		13.525	13.502	13.471	12.997	13.028	13.498	13.001	
456	13.475	.070		14.025	14.002	13.971	13.497	13.528	13.998	13.501	
457	13.975	.070		14.525	14.502	14.471	13.997	14.028	14.498	14.001	
458	14.475	.070		15.025	15.002	14.971	14.497	14.528	14.998	14.501	
459	14.975	.070		15.525	15.502	15.471	14.997	15.028	15.498	15.001	
460	15.475	.070		16.025	16.002	15.971	15.497	15.528	15.998	15.501	

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

† This groove width does not permit the use of Parbak rings. For pressures above 103.5 Bar (1500 PSI), consult Design Chart 5-2 for groove widths where Parbak rings must be used.

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O-Ring Glands for Pneumatic Floating Piston Ring Seals

Since it is impossible to bore, drill or tap perfect, true holes, and to machine perfect parts providing perfect alignment, the engineer should consider the floating gland. Eccentricity (lack of concentricity) is allowable, but it does cause high unit loads on small portions of bearing surfaces. In turn, this causes minute scratches on the metal surface on which the O-Ring must rub (with the possible exception of very soft bearing materials, such as babbitt).

In order to reduce or eliminate the high bearing loads, the relatively inexpensive floating gland should be used whenever possible. The object of this gland is to allow the piston or rod bearing (containing the O-Ring groove), to pivot, adjust, or float a small amount, offsetting misalignment. (See Figure 11).

This gland design increases the life of the O-Ring and eliminates many of the spasmodic or unscheduled failures, as well as reducing the maintenance cost.

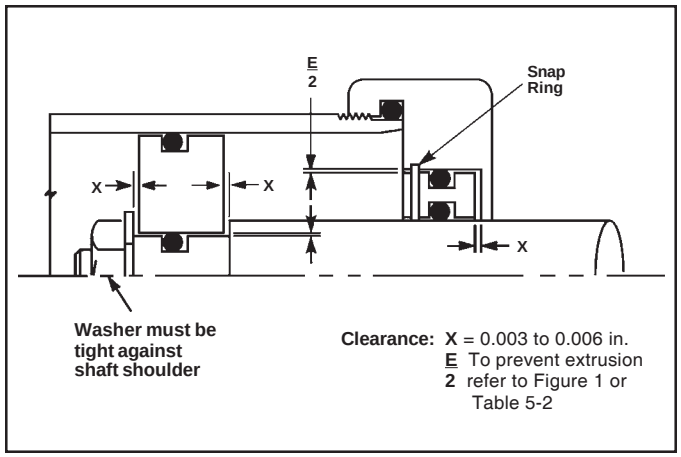

Figure 11: Floating Gland

Design Chart 5-3 provides the basis for calculating gland dimensions. For standard O-Ring sizes, these dimensions have been calculated and are listed in Design Table 5-3. The procedures for the use of Design Table 5-3 are outlined in Design Guide 5-3.

Design Guide 5-3: Guide For Design Table 5-3

If Desired Dimension Is Known For	Dimension In Column	Select Closest Horizontally In Column	Read To Determine Dimension For
Bore Dia. of Cylinder	A	B-1	Groove Dia of Piston
		C	OD of Piston
		G	Groove Width
		A	Bore Dia of Cylinder
OD of Piston	C	B-1	Groove Dia of Piston
		G	Groove Width

After selecting gland dimensions, read horizontally to determine proper O-Ring size number. Specify compound. Refer to Fluid Compatibility Tables to select the proper compound. The effective part number for an O-Ring consists of both a size number and a compound number.

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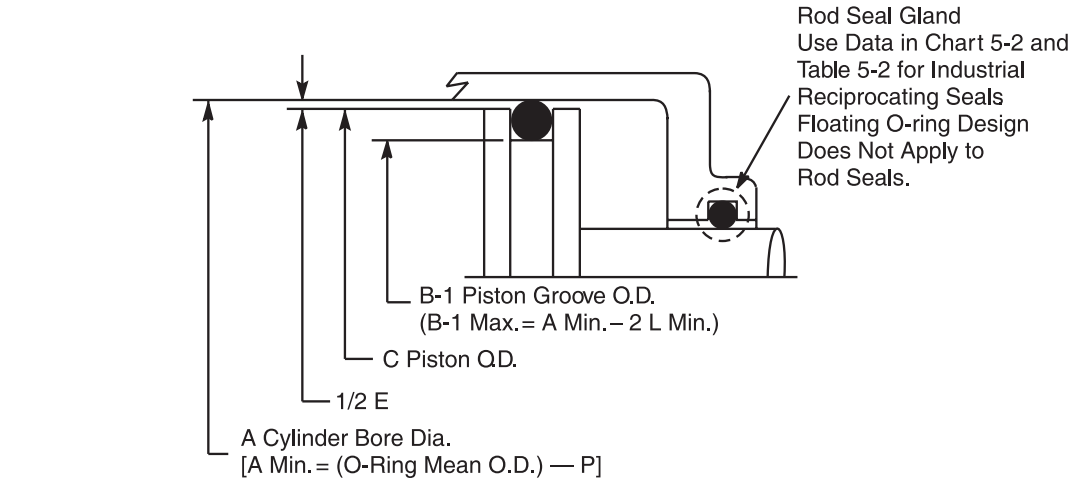
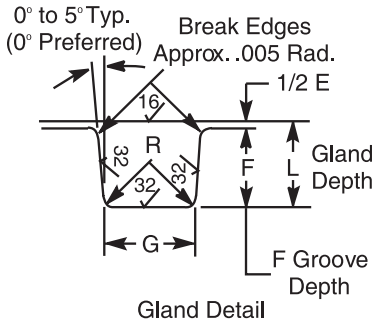
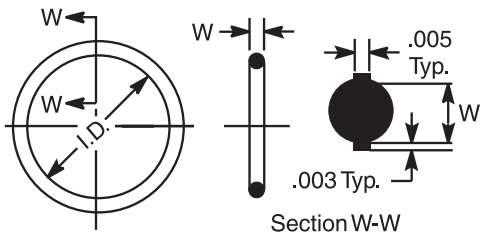
Design Chart 5-3: Floating Pneumatic Piston Ring Seal Glands 13.8 Bar (200 PSI) Max.





Gland Detail



Section W-W

Refer to Design Chart 5-3 (below) and Design Table 5-3 for Dimensions

Design Chart 5-3: Floating Pneumatic Piston Ring Seal Glands

O-Ring Size (a) Parker No. 2-	W Cross-Section		P (c) Peripheral Squeeze (Variable)	L Gland Depth	G Groove Width	E Diametral Clearance	Eccentricity Max. (b)	R Groove Radius
	Nominal	Actual						
006 - 012	1/16	.070 ±.003	.035 - .042	.072 - .076	.075 - .079	.002 - .010	.002	.005 - .015
104 - 116	3/32	.103 ±.003	.038 - .062	.105 - .109	.111 - .115	.002 - .010	.002	.005 - .015
201 - 222	1/8	.139 ±.004	.061 - .082	.143 - .147	.151 - .155	.003 - .111	.003	.010 - .025
309 - 349	3/16	.210 ±.005	.084 - .124	.214 - .218	.229 - .233	.003 - .011	.004	.020 - .035
425 - 460	1/4	.275 ±.006	.140 - .175	.282 - .286	.301 - .305	.004 - .012	.005	.020 - .035

(a) Only sizes listed are recommended for this design.
(b) Total indicator reading between groove and adjacent bearing surface.
(c) Use to calculate A_{min} diameter.

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Design Table 5-3: Floating Pneumatic Piston Ring Seal Gland Dimensions

O-Ring Size	Dimensions				A	B-1	C	G	P
					Bore Dia. (Cylinder)	Groove Dia. (Piston)	OD (Piston)	Groove Width	
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.004 -.000	+.000 -.004	+.000 -.004	+.004 -.000	Peripheral Squeeze
006	.114	.005		.254	.219	.075	*.217		.035
007	.145	.005		.285	.249	.105	*.247		.036
008	.176	.005		.316	.279	.135	*.277		.037
009	.208	.005	.070	.348	.309	.165	*.307	.075	.039
010	.239	.005	±.003	.379	.339	.195	*.377		.040
011	.301	.005		.441	.400	.256	*.398		.041
012	.364	.005		.504	.462	.318	.460		.042
104	.112	.005		.318	.280	.070	*.278		.038
105	.143	.005		.349	.309	.099	*.307		.040
106	.174	.005		.380	.338	.128	*.336		.042
107	.206	.005		.412	.368	.158	*.366		.044
108	.237	.005		.443	.397	.187	*.395		.046
109	.299	.005		.505	.457	.247	*.455		.048
110	.362	.005	.103	.568	.518	.308	*.516	.111	.050
111	.424	.005	±.003	.630	.578	.368	*.576		.052
112	.487	.005		.693	.639	.429	.637		.054
113	.549	.007		.755	.699	.489	.697		.056
114	.612	.009		.818	.760	.550	.758		.058
115	.674	.009		.880	.820	.610	.818		.060
116	.737	.009		.943	.881	.671	.879		.062
201	.171	.005		.449	.388	.102	*.385		.061
202	.234	.005		.512	.450	.164	*.447		.062
203	.296	.005		.574	.511	.255	*.508		.063
204	.359	.005		.637	.573	.287	.570		.064
205	.421	.005		.699	.634	.348	.631		.065
206	.484	.005		.762	.696	.410	.693		.066
207	.546	.007		.824	.757	.471	.754		.067
208	.609	.009		.887	.819	.533	.816		.068
209	.671	.009		.949	.880	.594	.877		.069
210	.734	.010		1.012	.942	.656	.939		.070
211	.796	.010	.139	1.074	1.003	.717	1.000	.151	.071
212	.859	.010	±.004	1.137	1.065	.779	1.026		.072
213	.921	.010		1.199	1.126	.840	1.123		.073
214	.984	.010		1.262	1.188	.902	1.185		.074
215	1.046	.010		1.324	1.249	.963	1.246		.075
216	1.109	.012		1.387	1.311	1.025	1.308		.076
217	1.171	.012		1.449	1.372	1.086	1.369		.077
218	1.234	.012		1.512	1.434	1.148	1.431		.078
219	1.296	.012		1.574	1.495	1.209	1.492		.079
220	1.359	.012		1.637	1.557	1.271	1.554		.080
221	1.421	.012		1.699	1.618	1.332	1.615		.081
222	1.484	.015		1.762	1.680	1.394	1.677		.082
309	.412	.005	.210	.832	.748	.320	.745	.229	.084
310	.475	.005	±.105	.895	.810	.382	.807		.085
311	.537	.007		.957	.871	.443	.868		.086

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

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Design Table 5-3: Floating Pneumatic Piston Ring Seal Gland Dimensions *- continued*

O-Ring Size	Dimensions				A	B-1	C	G	P
					Bore Dia. (Cylinder)	Groove Dia. (Piston)	OD (Piston)	Groove Width	
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.004 -.000	+.000 -.004	+.000 -.004	+.004 -.000	Peripheral Squeeze
312	.600	.009		1.020	.933	.505	.930		.087
313	.662	.009		1.082	.994	.566	.991		.088
314	.725	.010		1.145	1.056	.628	1.053		.089
315	.787	.010		1.207	1.117	.689	1.114		.090
316	.850	.010		1.270	1.179	.751	1.176		.091
317	.912	.010		1.332	1.240	.812	1.237		.092
318	.975	.010		1.395	1.302	.874	1.299		.093
319	1.037	.010		1.457	1.363	.935	1.360		.094
320	1.100	.012		1.520	1.425	.997	1.422		.095
321	1.162	.012		1.582	1.486	1.058	1.483		.096
322	1.225	.012		1.645	1.548	1.120	1.545		.097
323	1.287	.012		1.707	1.609	1.181	1.636		.098
324	1.350	.012		1.770	1.671	1.243	1.668		.099
325	1.475	.015		1.895	1.795	1.367	1.792		.100
326	1.600	.015		2.020	1.919	1.491	1.916		.101
327	1.725	.015		2.145	2.043	1.615	2.040		.102
328	1.850	.015		2.270	2.167	1.739	2.164		.103
329	1.975	.018	.210	2.395	2.291	1.863	2.288	.229	.104
330	2.100	.018	±.005	2.520	2.415	1.987	2.412		.105
331	2.225	.018		2.645	2.539	2.111	2.536		.106
332	2.350	.018		2.770	2.663	2.235	2.660		.107
333	2.475	.020		2.895	2.787	2.359	2.784		.108
334	2.600	.020		3.020	2.991	2.483	2.908		.109
335	2.725	.020		3.145	3.035	2.607	3.032		.110
336	2.850	.020		3.270	3.159	2.731	3.156		.111
337	2.975	.024		3.395	3.283	2.855	3.280		.112
338	3.100	.024		3.520	3.407	2.979	3.404		.113
339	3.225	.024		3.645	3.531	3.103	3.528		.114
340	3.350	.024		3.770	3.655	3.270	3.652		.115
341	3.475	.024		3.895	3.779	3.351	3.776		.116
342	3.600	.028		4.020	3.903	3.475	3.900		.117
343	3.725	.028		4.145	4.027	3.599	4.024		.118
344	3.850	.028		4.270	4.151	3.723	4.148		.119
345	3.975	.028		4.395	4.275	3.847	4.272		.120
346	4.100	.028		4.520	4.399	3.971	4.396		.121
347	4.225	.030		4.645	4.523	4.095	4.520		.122
348	4.350	.030		4.773	4.647	4.219	4.644		.123
349	4.475	.030		4.895	4.771	4.343	4.768		.124
425	4.475	.033		5.025	4.885	4.321	4.881		.140
426	4.600	.033		5.150	5.009	4.445	5.005		.141
427	4.725	.033		5.275	5.133	4.569	5.129		.142
428	4.850	.033	.275	5.400	5.257	4.693	5.253	.301	.143
429	4.975	.037	±.006	5.525	5.381	4.817	5.377		.144
430	5.100	.037		5.650	5.505	4.941	5.501		.145
431	5.225	.037		5.775	5.629	5.065	5.625		.146
432	5.350	.037		5.900	5.753	5.189	5.749		.147

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

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Design Table 5-3: Floating Pneumatic Piston Ring Seal Gland Dimensions *- continued*

O-Ring Size	Dimensions				A	B-1	C	G	P
					Bore Dia. (Cylinder)	Groove Dia. (Piston)	OD (Piston)	Groove Width	
Parker No. 2-	I.D.	±	W	Mean O.D. (Ref)	+.004 -.000	+.000 -.004	+.000 -.004	+.004 -.000	Peripheral Squeeze
433	5.475	.037		6.025	5.877	5.313	5.873		.148
434	5.600	.037		6.150	6.001	5.437	5.997		.149
435	5.725	.037		6.275	6.125	5.561	6.121		.150
436	5.850	.037		6.400	6.249	5.685	6.245		.151
437	5.975	.037		6.525	6.373	5.809	6.369		.152
438	6.225	.040		6.775	6.622	6.058	6.618		.153
439	6.475	.040		7.025	6.871	6.307	6.867		.154
440	6.725	.040		7.275	7.120	6.556	7.116		.155
441	6.975	.040		7.525	7.369	6.805	7.365		.156
442	7.225	.045	.275	7.775	7.618	7.054	7.614	.301	.157
443	7.475	.045	±.006	8.025	7.867	7.303	7.863		.158
444	7.725	.045		8.275	8.116	7.552	8.112		.159
445	7.975	.045		8.525	8.365	7.801	8.361		.160
446	8.475	.055		9.025	8.864	8.300	8.860		.161
447	8.975	.055		9.525	9.363	8.799	9.359		.162
448	9.475	.055		10.025	9.862	9.298	9.858		.163
449	9.975	.055		10.525	10.361	9.797	10.357		.164
450	10.475	.060		11.025	10.860	10.296	10.856		.165
451	10.975	.060		11.525	11.359	10.795	11.355		.166
452	11.475	.060		12.025	11.858	11.294	11.854		.167
453	11.975	.060		12.525	12.357	11.793	12.353		.168
454	12.475	.060		13.025	12.856	12.292	12.852		.169
455	12.975	.060		13.525	13.355	12.791	13.351		.170
456	13.475	.070		14.025	13.854	13.290	13.850		.171
457	13.975	.070		14.525	14.353	13.789	14.349		.172
458	14.475	.070		15.025	14.852	14.288	14.848		.173
459	14.975	.070		15.525	15.351	14.787	15.347		.174
460	15.475	.070		16.025	15.850	15.286	15.846		.175

* These designs require considerable installation stretch. If assembly breakage is incurred use a compound having higher elongation or use a two-piece piston.

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O-Rings as Rotary Seals

An O-Ring has proved to be a practical rotary shaft seal in many applications. With the correct design, Parker O-Ring rotary seal compound N1090-85 will provide satisfactory service at surface speeds up to 1500 feet per minute.

The design conditions are most critical for rotary seals, as would be expected. Relatively high durometer compounds, close control of tolerances, and minimum cross-section are required.

Rotary seals usually should not be used at temperatures below -40°C (-40°F) even though flexibility to -54°C (-65°F) is claimed, since thermal shrinkage and loss of resilience tend to cause loss of contact with the shaft. In some cases, initial leakage of frozen seals may be tolerable until heat build-up occurs in higher speed shafts. Spring loading may be helpful in some situations.

High-speed shafts of soft metal should be avoided since they will normally wear more rapidly than the rubber, opening the clearance and allowing leakage. Hardened steel shafts in the range of 55 Rockwell are desirable, but not mandatory. Attention to clearances, side thrust, and end-play are critical in designing effective rotary O-Ring seals.

Whenever it can be avoided, an O-Ring should not be installed in a gland that holds it in more than a minimum of tensional stress. This principle is especially important to consider when designing for an O-Ring rotary shaft seal. Most elastomers when heated in the stressed, or stretched condition will contract. This is of practical importance in a rotary seal because it results in a tendency for the O-Ring to seize the high-speed rotating shaft. This phenomenon, known as the Gow-Joule effect, occurs only if the rubber is under tensile stress.

The friction between the O-Ring and the rotating shaft creates heat. When it is installed in more than a minimum of tensional stress, the O-Ring tends to contract when heated and seize the high speed rotating shaft. This contraction causes more friction which in turn causes more heat and the process becomes self-perpetuating, until the O-Ring is destroyed.

Even at low surface speeds, where heating is not a problem, a stretched O-Ring tends to rotate with the shaft and leak. For speeds below 200 feet per minute, the squeeze recommended in Design Chart 5-2 may be used. However, the shaft diameter should be no larger than the free state ID of the O-Ring.

Shaft seal applications where the O-Ring is installed in a groove in the shaft are not recommended if the shaft rotates. This is due to the centrifugal action which causes the O-Ring to rotate and rub on all surfaces which generally causes early seal leakage or failure.

The use of O-Rings as high speed rotary shaft seals is usually not recommended for applications requiring lower than -40°C (-40°F) or higher than 121°C (250°F) operating temperatures.

The O-Ring gland in a rotary shaft application should not be used as a bearing surface. The shaft should be contained by bearings that will permit the O-Ring to operate under the lowest possible heat and load. Because of the limited interference that must be used to avoid frictional heat, the O-Ring will not compensate for shafts that are out of round or rotate eccentrically. Shafts should remain concentric within .013 mm (0.0005") T.I.R.

Bearings of all types cause considerable local heat and seals placed too close to them will fail prematurely.

Provision should be made for the dissipation of any heat that may be generated because of friction. The nearer to room temperature the seal interface, the longer the O-Ring will seal. There are two methods commonly used to prevent high bearing heat build-up:

Preferred – Provide a clearance of 0.203 mm (0.008") on a side between the rotating shaft and the O-Ring housing. Make sure that the shaft does not rub the housing. For pressures exceeding 55.2 Bar (800 psi), decrease the diametrical clearance per Figure 1. (Page 1-2)

Alternate – The bearing length should be at least 10 times the "W" dimension of the O-Ring used. This provides for a greater area for heat transfer. If the clearance must be kept to a minimum to prevent high pressure extrusion, the 10 times "W" rule also applies. A floating gland (see Figure 11) is preferred to avoid high unit load at a local point or area.

Experience has proven that it is desirable to use the O-Ring with the smallest "W", or cross-section diameter, available for the ID required. It is recommended that a "W" dimension of 0.103 be considered maximum for all speeds over 600 feet per minute. (See Table 5-5).

All metals and plastics suitable for the housing or gland construction of seal assemblies requiring rotary shaft seals can be used with O-Rings.

To insure maximum O-Ring life, use an O-Ring compound that has been specially developed for rotary seal applications and provides the required characteristics that are necessary for this service.

Table 5-5: O-Ring Sections for Rotary Seals

Speed (fpm*)	Maximum Recommended "W" Dimension
0 to 200	Usually Not Critical (Use chart 5-2)
200 to 400	0.139
200 to 600	0.103
200 to 1500	0.070

*Feet per minute = 0.26 x Shaft Diameter (inches) x rpm

Figure 12 shows two methods of "spring loading" the hard rotary seal. Either of these should only be used when absolutely necessary to obtain the desired seal. See Table 5-6 for a rotary seal design example.

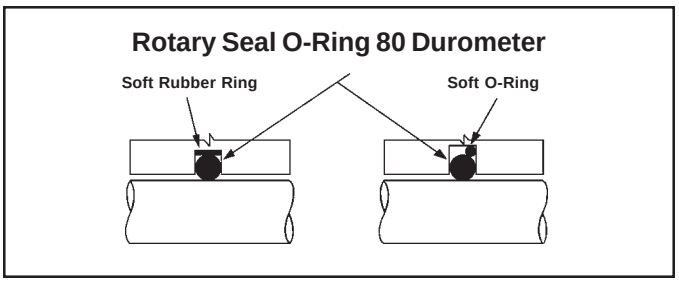

Figure 12: Spring-Loading for Rotary Seal

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O-Ring Glands for Rotary Seals

Design Chart 5-4 provides the basis for calculating gland dimensions. For standard O-Ring sizes, these dimensions have been calculated and are listed in Design Table 5-4. The procedures for the use of Design Table 5-4 are outlined in Design Guide 5-4 below.

Design Guide 5-4: Guide for Design Table 5-4

If Desired Dimension Is Known For	Select Closest Dimension In Column	Read Horizontally In Column	To Determine Dimension for
OD of Shaft	B	A-1	Groove Dia. for Shaft
		D	Throat Dia.
		G	Groove Width
Throat Dia.	D	A-1	Groove Dia. for Shaft
		B	OD of Shaft
		G	Groove Width

After selecting gland dimensions, read horizontally to determine proper O-Ring size number. Specify compound.

Table 5-6

Problem: To design a rotary seal gland for a 76.2 mm (3") (desired) shaft running at 1750 rpm with oil pressure at 6.9 Bar (100 psi).

Procedural Steps:	Example:
(A) Calculate surface speed.	**(A)** Speed = 0.26 x 3 x 1750 = 1365 fpm
(B) Determine O-Ring cross-section that may be used from Table 5-5.	**(B)** .070 (larger cross-sections are eliminated due to speed)
(C) Select .070 cross-section O-Ring with actual ID closest to desired shaft OD from Design Table 5-4.	**(C)** Parker No. 2-041
(D) Add 0.002 to O-Ring ID to determine maximum actual shaft OD, B.	**(D)** B max. = 2.969 + 0.002 = 2.971
(E) Determine gland depth, L from Design Chart 5-4.	**(E)** 0.065 to 0.067
(F) Calculate Gland Groove ID, A-1 A-1 min. = B max. + 2L min. A-1 max. = B min. + 2L max.	**(F)** A-1 min. = 2.991 + 2(0.065) = 3.121 A-1 max. = 2.990 + (0.067) = 3.057 A-1 = 3.121 (Tol: +.003, -.000)
(G) Determine diametral clearance, E from Design Chart 5-4.	**(G)** 0.012 + 0.016
(H) Calculate Shaft Bore D D min. = B max. + E min. D max. = B min. + E max.	**(H)** D min. = 2.991 + 0.012 = 3.003 D max. = 2.990 + 0.016 = 3.006 D = 3.003 (Tol: +.003, -.000)
(I) Determine groove width, G from Design Chart 5-4.	**(I)** 0.075 - 0.079
(J) Check Figure 1 to make sure design is extrusion safe.	

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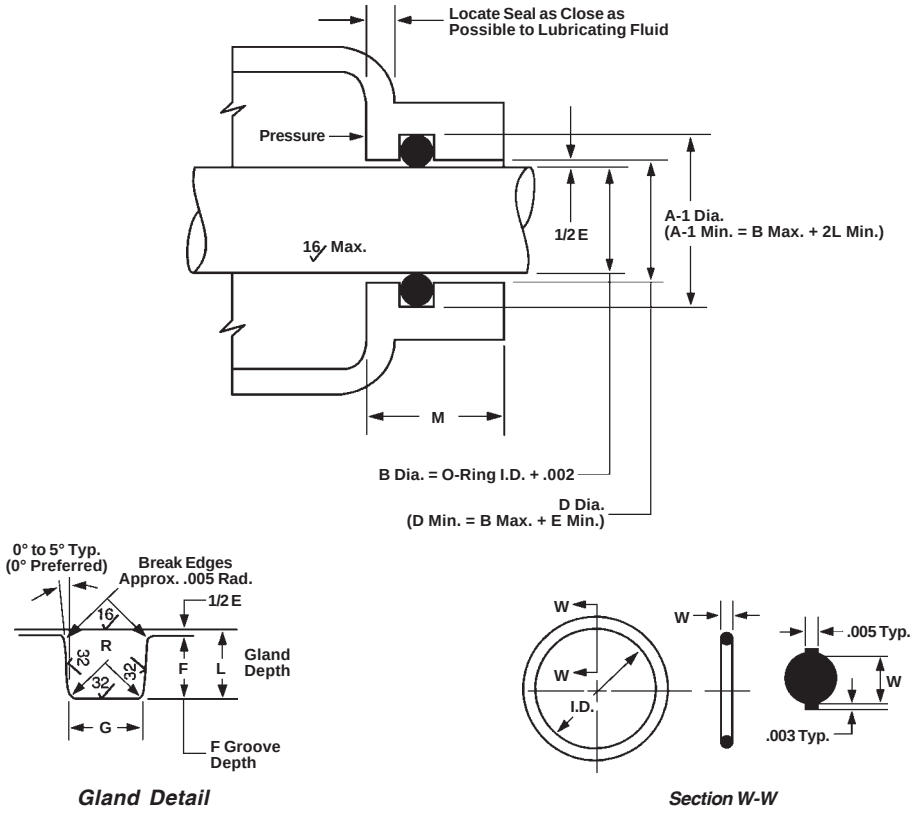
O-Ring Glands for Rotary Seals

See Rotary Seal discussion in Dynamic Seals section before using this chart.



Gland Detail *Section W-W*

Note: Due to effect of centrifugal force, do not locate groove in shaft. Refer to Design Chart 5-4 (below) and Design Table 5-4 for dimensions.

Design Chart 5-4: Rotary O-Ring Seal Glands, 55.2 Bar (800 psi) Max. (c) *(Below 200 FPM, Use Design Chart 5-2)*

O-Ring Size Parker No. 2-	W Cross-Section		Maximum Speed FPM (a)	Squeeze %	L Gland Depth	G Groove Width	E (c) Diametral Clearance	Eccen-tricity Max (b)	M Bearing Length Min. (c)	R Groove Radius
	Nominal	Actual								
004 through 045	1/16	0.070 ±.003	200 – 1500	0-11	0.065 to 0.067	0.075 to 0.079	0.012 to 0.016	0.002	0.700	0.005 to 0.015
102 through 163	3/32	0.103 ±.003	200 – 600	1-8½	0.097 to 0.099	0.108 to 0.112	0.012 to 0.016	0.002	1.030	0.005 to 0.015
201 through 258	1/8	0.139 ±.004	200 – 400	0-7	0.133 to 0.135	0.144 to 0.148	0.016 to 0.020	0.003	1.390	0.010 to 0.025

(a) Feet per minute = 0.26 x Shaft Diameter (inches) x rpm.
(b) Total indicator reading between groove OD, shaft, and adjacent bearing surface.
(c) If clearance (extrusion gap) must be reduced for higher pressures, bearing length M must be no less than the minimum figures given. Clearances given are based on the use of 80 shore durometer minimum O-Ring for 55.2 Bar (800 psi) max. See Figure 1 for recommended clearances when pressures exceed 55.2 Bar (800 psi).

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Table 5-4: Rotary O-Ring Seal Gland Dimensions

O-Ring Size Parker No. 2-	Dimensions				B	A-1	D	G
	I.D.	±	W	Mean O.D. (Ref)	O.D. (Shaft) +.000 -.001	Groove (Gland) +.003 -.000	Throat Dia. +.003 -.000	Groove Width +.004 -.000
004	.070	.005		.210	.072	.202	.084	
005	.101	.005		.241	.103	.233	.115	
006	.114	.005		.254	.116	.246	.128	
007	.145	.005		.285	.147	.277	.159	
008	.176	.005		.316	.178	.308	.190	
009	.208	.005		.348	.210	.340	.222	
010	.239	.005		.379	.241	.371	.253	
011	.301	.005		.441	.303	.433	.315	
012	.364	.005		.504	.366	.496	.378	
013	.426	.005		.566	.428	.558	.440	
014	.489	.005		.629	.491	.621	.503	
015	.551	.007		.691	.553	.683	.565	
016	.614	.009		.754	.616	.746	.628	
017	.676	.009		.816	.678	.808	.693	
018	.739	.009	.070	.879	.741	.871	.753	.075
019	.801	.009	±.003	.941	.803	.933	.815	
020	.864	.009		1.004	.866	.996	.878	
021	.926	.009		1.066	.928	1.058	.940	
022	.989	.010		1.129	.991	1.121	1.003	
023	1.051	.010		1.191	1.053	1.183	1.065	
024	1.114	.010		1.254	1.116	1.246	1.128	
025	1.176	.011		1.316	1.178	1.308	1.190	
026	1.239	.011		1.379	1.241	1.371	1.253	
027	1.301	.011		1.441	1.303	1.433	1.315	
028	1.364	.013		1.504	1.366	1.496	1.378	
029	1.489	.013		1.629	1.491	1.621	1.503	
030	1.614	.013		1.754	1.616	1.746	1.628	
031	1.739	.015		1.879	1.741	1.871	1.753	
032	1.864	.015		2.004	1.866	1.996	1.878	
033	1.989	.018		2.129	1.991	2.121	2.003	
034	2.114	.018		2.254	2.116	2.246	2.128	
035	2.239	.018		2.379	2.241	2.371	2.253	
036	2.364	.018		2.504	2.366	2.496	2.378	
037	2.489	.018		2.629	2.491	2.621	2.503	
038	2.614	.020		2.754	2.616	2.746	2.628	
039	2.739	.020		2.879	2.741	2.871	2.753	
040	2.864	.020		3.004	2.866	2.996	2.878	
041	2.989	.024		3.129	2.991	3.121	3.003	
042	3.239	.024		3.379	3.241	3.371	3.253	
043	3.489	.024		3.629	3.491	3.621	3.503	
044	3.739	.027		3.879	3.741	3.871	3.753	
045	3.989	.027		4.129	3.991	4.121	4.003	
102	.049	.005		.255	.051	.245	.063	
103	.081	.005		.287	.083	.277	.095	
104	.112	.005		.318	.114	.308	.126	
105	.143	.005		.349	.145	.339	.157	
106	.174	.005		.380	.176	.370	.188	
107	.206	.005		.412	.208	.402	.220	
108	.237	.005	.103	.443	.239	.433	.251	.108
109	.299	.005	±.003	.505	.301	.495	.313	
110	.362	.005		.568	.364	.558	.376	
111	.424	.005		.630	.426	.620	.438	
112	.487	.005		.693	.489	.683	.501	
113	.549	.007		.755	.551	.745	.563	
114	.612	.009		.818	.614	.808	.626	
115	.674	.009		.880	.676	.870	.688	
116	.737	.009		.943	.739	.933	.751	

[1]For pressures over 55.2 Bar (800 psi), consult Design Chart 1 and the design sections of this catalog.

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Table 5-4: Rotary O-Ring Seal Gland Dimensions

O-Ring Size Parker No. 2-	Dimensions				B	A-1	D	G
	I.D.	±	W	Mean O.D. (Ref)	O.D. (Shaft) +.000 -.001	Groove (Gland) +.003 -.000	Throat Dia. +.003 -.000	Groove Width +.004 -.000
117	.799	.010		1.005	.801	.995	.813	
118	.862	.010		1.068	.864	1.058	.876	
119	.924	.010		1.130	.926	1.120	.938	
120	.987	.010		1.193	.989	1.183	1.001	
121	1.049	.010		1.255	1.051	1.245	1.063	
122	1.112	.010		1.318	1.114	1.308	1.126	
123	1.174	.012		1.380	1.176	1.370	1.188	
124	1.237	.012		1.443	1.239	1.433	1.251	
125	1.299	.012		1.505	1.301	1.495	1.313	
126	1.362	.012		1.568	1.364	1.558	1.376	
127	1.424	.012		1.630	1.426	1.620	1.438	
128	1.487	.012		1.693	1.489	1.683	1.501	
129	1.549	.015		1.755	1.551	1.745	1.563	
130	1.612	.015		1.818	1.614	1.808	1.626	
131	1.674	.015		1.880	1.676	1.870	1.688	
132	1.737	.015		1.943	1.739	1.933	1.751	
133	1.799	.015		2.005	1.801	1.995	1.813	
134	1.862	.015		2.068	1.864	2.058	1.876	
135	1.925	.017		2.131	1.927	2.121	1.939	
136	1.987	.017		2.193	1.989	2.183	2.001	
137	2.050	.017		2.256	2.052	2.246	2.064	
138	2.112	.017		2.318	2.114	2.308	2.126	
139	2.175	.017	.103	2.381	2.177	2.371	2.189	.108
140	2.237	.017	±.003	2.443	2.239	2.433	2.251	
141	2.300	.020		2.506	2.302	2.496	2.314	
142	2.362	.020		2.568	2.364	2.558	2.376	
143	2.425	.020		2.631	2.427	2.621	2.439	
144	2.487	.020		2.693	2.489	2.683	2.501	
145	2.550	.020		2.756	2.552	2.746	2.564	
146	2.612	.020		2.818	2.614	2.808	2.626	
147	2.675	.022		2.881	2.677	2.871	2.689	
148	2.737	.022		2.943	2.739	2.933	2.751	
149	2.800	.022		3.006	2.802	2.996	2.814	
150	2.862	.022		3.068	2.864	3.058	2.876	
151	2.987	.024		3.193	2.989	3.183	3.001	
152	3.237	.024		3.443	3.239	3.433	3.251	
153	3.487	.024		3.693	3.489	3.683	3.501	
154	3.737	.028		3.943	3.739	3.933	3.751	
155	3.987	.028		4.193	3.989	4.183	4.001	
156	4.237	.030		4.443	4.239	4.433	4.251	
157	4.487	.030		4.693	4.489	4.683	4.501	
158	4.737	.030		4.943	4.739	4.933	4.751	
159	4.987	.035		5.193	4.989	5.183	5.001	
160	5.237	.035		5.443	5.239	5.433	5.251	
161	5.487	.035		5.693	5.489	5.683	5.501	
162	5.737	.035		5.943	5.739	5.933	5.751	
163	5.987	.035		6.193	5.989	6.183	6.001	
201	.171	.005		.499	.173	.439	.189	
202	.234	.005		.512	.236	.502	.252	
203	.296	.005		.574	.298	.564	.314	
204	.359	.005		.637	.361	.627	.377	
205	.421	.005	.139	.699	.423	.689	.439	.144
206	.484	.005	±.004	.762	.486	.752	.502	
207	.546	.007		.824	.548	.814	.564	
208	.609	.009		.887	.611	.877	.627	
209	.671	.009		.949	.673	.939	.689	
210	.734	.010		1.012	.736	1.002	.752	

†For pressures over 55.2 Bar (800 psi), consult Design Chart 1 and the design sections of this catalog.

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Table 5-4: Rotary O-Ring Seal Gland Dimensions

O-Ring Size Parker No. 2-	Dimensions				B	A-1	D	G
	I.D.	±	W	Mean O.D. (Ref)	O.D. (Shaft) +.000 -.001	Groove (Gland) +.003 -.000	Throat Dia. +.003 -.000	Groove Width +.004 -.000
211	.796	.010		1.074	.798	1.064	.814	
212	.859	.010		1.137	.861	1.127	.877	
213	.921	.010		1.199	.923	1.189	.939	
214	.984	.010		1.262	.986	1.252	1.002	
215	1.046	.010		1.324	1.048	1.314	1.064	
216	1.109	.012		1.387	1.111	1.377	1.127	
217	1.171	.012		1.449	1.173	1.439	1.189	
218	1.234	.012		1.512	1.236	1.502	1.252	
219	1.296	.012		1.574	1.298	1.564	1.314	
220	1.359	.012		1.637	1.361	1.627	1.377	
221	1.421	.012		1.699	1.423	1.689	1.439	
222	1.484	.015		1.762	1.486	1.752	1.502	
223	1.609	.015		1.887	1.611	1.877	1.627	
224	1.734	.015		2.012	1.736	2.002	1.752	
225	1.859	.018		2.137	1.861	2.127	1.877	
226	1.984	.018		2.262	1.986	2.252	2.002	
227	2.109	.018		2.387	2.111	2.377	2.127	
228	2.234	.020		2.512	2.236	2.502	2.252	
229	2.359	.020		2.637	2.361	2.627	2.377	
230	2.484	.020		2.762	2.486	2.752	2.502	
231	2.609	.020		2.887	2.611	2.877	2.627	
232	2.734	.024		3.012	2.736	3.002	2.752	
233	2.859	.024	.139	3.137	2.861	3.127	2.877	.144
234	2.984	.024	±.004	3.262	2.986	3.252	3.002	
235	3.109	.024		3.387	3.111	3.377	3.127	
236	3.234	.024		3.512	3.236	3.502	3.252	
237	3.359	.024		3.637	3.361	3.627	3.377	
238	3.484	.024		3.762	3.486	3.752	3.502	
239	3.609	.028		3.887	3.611	3.877	3.627	
240	3.734	.028		4.012	3.736	4.002	3.752	
241	3.859	.028		4.137	3.861	4.127	3.877	
242	3.984	.028		4.262	3.986	4.252	4.002	
243	4.109	.028		4.387	4.111	4.377	4.127	
244	4.234	.030		4.512	4.236	4.502	4.252	
245	4.359	.030		4.637	4.361	4.627	4.377	
246	4.484	.030		4.762	4.486	4.752	4.502	
247	4.609	.030		4.887	4.611	4.877	4.627	
248	4.734	.030		5.012	4.736	5.002	4.752	
249	4.859	.035		5.137	4.861	5.127	4.877	
250	4.984	.035		5.262	4.986	5.252	5.002	
251	5.109	.035		5.387	5.111	5.377	5.127	
252	5.234	.035		5.512	5.236	5.502	5.252	
253	5.359	.035		5.637	5.361	5.627	5.377	
254	5.484	.035		5.762	5.486	5.752	5.502	
255	5.609	.035		5.887	5.611	5.877	5.627	
256	5.734	.035		6.012	5.736	6.002	5.752	
257	5.859	.035		6.137	5.861	6.127	5.877	
258	5.984	.035		6.262	5.986	6.252	6.002	

†For pressures over 55.2 Bar (800 psi), consult Design Chart 1 and the design sections of this catalog.

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Table 24: Statement of Problem

For a design problem that cannot be resolved using this catalog, fill out a copy of this "Statement of Problem" sheet as completely as possible, then contact your nearest Zatkoff location for analysis and recommendation.

1.	Seal Type			
2.	Fluid Sealed (In sequence if multiple)	A.	B.	Material Spec.
		C.	D.	
3.	Temperature	High	Low	Working
4.	Pressure	High	Low	Working
5.	Applied Pressure	Uni-Directional	Steady	Surge
		Bi-Directional	Fluctuating	Frequency
6.	Gland Dimensions	OD	Finish	Material
		ID	Finish	Material
	(If separate, groove wall)		Finish	Material
7.	Max. Stretch at Installation			
8.	Assembly Problems	Dirt	Lint	Lube
		Twisted	Blind	Pinching
		Over Threads Corners, Holes, Etc.		
MOVING SEALS				
9.	Length of Stroke (Reciprocating)		Arc of Travel (Oscillating)	
	Surface Speed (Rotary)		Frequency (Oscillating or Reciprocating)	
10.	Shaft Bearings	No		
	Side Loading Effect		Eccentricity	
11.	Operating Clearance	Max.	Min.	
12.	Leakage Tolerance			
13.	Friction Tolerance	Breakaway	Running	
14.	Anticipated Overhaul Period			
	Ease of Access and Replacement			
15.	Lubrication	By Fluid Sealed	External	
16.	Cleanliness	Protected	Open	Bad
	O-Ring Size No.	And Parker Compound No.	Or Military Part No.	
17.	Please include a drawing or sketch if needed to clarify the assembly, and add any other pertinent information.			

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Nitrile (General Service)	-34°C to 121°C (-30°F to 250°F)*	AFLAS	-4°C to 232°C (25°F to 450°F)*
Nitrile (Low Temperature)	-55°C to 107°C (-65°F to 225°F)*	Neoprene	-37°C to 107°C (-35°F to 225°F)*
Hydrogenated Nitrile	-32°C to 149°C (-23°F to 300°F)*	Polyacrylate	-21°C to 177°C (- 5°F to 350°F)*
Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
— A —																			
Abietic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Acetaldehyde	**E0540-80**	3	3	2	4	1	1	3	3	3	4	4	2	2	2	2	3	4	2
Acetamide	**C0873-70**	1	1	1	3	1	1	2	1	4	4	4	2	4	4	4	2	1	2
Acetanilide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Acetic Acid, 30%	**E0540-80**	X	X	1	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Acetic Acid, 5%	**E0540-80**	2	2	1	1	1	1	1	1	2	4	4	1	2	2	2	1	2	1
Acetic Acid, Glacial	**E0540-80**	2	2	1	2	1	1	3	4	2	4	4	2	2	2	2	3	2	1
Acetic Acid, Hot, High Pressure	**Zatkoff**	4	4	3	4	4	4	3	4	4	4	4	4	4	4	4	3	4	3
Acetic Anhydride	**C0873-70**	3	4	2	4	1	1	2	2	2	4	4	2	2	2	2	2	4	2
Acetoacetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Acetone	**E0540-80**	4	4	1	4	2	1	2	4	4	4	4	1	4	4	4	3	4	4
Acetone Cyanohydrin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Acetonitrile	**E0540-80**	3	X	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X
Acetophenetidine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Acetophenone	**E0540-80**	4	4	1	4	2	1	2	4	4	4	4	2	4	4	4	4	4	4
Acetotoluidide	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Acetyl Acetone	**E0540-80**	4	4	1	4	2	1	2	4	4	4	4	1	4	4	4	4	4	4
Acetyl Bromide	**V1164-75**	4	4	1	1	1	1	2	4	4	4	4	1	4	4	4	4	4	4
Acetyl Chloride	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Acetylene	**E0540-80**	1	1	1	1	1	1	1	2	2	4	4	1	2	2	2	2	X	2
Acetylene Tetrabromide	**V1164-75**	4	4	1	1	1	1	1	2	4	X	4	1	X	X	X	X	X	X
Acetylene Tetrachloride	**V1164-75**	4	4	1	1	1	1	1	2	4	X	4	1	X	X	X	X	X	X
Acetylsalicylic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Acids, Non-organic	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Acids, Organic	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aconitic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Acridine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Acrolein	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Acrylic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Acrylonitrile	**V8545-75**	4	4	4	3	1	1	3	4	3	4	4	4	X	3	3	3	4	4
Adipic Acid	**E0540-80**	1	1	2	X	1	1	2	X	X	X	X	X	X	X	X	X	X	X
Aero Lubriplate	**N0674-70**	1	1	4	1	1	1	2	1	2	1	1	4	4	4	4	1	1	2
Aero Shell 17 Grease	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	1	1	2
Aero Shell 750	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Aero Shell 7A Grease	**N0674-70**	2	2	4	1	1	1	2	2	4	1	1	4	4	4	4	1	1	2
Aero Shell IAC	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	1	1	2
Aerosafe 2300	**E0540-80**	4	4	1	4	4	4	2	4	4	4	4	2	4	4	4	4	3	3
Aerosafe 2300W	**E0540-80**	4	4	1	4	4	4	2	4	4	4	4	2	4	4	4	4	3	3
Aerozene 50 (50% Hydrazine 50% UDMH)	**E0540-80**	3	3	1	4	4	4	2	4	4	X	4	1	4	4	4	4	4	4

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Zatkoff SEALS & PACKINGS

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Air Below 200° F	**E0540-80**	2	2	1	1	1	1	1	1	2	1	2	1	2	2	2	1	1	1
Air, 200 - 300° F	**S0604-70**	3	3	2	1	1	1	1	2	4	2	3	2	4	4	4	2	1	1
Air, 300 - 400° F	**S0604-70**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	1
Air, 400 - 500° F	**S0455-70**	4	4	4	3	2	2	3	4	4	4	4	4	4	4	4	4	4	2
Aliphatic Dicarboxylic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Alkanes (Paraffin Hydrocarbons)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkanesulfonic Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkazene	**V1164-75**	4	4	4	2	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Alkenes (Olefin Hydrocarbons)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Alkyl Acetone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Alkyl Alcohol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkyl Amine	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkyl Aryl Sulfonates	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkyl Aryl Sulfonics	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Alkyl Benzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Alkyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Alkyl Sulfide	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Alkylnaphthalene Sulfonic Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Allyl Chloride	**V1164-75**	2	2	4	1	1	1	X	1	X	X	X	X	X	X	X	X	X	X
Allylidene Diacetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Alpha Picoline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Acetate	**E0540-80**	2	2	1	4	1	1	2	2	2	4	4	1	4	1	1	4	4	4
Aluminum Bromide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
Aluminum Chlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Chloride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	2
Aluminum Ethylate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aluminum Fluoride	**N0674-70**	1	1	1	1	1	1	1	1	1	X	3	1	1	1	2	1	1	2
Aluminum Fluorosilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aluminum Formate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Hydroxide	**E0540-80**	2	X	1	2	1	1	1	X	X	X	X	X	X	X	X	X	X	2
Aluminum Linoleate	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Aluminum Nitrate	**N0674-70**	1	1	1	1	1	1	1	1	1	X	3	1	1	1	1	1	X	2
Aluminum Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Phosphate	**E0540-80**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	2
Aluminum Potassium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Salts	**N0674-70**	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
Aluminum Sodium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aluminum Sulfate	**N0674-70**	1	1	1	1	1	1	1	1	2	4	4	1	1	1	1	1	1	1
Alums-NH3 -Cr -K	**N0674-70**	1	1	1	4	4	4	2	1	1	4	X	1	1	1	1	1	4	1
Ambrex 33 (Mobil)	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	3	3	4

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Ambrex 830 (Mobil)	**N0674-70**	1	1	3	1	1	1	2	2	4	1	1	3	4	4	4	2	1	2
Amines-Mixed	**C0873-70**	4	4	2	4	4	4	3	2	2	4	4	2	2	2	2	4	4	2
Aminoanthraquinone	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aminoazobenzene	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aminobenzene Sulfonic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aminobenzoic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aminopyridine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aminosalicylic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ammonia (Anhydrous)	**C0873-70**	2	2	1	4	4	4	2	1	4	4	4	1	4	4	4	4	4	2
Ammonia and Lithium Metal in Solution	**E0540-80**	2	2	2	4	4	4	3	X	4	4	4	2	4	4	4	4	4	4
Ammonia, Gas, Cold	**C0873-70**	1	1	1	4	4	4	2	1	1	4	X	1	1	1	1	1	4	1
Ammonia, Gas, Hot	**S0604-70**	4	4	2	4	4	4	2	2	4	4	X	2	4	4	4	2	4	X
Ammonia, Liquid (Anhydrous)	**C0873-70**	2	2	1	4	4	4	2	1	4	4	4	1	4	4	4	2	4	2
Ammonium Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Arsenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Benzoate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Bicarbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Bisulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Bromide	**N0674-70**	1	1	1	1	1	1	1	1	1	X	1	1	X	X	1	1	X	X
Ammonium Carbamate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Carbonate	**C0873-70**	4	4	1	1	1	1	1	1	1	4	4	1	X	X	1	1	X	X
Ammonium Chloride, 2N	**N0674-70**	1	1	1	1	1	1	1	1	1	X	1	1	X	X	1	1	X	X
Ammonium Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Dichromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Diphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Fluoride	**N0674-70**	1	1	1	1	1	1	1	1	1	X	1	1	X	X	1	1	X	X
Ammonium Fluorosilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ammonium Formate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Hydroxide, 3 Molar	**E0540-80**	1	1	1	3	2	2	2	1	2	4	4	1	2	2	2	1	1	1
Ammonium Hydroxide, Concentrated	**E0540-80**	4	4	1	4	4	4	2	1	3	4	4	1	3	3	3	1	1	1
Ammonium Iodide	**N0674-70**	1	1	1	1	1	1	1	1	1	X	1	1	X	X	1	1	X	X
Ammonium Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Metaphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Molybdenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Nitrate, 2N	**N0674-70**	1	1	1	X	X	X	2	1	1	2	X	1	X	X	3	1	X	X
Ammonium Nitrite	**N0674-70**	1	1	1	X	1	1	2	1	1	X	X	1	1	1	1	1	X	2
Ammonium Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Perchlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Perchloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ammonium Persulfate 10%	**E0540-80**	4	4	1	X	X	X	2	1	4	4	4	1	X	1	1	X	X	X

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Zatkoff SEALS & PACKINGS

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Ammonium Persulfate Solution	**E0540-80**	4	4	1	X	1	1	2	X	4	4	4	1	X	1	1	X	X	X
Ammonium Phosphate	**N0674-70**	1	1	1	4	1	1	2	1	1	X	X	1	X	1	1	1	X	1
Ammonium Phosphate, Dibasic	**N0674-70**	1	1	1	X	1	1	2	1	1	X	X	1	X	1	1	1	X	1
Ammonium Phosphate, Mono-Basic	**N0674-70**	1	1	1	X	1	1	2	1	1	X	X	1	X	1	1	1	X	1
Ammonium Phosphate, Tribasic	**N0674-70**	1	1	1	X	1	1	2	1	1	X	X	1	X	1	1	1	X	1
Ammonium Phosphite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Picrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Polysulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Salicylate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Salts	**N0674-70**	1	1	1	3	1	1	2	1	1	3	X	1	X	1	1	1	3	1
Ammonium Sulfamate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Sulfate	**N0674-70**	1	1	1	4	1	1	2	1	2	4	X	1	1	1	1	1	X	X
Ammonium Sulfate Nitrate	**N0674-70**	1	1	1	4	1	1	2	1	2	4	X	1	1	1	1	1	X	X
Ammonium Sulfide	**N0674-70**	1	1	1	4	1	1	2	1	2	4	X	1	1	1	1	1	X	X
Ammonium Sulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Thiocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Thioglycolate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Thiosulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Tungstate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ammonium Valerate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Amyl Acetate	**N0674-70**	1	1	3	4	1	1	3	4	4	4	4	3	4	4	4	4	4	4
Amyl Alcohol	**E0540-80**	2	2	1	2	1	1	1	2	2	4	4	1	2	2	2	2	1	4
Amyl Borate	**N0674-70**	1	1	4	1	1	1	2	1	4	X	X	4	4	4	4	1	X	X
Amyl Butyrate	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Amyl Chloride	**V1164-75**	X	X	4	1	1	1	2	4	4	4	X	4	4	4	4	4	2	4
Amyl Chloronaphthalene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	X	4	4	4	4	4	2	4
Amyl Cinnamic Aldehyde	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Amyl Laurate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Amyl Mercaptan	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Amyl Naphthalene	**V1164-75**	4	4	4	1	1	1	2	4	4	2	4	4	4	4	4	4	1	4
Amyl Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Amyl Nitrite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Amyl Phenol	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Amyl Propionate	**N0674-70**	1	1	4	1	2	1	X	2	4	1	1	4	4	4	4	2	1	2
Anderol, L- 826 (di-ester)	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Anderol, L- 829 (di-ester)	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Anderol, L-774 (di-ester)	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
ANG-25 (Di-ester Base) (TG749)	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	2
ANG-25 (Glyceral Ester)	**E0540-80**	2	2	1	1	1	1	1	2	2	4	4	2	2	2	2	2	2	2
Aniline	**E0540-80**	4	4	2	3	1	1	2	4	4	4	4	2	4	4	4	4	3	4

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Aniline Dyes	**E0540-80**	4	4	2	2	1	1	2	2	2	4	4	2	2	2	2	2	2	3
Aniline Hydrochloride	**E0540-80**	2	2	2	2	1	1	2	4	3	4	4	2	4	2	2	4	2	3
Aniline Oil	**E0540-80**	4	4	2	3	2	2	2	4	4	4	4	2	4	4	4	4	3	4
Aniline Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Aniline Sulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Animal Fats	**N0674-70**	1	1	2	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Animal Oil (Lard Oil)	**N0674-70**	1	1	2	1	1	1	2	2	4	1	2	2	4	4	4	2	1	2
Anisole	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Anisoyl Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
AN-O-3 Grade M	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	2
AN-O-366	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	2	1	4
AN-O-6	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Ansul Ether 161 or 181	**V3819-75**	3	3	3	4	1	1	3	4	4	4	2	3	4	4	4	4	3	4
Anthracene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Anthranilic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Anthraquinone	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Anti-freeze Solutions	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Antimony Chloride	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Antimony Pentachloride	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Antimony Pentafluoride	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Antimony Sulfate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Antimony Tribromide	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Antimony Trichloride	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Antimony Trifluoride	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
Antimony Trioxide	**N0674-70**	1	1	4	1	1	1	1	2	4	1	1	4	4	4	4	2	1	4
AN-VV-O-366b Hydr. Fluid	**N0674-70**	1	1	4	1	1	1	1	2	4	2	2	4	4	4	4	2	1	4
Aqua Regia	**V3819-75**	4	3	3	2	2	2	3	4	X	X	X	X	X	X	X	X	X	X
Arachidic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Argon	**B0612-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Aroclor, 1248	**V1164-75**	3	3	2	1	1	1	1	4	4	4	4	2	4	4	4	4	2	2
Aroclor, 1254	**V1164-75**	4	4	2	1	1	1	1	4	4	4	4	4	4	4	4	4	2	3
Aroclor, 1260	**V1164-75**	1	1	X	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Aromatic Fuel -50%	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Arsenic Acid	**E0540-80**	1	1	1	1	1	1	1	1	1	3	3	1	1	1	2	1	1	1
Arsenic Oxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Arsenic Trichloride	**N0674-70**	1	1	4	4	1	1	X	1	X	X	X	X	X	X	X	X	X	X
Arsenic Trioxide	**N0674-70**	1	1	4	4	1	1	X	1	X	X	X	X	X	X	X	X	X	X
Arsenic Trisulfide	**N0674-70**	1	1	4	4	1	1	X	1	X	X	X	X	X	X	X	X	X	X
Arsenites	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Arsine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Aryl Orthosilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ascorbic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Askarel Transformer Oil	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Aspartic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Asphalt	**V1164-75**	2	2	4	1	1	1	2	2	4	2	2	4	4	4	4	2	2	4
ASTM Oil, No.1	**N0674-70**	1	1	4	1	1	1	1	1	4	1	1	4	4	4	4	2	1	1
ASTM Oil, No.2	**N0674-70**	1	1	4	1	1	1	1	2	4	1	2	4	4	4	4	4	1	4
ASTM Oil, No.3	**N0674-70**	1	1	4	1	1	1	1	4	4	1	2	4	4	4	4	4	1	3
ASTM Oil, No.4	**V1164-75**	2	2	4	1	1	1	1	4	4	2	4	4	4	4	4	4	2	4
ASTM Oil, No.5	**V1164-75**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
ASTM Reference Fuel A	**N0674-70**	1	1	4	1	1	1	1	2	4	2	1	4	4	4	4	2	1	4
ASTM Reference Fuel B	**N0674-70**	1	1	4	1	1	1	1	4	4	4	2	4	4	4	4	4	1	4
ASTM Reference Fuel C	**V1164-75**	2	2	4	1	1	1	1	4	4	4	4	4	4	4	4	4	2	4
ASTM Reference Fuel D	**V1164-75**	2	2	4	1	1	1	4	4	X	X	X	X	X	X	X	X	X	X
ATL-857	**V1164-75**	2	2	4	1	1	1	1	4	4	2	4	4	4	4	4	4	2	4
Atlantic Dominion F	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	4	1	4
Atlantic Utro Gear-e	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Atlantic Utro Gear-EP Lube.	**V1164-75**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	4	1	4
Aure 903R (Mobil)	**N0304-75**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	2	4	4	4
AUREX 256	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Automatic Transmission Fluid	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	3	X	4
Automotive Brake Fluid	**E0667-70**	3	3	1	4	1	1	2	2	1	4	4	2	X	X	X	2	4	3
AXAREL 9100	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Azobenzene	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
— B —																			
Bardol B	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Barium Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Barium Chlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Barium Chloride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Barium Cyanide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Barium Hydroxide	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Barium Iodide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Barium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Barium Oxide	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Barium Peroxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Barium Polysulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Barium Salts	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Barium Sulfate	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Barium Sulfide	**N0674-70**	1	1	1	1	1	1	1	1	2	4	1	1	2	1	1	1	1	1

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
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Bayol 35	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	4	1	4
Bayol D	**N0674-70**	1	1	4	1	1	1	2	2	4	1	4	4	4	4	4	4	1	4
Beer	**E1028-70**	1	1	1	1	1	1	1	1	1	4	2	1	1	1	1	1	1	1
Beet Sugar Liquids	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Beet Sugar Liquors	**N0674-70**	1	1	1	1	1	1	1	2	1	4	4	1	1	1	1	1	1	1
Benzaldehyde	**E0540-80**	4	4	1	4	1	1	2	4	4	4	4	1	4	4	4	1	4	2
Benzaldehyde Disulfonic Acid	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Benzamide	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzanthrone	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	3	4
Benzene Hexachloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Benzenesulfonic Acid 10%	**V1164-75**	4	4	4	1	1	1	2	2	4	4	4	4	4	4	4	1	2	4
Benzidine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzidine 3 Sulfonic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzil	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzilic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzine (Ligroin)	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	3	1	4
Benzocatechol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzochloride	**V1164-75**	4	4	1	1	1	1	1	4	4	4	X	2	4	4	4	4	1	X
Benzoic Acid	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Benzoin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzonitrile	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Benzophenone	**V1164-75**	X	X	2	1	1	1	2	X	4	4	4	2	4	4	X	X	1	X
Benzoquinone	**V1164-75**	X	X	2	1	1	1	2	X	4	4	4	2	4	4	X	X	X	X
Benzotrichloride	**V1164-75**	4	4	1	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Benzotrifluoride	**V1164-75**	4	4	1	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Benzoyl Chloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzoyl Peroxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Benzoylsulfonilic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzyl Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Benzyl Alcohol	**V1164-75**	4	4	2	1	1	1	2	2	4	4	4	2	4	4	4	2	2	2
Benzyl Amine	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Benzyl Benzoate	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	2	4	4	4	4	1	4
Benzyl Bromide	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Benzyl Butyl Phthalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Benzyl Chloride	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Benzyl Phenol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Benzyl Salicylate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Beryllium Chloride	**N0674-70**	1	1	1	1	1	1	1	3	3	3	3	1	3	3	3	3	3	3
Beryllium Fluoride	**N0674-70**	1	1	1	1	1	1	1	3	3	3	3	1	3	3	3	3	3	3

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Zatkoff SEALS & PACKINGS

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Beryllium Oxide	**N0674-70**	1	1	1	1	1	1	1	3	3	3	3	1	3	3	3	3	3	3
Beryllium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bismuth Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bismuth Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bismuth Oxychloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bittern	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Black Liquor	**E0540-80**	2	X	1	1	3	3	1	1	X	X	X	X	X	X	X	X	X	X
Black Point 77	**N0674-70**	1	1	1	1	1	1	1	3	3	3	3	1	3	3	3	3	3	3
Blast Furnace Gas	**S0604-70**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	1
Bleach Liquor	**E0540-80**	3	3	1	1	1	1	1	2	3	4	4	1	2	2	3	1	2	2
Bleach Solutions	**E0540-80**	X	X	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Borax	**E0540-80**	2	2	1	1	1	1	1	4	2	2	1	1	2	2	2	4	2	2
Borax Solutions	**E0540-80**	X	X	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Bordeaux Mixture	**E0540-80**	2	2	1	1	1	1	1	2	2	4	4	1	2	2	2	1	2	2
Boric Acid	**N0674-70**	1	1	1	1	1	1	1	1	1	4	1	1	1	1	1	1	1	1
Boric Oxide	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Borneol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Bornyl Acetate	**V1164-75**	2	2	4	1	2	1	X	4	4	4	3	4	4	4	4	4	2	X
Bornyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Bornyl Formate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Boron Fluids (HEF)	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Boron Hydride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Boron Phosphate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Boron Tribromide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Boron Trichloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Boron Trifluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Boron Trioxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Brake Fluid DOT3 (Glycol Type)	**E0667-70**	3	3	1	4	4	4	2	2	1	X	4	2	X	X	X	2	4	3
Bray GG-130	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Brayco 719-R (VV-H-910)	**E0603-70**	3	3	1	4	4	4	2	2	X	4	4	2	2	2	2	2	2	2
Brayco 885 (MIL-L-6085A)	**V1164-75**	2	2	4	1	1	1	2	4	4	2	1	4	4	4	4	4	2	4
Brayco 910	**E0540-80**	2	2	1	4	4	4	2	2	2	3	3	1	1	1	1	1	4	4
Bret 710	**E0540-80**	2	2	1	4	4	4	2	2	2	3	3	1	1	1	1	1	4	4
Brine	**N0674-70**	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Brine (Seawater)	**N0674-70**	1	1	3	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Brom - 113	**V3819-75**	3	3	4	X	X	X	3	4	4	X	X	4	X	X	X	4	X	4
Brom - 114	**V3819-75**	2	2	4	2	1	1	3	2	4	X	X	4	4	4	4	2	X	4
Bromic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bromine	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Bromine Pentafluoride	**Zatkoff**	4	4	4	4	2	2	3	4	4	4	4	4	4	4	4	4	4	4

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Bromine Trifluoride	**Zatkoff**	4	4	4	4	2	2	3	4	4	4	4	4	4	4	4	4	4	4
Bromine Water	**V1164-75**	4	4	2	1	1	1	3	4	4	4	4	4	4	4	4	1	2	4
Bromobenzene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Bromobenzene Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Bromochlorotrifluoroethane (Halothane)	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Bromoform	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Bromomethane (Methyl Bromide)	**V1164-75**	2	2	4	1	1	1	1	4	4	3	X	4	4	4	4	4	1	X
Bromotrifluoroethylene (BFE)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Bromotrifluoromethane (F-13B1)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Brucine Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Buffered Oxide Etchants	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Bunker Oil	**N0674-70**	1	1	4	1	1	1	2	4	4	1	2	4	4	4	4	4	1	2
Bunker's "C" (Fuel Oil)	**N0674-70**	1	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Butadiene (Monomer)	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Butane	**N0674-70**	1	1	4	1	1	1	2	1	3	1	1	4	4	4	4	2	3	4
Butane, 2, 2-Dimethyl	**N0674-70**	1	1	4	1	1	1	2	2	3	1	4	4	4	4	4	2	3	4
Butane, 2, 3-Dimethyl	**N0674-70**	1	1	4	1	1	1	2	2	3	1	4	4	4	4	4	2	3	4
Butanedial	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butanol (Butyl Alcohol)	**N0674-70**	1	1	2	1	1	1	1	1	1	4	4	2	1	1	1	1	1	2
Butene 2-Ethyl (1-Butene 2-Ethyl)	**N0674-70**	1	1	4	1	1	1	1	4	4	1	4	4	4	4	4	4	3	4
Butter-Animal Fat	**N0508-75**	1	1	1	1	1	1	1	2	4	1	1	2	4	4	4	2	1	2
Butyl Acetate or n-Butyl Acetate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Butyl Acetate Ricinoleate	**E0540-80**	2	2	1	1	1	1	1	2	4	X	4	1	4	4	4	2	2	X
Butyl Acrylate	**E0540-80**	4	4	1	4	4	4	4	4	4	4	X	4	4	4	4	4	4	2
Butyl Alcohol	**N0674-70**	1	1	2	1	1	1	1	1	1	4	4	2	1	1	1	1	1	2
Butyl Alcohol (Secondary)	**V1164-75**	2	2	2	1	1	1	1	2	2	4	4	2	2	2	2	2	2	2
Butyl Alcohol (Tertiary)	**V1164-75**	2	2	2	1	1	1	1	2	2	4	4	2	2	2	2	2	2	2
Butyl Amine or N-Butyl Amine	**N0674-70**	1	1	3	4	1	1	3	4	4	4	4	4	4	4	4	4	4	4
Butyl Benzoate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Benzoate or n-Butyl Benzoate	**E0540-80**	4	4	1	1	1	1	X	4	2	4	X	1	4	4	4	4	1	X
Butyl Benzolate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Butyl Butyrate or n-Butyl Butyrate	**E0540-80**	4	4	1	1	1	1	X	4	4	4	X	1	4	4	4	4	1	X
Butyl Carbitol	**E0540-80**	4	4	1	3	1	1	2	3	4	4	X	1	4	4	4	2	4	4
Butyl Cellosolve	**E0540-80**	3	3	2	4	1	1	2	3	4	4	4	2	4	4	4	4	4	X
Butyl Cellosolve Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Cellosolve Adipate	**E0540-80**	4	4	2	2	1	1	2	4	4	4	4	2	4	4	4	4	2	2
Butyl Chloride	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Butyl Ether or n-Butyl Ether	**V3819-75**	3	3	3	4	1	1	X	4	4	4	3	3	4	4	4	4	3	4
Butyl Glycolate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Zatkoff SEALS & PACKINGS

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Hydrogenated Nitrile	-32°C to 149°C (-23°F to 300°F)*	Polyacrylate	-21°C to 177°C (- 5°F to 350°F)*
Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Butyl Laurate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Mercaptan (Tertiary)	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	X	4
Butyl Methacrylate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Oleate	**V1164-75**	4	4	2	1	1	1	2	4	4	X	X	2	4	X	4	4	2	X
Butyl Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyl Stearate	**V1164-75**	2	2	4	1	1	1	2	4	4	X	X	4	4	4	4	4	2	X
Butylbenzoic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Butylene	**V1164-75**	2	2	4	1	1	1	2	3	4	4	4	4	4	4	4	4	2	4
Butyraldehyde	**E0540-80**	4	4	2	4	1	1	2	4	4	4	4	2	4	4	4	4	4	4
Butyric Acid	**V1164-75**	4	4	2	2	1	1	1	4	4	4	X	2	4	X	X	4	X	X
Butyric Anhydride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyrolacetone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Butyryl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
— C —																			
Cadmium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cadmium Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cadmium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cadmium Oxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cadmium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cadmium Sulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcine Liquors	**N0674-70**	1	1	1	1	1	1	1	X	X	4	4	1	X	X	X	X	1	X
Calcium Acetate	**E0540-80**	2	2	1	4	1	1	2	2	4	4	4	1	4	1	1	2	4	4
Calcium Arsenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Benzoate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Calcium Bicarbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Bisulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Bisulfite	**E0540-80**	2	2	1	2	1	1	1	2	2	3	3	1	4	4	4	1	3	3
Calcium Bromide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calcium Carbide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Carbonate	**N0674-70**	1	1	1	1	1	1	1	1	1	3	3	1	1	1	1	1	1	1
Calcium Chlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Chloride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calcium Chromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Cyanamide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Cyanide	**N0674-70**	1	1	1	X	1	1	1	1	1	X	X	1	1	1	1	1	X	1
Calcium Fluoride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calcium Gluconate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Hydride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calcium Hydrosulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Hydroxide	**N0674-70**	1	1	1	1	1	1	1	1	1	4	2	1	1	1	1	1	1	1

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Calcium Hypochlorite	**E0540-80**	2	2	1	1	1	1	1	2	2	4	4	1	2	2	2	1	2	2
Calcium Hypophosphite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Nitrate	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Calcium Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Oxide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calcium Permanganate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Peroxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Phenolsulfonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Phosphate	**N0674-70**	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	X	1
Calcium Phosphate Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Propionate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Pyridine Sulfonate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Calcium Salts	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Calcium Silicate	**N0674-70**	1	1	1	1	1	1	1	1	1	X	X	1	1	1	1	1	X	X
Calcium Stearate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Calcium Sulfamate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Calcium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Sulfide	**N0674-70**	1	1	1	1	1	1	1	1	2	4	1	1	2	2	2	1	1	1
Calcium Sulfite	**N0674-70**	1	1	1	1	1	1	1	1	2	4	1	1	2	2	2	1	1	1
Calcium Thiocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Calcium Thiosulfate	**E0540-80**	2	2	1	1	1	1	1	1	2	4	1	1	2	2	2	1	1	1
Calcium Tungstate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Caliche Liquors	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Camphene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Camphor	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Camphoric Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cane Sugar Liquors	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Capric Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Caproic Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Caproic Aldehyde	**E0540-80**	X	X	2	4	1	1	3	X	X	4	4	2	2	2	2	X	4	2
Caprolactam	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Capronaldehyde	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Carbamate	**V1164-75**	3	3	2	1	1	1	1	2	4	4	4	2	4	4	4	2	1	X
Carbazole	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Carbitol	**E0540-80**	2	2	2	2	1	1	1	2	2	4	4	2	2	2	2	2	2	2
Carbolic Acid (Phenol)	**V0494-70**	4	4	2	1	1	1	1	4	4	4	3	2	4	4	4	4	1	4
Carbon Bisulfide	**V1164-75**	4	4	4	1	1	1	2	4	4	3	X	4	4	4	4	4	1	4
Carbon Dioxide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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Carbon Dioxide (Explosive Decompression Use)	**E0962-90**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Carbon Disulfide	**V1164-75**	4	4	4	1	1	1	2	4	4	3	X	4	4	4	4	4	1	4
Carbon Fluorides	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Carbon Monoxide	**N0674-70**	1	1	1	1	1	1	1	2	2	X	1	1	2	2	2	2	2	1
Carbon Tetrabromide	**V1164-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Carbon Tetrachloride	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Carbon Tetrafluoride	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Carbonic Acid	**E0540-80**	2	2	1	1	1	1	1	1	2	1	1	1	2	1	1	1	1	1
Casein	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Castor Oil	**N0674-70**	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
Caustic Lime	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Caustic Potash	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Caustic Soda (Sodium Hydroxide)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellosolve	**E0540-80**	4	4	2	4	1	1	3	4	4	4	4	2	4	4	4	4	4	4
Cellosolve Butyl	**E0540-80**	4	4	2	4	4	4	2	4	4	4	4	2	4	4	4	4	4	4
Cellosolve Acetate	**E0540-80**	4	4	2	4	1	1	2	4	4	4	4	2	4	4	4	4	4	4
Celluguard	**N0674-70**	1	1	1	1	1	1	1	1	1	3	4	1	1	1	1	1	1	1
Cellulose Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellulose Acetate Butyrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellulose Ether	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellulose Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellulose Tripropionate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cellulube (Phosphate Esters)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cellutherm 2505A	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Cerium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cerous Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cerous Fluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cerous Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Cetane (Hexadecane)	**N0674-70**	1	1	4	1	1	1	2	2	4	1	4	4	4	4	4	2	3	4
Cetyl Alcohol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Chaulmoogric Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
China Wood Oil (Tung Oil)	**N0674-70**	1	1	4	1	1	1	2	2	4	X	3	3	4	4	4	3	2	4
Chloral	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chloramine	**E1235-80**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chloranthraquinone	**V1164-75**	2	2	4	1	2	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlordane	**V1164-75**	2	2	4	1	1	1	2	3	4	X	X	4	4	4	4	3	2	4
Chlorextol	**V1164-75**	2	2	4	1	1	1	2	2	4	2	4	4	4	4	4	4	2	4
Chloric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chlorinated Solvents, Dry	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Chlorinated Solvents, Wet	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Chlorine (Dry)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorine (Plasma)	**V3819-75**	X	X	X	X	3	3	X	X	X	X	X	X	X	X	X	X	X	X
Chlorine (Wet)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Chlorine Dioxide	**V1164-75**	4	4	3	1	1	1	2	4	4	4	4	3	4	4	4	3	2	X
Chlorine Dioxide, 8% Cl as NaClO2 in Solution	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	X
Chlorine Trifluoride	**Zatkoff**	4	4	4	4	2	2	4	4	4	4	4	4	4	4	4	4	4	4
Chlorine Water	**V1164-75**	3	3	2	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Chlorine, Dry	**V1164-75**	4	4	X	2	1	1	2	2	4	4	X	X	4	4	4	2	X	4
Chlorine, Wet	**Zatkoff**	4	4	X	2	1	1	2	4	4	4	X	X	4	4	4	2	X	4
Chloro 1-Nitro Ethane (1-Chloro 1-Nitro Ethane)	**Zatkoff**	4	4	4	4	1	1	3	4	4	4	4	4	4	4	4	4	4	4
Chloro Oxyfluorides	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Chloro Xylenols	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chloroacetaldehyde	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	1	2
Chloroacetic Acid	**E0540-80**	4	4	2	4	1	1	2	4	4	4	4	2	4	4	4	1	4	X
Chloroacetone	**E0540-80**	4	4	1	4	2	1	2	4	4	4	4	2	4	4	4	4	4	4
Chloroacetyl Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chloroamino Benzoic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chloroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chlorobenzaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chlorobenzene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Chlorobenzene (Mono)	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Chlorobenzene Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorobenzene Trifluoride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorobenzochloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorobenzotrifluoride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorobromo Methane	**V1164-75**	4	4	2	1	1	1	1	4	4	4	4	2	4	4	4	4	2	4
Chlorobromopropane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorobutadiene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Chlorobutane (Butyl Chloride)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Chlorododecane	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	1	4
Chloroethane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Chloroethane Sulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chloroethylbenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chloroform	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	4	4
Chlorohydrin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chloronaphthalene or o-Chloronaphthalene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Chloronitrobenzene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chlorophenol or o-Chlorophenol	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Chloropicrin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chloroprene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Zatkoff SEALS & PACKINGS

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Chlorosilanes	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chlorosulfonic Acid	**Zatkoff**	4	4	4	4	1	1	4	4	4	4	4	4	4	4	4	4	4	4
Chlorotoluene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Chlorotoluene Sulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Chlorotoluidine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chlorotrifluoroethylene (CTFE)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Chlorox	**V1164-75**	2	2	2	1	1	1	1	2	4	4	4	2	4	4	4	2	1	X
Chloroxylols	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cholesterol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chrome Alum	**N0674-70**	1	1	1	1	1	1	1	1	1	4	X	1	1	1	1	1	X	1
Chrome Plating Solutions	**V1164-75**	4	4	2	1	1	1	1	4	4	4	4	2	4	4	4	4	2	2
Chromic Acid	**V1164-75**	4	4	2	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Chromic Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromic Fluorides	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromic Hydroxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromic Nitrates	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromic Oxide	**V1164-75**	4	4	2	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Chromic Phosphate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromic Sulfate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Chromium Potassium Sulfate (Alum)	**V1164-75**	2	X	2	1	1	1	2	X	X	X	X	X	X	X	X	X	X	X
Chromyl Chlorides	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cinnamic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cinnamic Alcohol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cinnamic Aldehyde	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Circo Light Process Oil	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	2	1	4
Citric Acid	**C0873-70**	1	1	1	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1
City Service #65 #120 #250	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	4	1	4
City Service Koolmoter-AP Gear Oil 140-EP Lube	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	2	1	4
City Service Pacemaker #2	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	4	1	4
Clorox	**V1164-75**	2	X	2	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Coal Tar	**N0674-70**	1	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cobalt Chloride	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Cobalt Chloride, 2N	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Cobaltous Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Cobaltous Bromide	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Cobaltous Linoleate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cobaltous Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cobaltous Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Coconut Oil	**N0674-70**	1	1	3	1	1	1	2	3	4	1	3	3	4	4	4	3	1	1
Cod Liver Oil	**N0674-70**	1	1	1	1	1	1	1	2	4	1	1	1	4	4	4	2	1	2

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Codeine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Coffee	**N0508-75**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Coke Oven Gas	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	2
Coliche Liquors	**C0873-70**	2	2	2	X	X	X	2	1	2	X	X	2	1	1	1	X	X	X
Convelex 10	**Zatkoff**	4	4	X	X	X	X	X	4	4	X	2	4	4	4	4	4	X	4
Coolanol 20 25R 35R 40& 45A (Monsanto)	**V1164-75**	1	1	3	1	1	1	2	2	4	4	1	4	4	4	4	2	1	4
Copper Acetate	**E0540-80**	2	2	1	4	1	1	2	2	4	4	4	1	4	1	1	2	4	4
Copper Ammonium Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Copper Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Copper Chloride	**N0674-70**	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	1
Copper Cyanide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Copper Gluconate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Copper Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Copper Nitrate	**V1164-75**	2	X	2	1	1	1	2	X	X	X	X	X	X	X	X	X	X	X
Copper Oxide	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Copper Salts	**N0674-70**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Copper Sulfate	**N0674-70**	1	1	1	1	1	1	1	1	2	4	1	2	2	2	2	1	1	1
Copper Sulfate 10%	**N0674-70**	1	1	1	1	1	1	1	1	2	4	2	2	2	2	2	1	1	1
Copper Sulfate 50%	**N0674-70**	1	1	1	1	1	1	1	1	2	4	3	2	2	2	1	1	1	1
Corn Oil	**N0674-70**	1	1	3	1	1	1	2	3	4	1	1	3	4	4	4	2	1	1
Cottonseed Oil	**N0674-70**	1	1	3	1	1	1	2	3	4	1	1	3	4	4	4	2	2	1
Creosote, Coal Tar	**N0674-70**	1	1	4	1	1	1	2	2	4	1	3	4	4	4	4	4	1	4
Creosote, Wood	**N0674-70**	1	1	4	1	1	1	2	2	4	1	3	4	4	4	4	4	1	4
Cresol (Methyl Phenol)	**V1164-75**	X	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cresols	**V0834-70**	4	4	4	2	1	1	2	4	4	4	X	4	4	4	4	4	X	4
Cresylic Acid	**V0834-70**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	X	4
Crotonaldehyde	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Crotonic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Crude Oil	**V1164-75**	2	2	4	1	1	1	2	4	4	1	X	4	4	4	4	4	2	4
Cumaldehyde	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cumene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Cumene Hydroperoxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cupric Sulfate	**V1164-75**	2	X	2	1	1	1	2	X	X	X	X	X	X	X	X	X	X	X
Cutting Oil	**N0674-70**	1	1	4	1	1	1	2	2	4	1	1	4	4	4	4	2	1	4
Cyanamide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyanides	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyanogen Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyanogen Gas	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyanohydrin	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyanuric Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Zatkoff SEALS & PACKINGS

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Cyclohexane	**N0674-70**	1	1	4	1	1	1	2	3	4	2	1	4	4	4	4	4	1	4
Cyclohexanol	**N0674-70**	1	1	4	1	1	1	2	2	4	X	X	4	4	4	4	2	1	4
Cyclohexanone	**E0540-80**	4	4	2	4	1	1	3	4	4	4	4	2	4	4	4	4	4	4
Cyclohexene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cyclohexylamine	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Cyclohexylamine Carbonate	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Cyclohexylamine Laurate	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Cyclopentadiene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Cyclopentane	**N0674-70**	1	1	4	1	1	1	2	3	4	2	1	4	4	4	4	4	1	4
Cyclopolyolefins	**V1164-75**	1	1	4	1	1	1	2	3	4	2	1	4	4	4	4	4	1	4
Cymene or p-Cymene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
— D —																			
DDT (Dichlorodiphenyltrichloroethane)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Decalin	**V1164-75**	4	4	4	1	1	1	2	4	4	X	X	4	4	4	4	4	1	4
Decane	**N0674-70**	1	1	4	1	1	1	2	3	4	1	2	4	4	4	4	3	1	2
Delco Brake Fluid	**E0603-70**	3	3	1	4	4	4	2	2	1	X	X	2	X	X	X	2	4	3
Denatured Alcohol	**N0674-70**	1	1	1	1	1	1	1	1	1	4	4	1	1	1	1	1	1	1
Detergent, Water Solution	**E0540-80**	1	1	1	1	1	1	1	2	2	4	4	1	2	2	2	2	1	1
Developing Fluids (Photo)	**N0674-70**	1	1	2	1	1	1	1	1	2	X	X	2	2	1	1	1	1	1
Dexron	**N0674-70**	1	1	4	1	1	1	2	2	4	1	2	4	4	4	4	4	2	4
Dextrin	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Dextro Lactic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dextron	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Dextrose	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
DI Water	**E0540-80**	2	X	1	2	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diacetone	**E0540-80**	4	4	1	4	1	1	2	4	4	4	4	1	4	4	4	4	4	4
Diacetone Alcohol	**E0540-80**	4	4	1	4	1	1	2	2	4	4	4	1	4	4	4	2	4	4
Dialkyl Sulfates	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diallyl Ether	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Diallyl Phthalate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Diamylamine	**N0674-70**	1	1	4	1	2	1	X	2	4	1	1	4	4	4	4	2	1	2
Diazinon	**V1164-75**	3	3	4	2	1	1	2	3	4	X	X	4	4	4	4	3	2	4
Dibenzyl (sym-Diphenylethane)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dibenzyl Ether	**Zatkoff**	4	4	2	4	1	1	2	4	4	X	2	2	4	4	4	4	X	X
Dibenzyl Sebacate	**V1164-75**	4	4	2	2	1	1	2	4	4	4	2	2	4	4	4	4	3	3
Diborane	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Dibromoethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dibromoethyl Benzene	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Dibutyl Cellosolve Adipate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dibutyl Ether	**Zatkoff**	4	4	3	3	1	1	3	4	4	3	2	3	4	4	4	4	3	4

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Dibutyl Methylenedithio Glycolate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dibutyl Phthalate	**E0540-80**	4	4	2	3	2	1	3	4	4	4	3	3	4	4	4	4	3	2
Dibutyl Sebacate	**E0540-80**	4	4	2	2	1	1	2	4	4	4	4	2	4	4	4	4	2	2
Dibutyl Thioglycolate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dibutyl Thiourea	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dibutylamine	**E0540-80**	4	4	1	4	1	1	4	3	4	4	4	4	4	4	4	4	4	3
Dichloroacetic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichloroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dichlorobenzene or o-Dichlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Dichlorobenzene or p-Dichlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Dichlorobutane	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Dichlorobutene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichlorodiphenyl-Dichloroethane (DDD)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichloroethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichloroethylene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichlorohydrin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dichloroisopropyl Ether	**Zatkoff**	4	4	3	3	1	1	3	4	4	3	2	4	4	4	4	4	3	4
Dichloromethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichlorophenol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichlorophenoxyacetic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichloropropane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichloropropene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dichlorosilane	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Dicyclohexylamine	**N0674-70**	1	1	4	4	1	1	4	4	4	4	4	4	4	4	4	4	4	2
Dicyclohexylammonium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dieldrin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Diesel Oil	**N0674-70**	1	1	4	1	1	1	2	3	4	1	3	4	4	4	4	3	1	4
Di-ester Lubricant MIL-L-7808	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Di-ester Synthetic Lubricants	**V1164-75**	2	2	4	1	1	1	2	4	4	2	4	4	4	4	4	4	2	4
Diethanolamine (DEA)	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Diethyl Benzene	**V1164-75**	X	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Diethyl Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diethyl Ether	**Zatkoff**	4	4	4	4	1	1	4	3	4	3	1	4	4	4	4	4	3	4
Diethyl Phthalate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Diethyl Sebacate	**V1164-75**	2	2	2	2	1	1	2	4	4	4	4	2	4	4	4	4	2	2
Diethyl Sulfate	**E0540-80**	4	X	1	3	1	1	2	4	X	X	X	X	X	X	X	X	X	2
Diethylamine	**E0540-80**	2	X	1	4	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diethylaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diethylene Glycol	**E0540-80**	1	1	1	1	1	1	1	1	1	2	4	1	1	1	1	1	1	2
Diethylenetriamine	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Difluorodibromomethane	**E0540-80**	4	4	2	X	1	1	2	4	4	4	4	2	4	4	4	4	X	4
Difluoroethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Difluoromonochloroethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Diglycol Chloroformate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Diglycolic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dihydroxydiphenylsulfone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Diisobutyl Ketone	**E0540-80**	X	X	1	X	2	1	1	X	X	X	X	1	X	X	X	X	X	X
Diisobutylcarbinol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Diisobutylene	**V1164-75**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	3	4
Diisooctyl Sebacate	**V1164-75**	3	3	3	2	1	1	2	4	4	4	4	4	4	4	4	4	3	3
Diisopropyl Ether (DIPE)	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Diisopropyl Ketone	**E0540-80**	4	4	1	4	2	1	2	4	4	4	4	1	4	4	4	4	4	4
Diisopropylbenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Diisopropylidene Acetone	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dimethyl Acetamide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dimethylaniline	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dimethyldisulfide (DMDS)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Dimethyl Ether	**N0674-70**	1	X	2	2	1	1	4	3	X	X	X	X	X	X	X	X	X	X
Dimethyl Formaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dimethyl Formamide (DMF)	**E0540-80**	2	2	1	4	1	1	2	3	4	4	4	2	X	X	4	4	4	2
Dimethylhydrazine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dimethyl Phenyl Carbinol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dimethyl Phenyl Methanol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dimethyl Phthalate	**V1164-75**	4	4	2	2	1	1	2	4	4	4	X	2	4	4	4	4	2	X
Dimethyl Sulfoxide (DMSO)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Dimethyl Terephthalate (DMT)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dimethylamine (DMA)	**E0540-80**	2	2	1	4	1	1	2	2	2	4	3	2	2	2	2	3	4	2
Dinitrochlorobenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dinitrogen Tetroxide	**V8545-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Dinitrotoluene (DNT)	**Zatkoff**	4	4	4	4	1	1	4	4	4	4	4	4	4	4	4	4	4	4
Dioctyl Phthalate	**V1164-75**	4	4	2	2	1	1	2	4	4	4	4	2	4	4	4	4	2	3
Dioctyl Sebacate	**E0540-80**	4	4	2	2	1	1	2	4	4	4	2	2	4	4	4	4	3	3
Dioctylamine	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Dioxane	**E0540-80**	4	4	2	4	1	1	3	4	4	4	4	2	4	4	4	4	4	4
Dioxolane	**E0540-80**	4	4	2	4	1	1	3	4	4	4	4	3	4	4	4	4	4	4
Dipentene	**N0674-70**	2	2	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Diphenyl	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	4
Diphenyl Oxides	**V1164-75**	4	4	4	1	1	1	2	4	4	4	4	4	4	4	4	4	2	3
Diphenylamine (DPA)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Diphenylene Oxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Diphenylpropane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Disilane	**Zatkoff**	X	X	X	X	4	4	X	X	X	X	X	X	X	X	X	X	X	X
Di-Tert-Butyl Peroxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Dodecylbenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Dow Chemical 50-4	**E0540-80**	X	X	1	4	4	4	2	2	1	X	X	2	X	X	X	2	4	X
Dow Chemical ET378	**Zatkoff**	4	4	X	X	X	X	X	4	4	3	2	4	4	4	4	4	X	4
Dow Chemical ET588	**E0540-80**	3	3	1	4	4	4	2	2	1	X	X	2	X	X	X	2	4	X
Dow Corning -11	**E0540-80**	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Dow Corning 1208, 4050, 6620, F-60, XF-60	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Dow Corning -1265 Fluorosilicone Fluid	**E0540-80**	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1
Dow Corning -200	**E0540-80**	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -220	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Dow Corning -3	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	2
Dow Corning -33	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -4	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	2
Dow Corning -44	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -5	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -510	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -55	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -550	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -704	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -705	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning -710	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Dow Corning F-61	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Dow Guard	**N0674-70**	1	1	1	1	1	1	X	1	1	3	3	1	1	1	1	1	1	1
Dowanol P Mix	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Dowtherm, 209	**E0540-80**	3	3	1	4	1	1	X	2	X	X	X	2	X	X	X	X	3	3
Dowtherm, A	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Dowtherm, E	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Drinking Water	**E3609-70**	1	1	1	1	1	1	X	2	1	4	4	1	1	1	1	1	1	1
Dry Cleaning Fluids	**V1164-75**	3	3	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
DTE 20 Series, Mobil	**V1164-75**	2	2	4	1	1	1	2	1	X	2	1	4	X	X	2	2	2	4
DTE named series, Mobil, light-heavy	**N0674-70**	1	1	4	1	1	1	2	2	4	X	1	4	4	X	3	1	1	3
— E —																			
Elco 28-EP lubricant	**N0674-70**	1	1	4	1	1	1	X	3	4	1	1	4	4	4	4	4	1	2
Epichlorohydrin	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Epoxy Resins	**E0540-80**	X	X	1	4	4	4	X	1	X	X	X	1	X	X	X	X	X	X
Erucic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Esam-6 Fluid	**E0540-80**	X	X	1	4	4	4	X	2	1	X	X	2	X	X	X	2	4	X
Esso Fuel 208	**N0674-70**	1	1	4	1	1	1	X	2	4	1	4	4	4	4	4	3	1	4

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Zatkoff SEALS & PACKINGS

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Esso Golden Gasoline	**V1164-75**	2	2	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
Esso Motor Oil	**N0674-70**	1	1	4	1	1	1	X	3	4	1	4	4	4	4	4	4	1	4
Esso Transmission fluid (Type A)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	4	1	4
Esso WS2812 (MIL-L-7808A)	**V1164-75**	1	1	4	1	1	1	X	4	4	2	4	4	4	4	4	4	1	4
Esso XP90-EP lubricant	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Esstic 42, 43	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Ethane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	2	3	4
Ethanol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethanol Amine	**E0540-80**	2	2	1	4	1	1	X	2	2	4	3	2	2	2	2	3	4	2
Ethers	**V3819-75**	4	4	3	3	1	1	X	4	4	3	2	4	4	4	4	4	3	4
Ethoxyethyl Acetate (EGMEEA)	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethyl Acetate-Organic Ester	**E0540-80**	4	4	2	4	2	1	X	4	4	4	4	2	4	4	4	4	4	2
Ethyl Acetoacetate	**E0540-80**	4	4	2	4	1	1	X	4	3	4	4	2	3	3	3	4	4	2
Ethyl Acrylate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	2
Ethyl Alcohol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethyl Ammonium Dichloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ethyl Benzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
Ethyl Benzoate	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
Ethyl Bromide	**V1164-75**	2	2	4	1	1	1	X	4	X	X	X	4	4	4	4	4	1	X
Ethyl Cellosolve	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Ethyl Cellulose	**N0674-70**	2	2	2	4	1	1	X	2	2	4	2	2	2	2	2	2	4	2
Ethyl Chloride	**N0674-70**	1	1	3	1	1	1	X	4	4	3	2	4	2	1	4	4	1	4
Ethyl Chlorocarbonate	**V1164-75**	4	4	2	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ethyl Chloroformate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	3	4	4	4	4	4	4
Ethyl Ether	**Zatkoff**	3	3	3	4	1	1	X	4	4	4	2	3	4	4	4	4	3	4
Ethyl Formate	**V1164-75**	4	4	2	1	1	1	X	2	4	X	X	2	4	4	4	2	1	X
Ethyl Hexanol	**N0674-70**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethyl Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethyl Mercaptan	**V1164-75**	4	4	X	2	1	1	X	3	4	X	X	4	4	4	4	3	X	3
Ethyl Nitrite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ethyl Oxalate	**E0540-80**	4	4	1	2	1	1	X	4	4	4	X	4	4	1	4	4	2	4
Ethyl Pentachlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ethyl Pyridene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ethyl Silicate	**E0540-80**	1	1	1	1	1	1	X	1	2	X	X	1	2	2	2	2	1	X
Ethyl Stearate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ethyl Sulfate	**E0540-80**	X	X	1	4	1	1	1	X	X	X	X	X	X	X	X	X	X	X
Ethyl Tertiary Butyl Ether	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Ethyl Valerate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ethylacrylic Acid	**E0540-80**	4	4	2	X	X	X	X	2	4	4	4	2	4	4	4	4	4	4
Ethylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Ethylcyclopentane	**N0674-70**	1	1	4	1	1	1	X	3	4	2	1	4	4	4	4	4	1	4
Ethylene	**V1164-75**	3	2	4	2	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ethylene Chloride	**V1164-75**	4	4	4	2	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ethylene Chlorohydrin	**V1164-75**	4	4	2	1	1	1	X	2	2	4	4	2	2	2	2	2	2	3
Ethylene Cyanohydrin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ethylene Diamine	**E0540-80**	1	1	1	4	2	2	X	1	2	4	4	1	2	1	1	2	4	1
Ethylene Dibromide	**V1164-75**	4	4	3	1	1	1	X	4	4	4	4	3	4	4	4	4	3	4
Ethylene Dichloride	**V1164-75**	4	4	3	1	1	1	X	4	4	4	4	3	4	4	4	4	3	4
Ethylene Glycol	**E0540-80**	1	1	1	1	1	1	X	1	1	4	2	1	1	1	1	1	1	1
Ethylene Hydrochloride	**V1164-75**	4	4	3	1	1	1	X	4	4	4	4	3	4	4	4	4	3	4
Ethylene Oxide	**V8545-75**	4	4	3	4	1	1	X	4	4	4	4	3	4	4	4	4	4	4
Ethylene Oxide, (12%) and Freon 12 (80%)	**Zatkoff**	3	3	2	4	4	4	X	4	4	4	4	2	4	4	4	4	4	4
Ethylene Trichloride	**V1164-75**	4	4	3	1	1	1	X	4	4	4	4	3	4	4	4	4	3	4
Ethyleneimine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ethylmorpholene Stannous Octotate	**E0540-80**	4	4	2	4	4	4	X	X	4	X	X	2	X	X	X	X	X	X
(50/50 mixture)																			
Ethylmorpholine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ethylsulfuric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
— F —																			
F-60 Fluid (Dow Corning)	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	4
F-61 Fluid (Dow Corning)	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	4
Fatty Acids	**V1164-75**	2	2	3	1	1	1	X	2	4	X	X	3	4	4	4	2	X	3
FC-43 Heptacosofluorotri-butylamine	**N0674-70**	1	1	1	1	1	1	X	1	4	X	X	1	X	X	X	1	1	1
FC75 & FC77 (Fluorocarbon)	**E0540-80**	1	1	1	2	1	1	X	1	4	X	X	1	X	X	X	1	2	1
Ferric Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferric Ammonium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferric Chloride	**N0674-70**	1	1	1	1	1	1	X	2	1	1	1	1	1	1	1	2	1	2
Ferric Ferrocyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferric Hydroxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferric Nitrate	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	2
Ferric Persulfate	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Ferric Sulfate	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Ferrous Ammonium Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferrous Ammonium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferrous Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferrous Chloride	**N0674-70**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Ferrous Iodide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferrous Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ferrous Tartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Fish Oil	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Zatkoff SEALS & PACKINGS

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Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Fisher Reagent	**E0540-80**	X	X	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fluorinated Cyclic Ethers	**V3819-75**	X	X	1	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Fluorine (Gas)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Fluorine (Liquid)	**V1164-75**	4	4	4	2	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Fluorobenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Fluoroboric Acid	**N0674-70**	1	X	1	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Fluorocarbon Oils	**E0540-80**	X	X	1	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Fluoroform (Trifluoromethane)	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Fluorolube	**E0540-80**	1	1	1	2	1	1	X	1	4	X	X	1	X	X	X	1	2	1
Fluorophosphoric Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Fluorosilicic Acid	**N0674-70**	1	1	2	2	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Fluorosulfonic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Formaldehyde	**E0540-80**	3	3	2	4	1	1	X	3	3	4	4	2	2	2	2	2	4	2
Formamide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Formic Acid	**E0540-80**	X	X	1	4	1	1	3	1	X	X	X	X	X	X	X	X	X	X
Freon, 11	**V3819-75**	4	4	4	2	2	2	X	4	4	4	X	4	X	X	4	1	2	4
Freon, 112	**V1164-75**	2	2	4	1	1	1	X	2	4	X	X	4	X	X	4	2	X	4
Freon, 113	**C0873-70**	1	1	4	2	2	2	X	1	2	X	1	4	X	X	4	1	X	4
Freon, 113 + High and Low Aniline Oil	**N0674-70**	1	X	X	X	3	3	4	X	X	X	X	X	X	X	X	X	X	X
Freon, 114	**C0873-70**	1	1	1	1	2	2	X	1	1	X	X	1	X	X	1	X	X	4
Freon, 114B2	**C0873-70**	2	2	4	2	2	2	X	2	4	X	X	4	X	X	4	1	X	4
Freon, 115, 116	**C0873-70**	1	1	1	2	2	2	X	1	1	X	X	1	X	X	1	X	X	X
Freon, 12	**C0873-70**	2	2	3	3	2	2	X	1	1	X	1	3	4	4	2	1	3	4
Freon, 12 and ASTM Oil #2(50/50 Mixture)	**V1164-75**	2	2	4	1	1	1	X	3	4	X	X	4	4	4	4	2	2	4
Freon, 12 and Suniso 4G(50/50 Mixture)	**V1164-75**	2	2	4	1	1	1	X	3	4	X	X	4	4	4	4	2	2	4
Freon, 123 (Dichlorotrifluoroethane)	**C0873-70**	X	X	X	X	3	3	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 124 (Chlorotetrafluoroethane)	**C0873-70**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 125 (Pentafluoroethane)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 13	**C0873-70**	1	1	1	1	1	1	X	1	1	X	X	1	X	1	1	1	4	4
Freon, 134a (Tetrafluoroethane)	**C0873-70**	X	1	1	X	3	3	X	1	X	X	X	X	X	X	X	X	X	X
Freon, 13B1	**N0674-70**	1	1	1	1	2	2	X	1	1	X	X	1	X	X	1	1	2	4
Freon, 14	**C0873-70**	1	1	1	1	1	1	X	1	1	X	1	1	X	X	1	1	X	4
Freon, 141b (Dichlorofluoroethane)	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 142b	**V1164-75**	2	2	4	2	2	2	4	1	X	X	X	X	X	X	X	X	X	X
Freon, 152a (Difluoroethane)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 21	**V8545-75**	4	4	4	4	1	1	X	3	4	X	X	4	4	4	4	4	X	4
Freon, 218	**N0674-70**	1	X	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Freon, 22	**C0873-70**	4	4	3	4	1	1	X	1	1	2	4	3	X	X	1	1	4	4
Freon, 22 and ASTM Oil #2(50/50 Mixture)	**C0873-70**	4	4	4	2	1	1	X	2	4	2	X	4	X	X	4	X	2	4
Freon, 23 (Fluoroform)	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Freon, 31	**C0873-70**	4	4	1	4	2	2	X	1	2	X	X	1	X	X	2	2	X	X
Freon, 32	**C0873-70**	1	1	1	4	2	2	X	1	1	X	X	1	X	X	1	1	X	X
Freon, 502 (R22 + R115)	**C0873-70**	2	2	1	2	2	2	X	1	1	X	X	1	X	X	1	X	X	X
Freon, BF (R112)	**V1164-75**	2	2	4	1	2	2	X	2	4	X	X	4	X	X	4	2	X	4
Freon, C316	**N0674-70**	1	X	1	1	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, C318	**C0873-70**	1	1	1	2	2	2	X	1	1	X	X	1	X	X	1	1	X	X
Freon, K-142b	**C0873-70**	1	1	1	4	4	4	X	1	1	X	X	1	X	X	2	1	X	X
Freon, K-152a	**C0873-70**	1	1	1	4	4	4	X	1	1	X	X	1	X	X	1	4	X	X
Freon, MF (R11)	**N0674-70**	2	2	4	2	2	2	X	4	4	X	3	4	X	X	4	1	X	4
Freon, PCA	**N0674-70**	1	1	4	2	1	1	X	1	2	X	1	4	X	X	4	1	X	4
Freon, TA	**N0674-70**	1	X	2	3	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, TC	**N0674-70**	1	X	2	1	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, TF	**N0674-70**	1	1	4	2	2	2	X	1	2	X	1	4	X	X	4	1	X	4
Freon, TMC	**V1164-75**	2	X	3	1	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, T-P35	**N0674-70**	1	X	1	1	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Freon, T-WD602	**V1164-75**	2	X	2	1	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Fuel Oil, #6	**V1164-75**	2	2	4	1	1	1	X	4	4	1	2	4	4	4	4	4	1	1
Fuel Oil, 1, and 2	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	3	1	4
Fuel Oil, Acidic	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	1
Fumaric Acid	**N0674-70**	1	1	2	1	1	1	X	2	2	4	X	4	2	1	3	2	1	2
Fuming Sulphuric Acid (20/25% Oleum)	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	X	4
Furaldehyde	**E0540-80**	4	4	2	4	2	2	4	4	X	X	X	X	X	X	X	X	X	X
Furan (Furfuran)	**V1164-75**	4	4	3	1	1	1	X	4	4	4	X	4	4	4	4	4	X	X
Furfural (Furfuraldehyde)	**E0540-80**	4	4	2	4	1	1	X	4	4	4	3	2	4	4	4	3	X	4
Furfuraldehyde	**E0540-80**	4	4	2	4	1	1	X	4	4	4	3	2	4	4	4	3	X	4
Furfuryl Alcohol	**E0540-80**	4	4	2	X	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Furoic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Furyl Carbinol	**E0540-80**	4	4	2	X	X	X	X	4	4	4	4	2	4	4	4	4	4	4
Fyrquel 150 220 300 550	**E0540-80**	4	4	1	1	1	1	X	4	4	4	4	1	4	4	4	4	2	1
Fyrquel 90, 100, 500	**E0540-80**	4	4	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X
Fyrquel A60	**V3819-75**	4	4	2	4	1	1	2	4	X	X	X	X	X	X	X	X	X	X
— G —																			
Gallic Acid	**V1164-75**	2	2	2	1	1	1	X	2	2	4	4	2	X	1	1	2	1	X
Gasoline	**N0497-70**	1	1	4	1	1	1	X	4	4	4	2	4	4	4	4	4	1	4
Gelatin	**N0674-70**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Germane (Germanium Tetrahydride)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Girling Brake Fluid	**E0603-70**	3	3	1	4	4	4	X	2	1	X	X	2	X	X	X	2	4	X
Glauber's Salt	**V1164-75**	4	4	2	1	1	1	X	2	4	4	X	2	4	2	2	2	1	X
Gluconic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glucose	**N0674-70**	1	1	1	1	1	1	X	1	1	X	4	1	1	1	1	1	1	1

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Glue	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Glutamic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycerine (Glycerol)	**N0674-70**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Glycerol Dichlorohydrin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycerol Monochlorohydrin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycerol Triacetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycerophosphoric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glyceryl Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycidol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycol Monoether	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Glycolic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Glycols	**E0540-80**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Glycoxylic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Grease Petroleum Base	**N0674-70**	1	1	4	1	1	1	X	3	4	1	1	4	4	4	4	4	1	4
Green Sulfate Liquor	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	2	2	2	2	X
Gulf Endurance Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Gulf FR Fluids (Emulsion)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Gulf FR G-Fluids	**E0540-80**	1	1	1	1	1	1	X	1	1	4	2	1	1	1	1	1	1	1
Gulf FR P-Fluids	**E0540-80**	4	4	2	2	1	1	X	4	4	4	4	2	4	4	4	4	2	1
Gulf Harmony Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Gulf High Temperature Grease	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Gulf Legion Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Gulf Paramont Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Gulf Security Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Gulfcrown Grease	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
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Halothane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Halowax Oil	**V1164-75**	4	4	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	4
Hannifin Lube A	**N0674-70**	1	1	4	1	1	1	X	1	2	1	1	4	4	4	4	1	1	2
Heavy Water	**N0674-70**	1	1	1	X	1	1	X	2	1	4	4	1	1	1	1	1	1	1
HEF-2 (High Energy Fuel)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Helium	**B0612-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Heptachlor	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Heptachlorobutene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Heptaldehyde (Heptanal)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Heptane or n-Heptane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	2	3	4
Heptanoic Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Hexachloroacetone	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hexachlorobutadiene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hexachlorobutene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Compatibility Tables For Gases, Fluids & Solids

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Hexachloroethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hexaethyl Tetraphosphate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hexafluoroethane (F-116)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Hexafluoroxylene	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hexafluoroxylene	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hexaldehyde or n-Hexaldehyde	**E0540-80**	4	4	1	4	1	1	X	1	4	X	2	2	4	4	4	3	4	2
Hexamethyldisilizane	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hexamethylene (Cyclohexane)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Hexamethylene Diammonium Adipate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hexamethylenediamine	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	1	2
Hexamethylenetetramine	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	1	2
Hexane or n-Hexane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	2	3	4
Hexene-1 or n-Hexene-1	**V1164-75**	2	2	4	1	1	1	X	2	4	1	2	4	4	4	4	2	4	4
Hexone (Methyl Isobutyl Ketone)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hexyl Acetate	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Hexyl Alcohol	**N0674-70**	1	1	3	1	1	1	X	2	1	4	4	3	1	1	1	2	2	2
Hexylene Glycol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hexylresorcinol	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
High Viscosity Lubricant, H2	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	1	2	X	X	X	2	1
High Viscosity Lubricant, U4	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	1	2	X	X	X	2	1
HiLo MS #1	**E0540-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	4	4	4	3	3
Houghto-Safe 1010 phosphate ester	**E0540-80**	4	4	1	1	1	1	X	4	4	4	X	1	4	4	4	4	2	3
Houghto-Safe 1055 phosphate ester	**E0540-80**	4	4	1	1	1	1	X	4	4	4	X	1	4	4	4	4	2	3
Houghto-Safe 1120 phosphate ester	**V1164-75**	4	4	2	1	1	1	X	4	4	4	4	1	4	4	4	4	2	3
Houghto-Safe 271 (Water & Glycol Base)	**N0674-70**	1	1	1	2	1	1	X	2	1	4	4	2	X	X	X	X	2	2
Houghto-Safe 416 & 500 Series	**N0674-70**	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Houghto-Safe 5040 (Water/Oil emulsion)	**N0674-70**	1	1	4	1	1	1	X	2	4	4	4	4	4	4	4	4	2	3
Houghto-Safe 620 Water/Glycol	**N0674-70**	1	1	1	2	1	1	X	2	1	4	4	2	X	X	X	X	2	2
Hydraulic Oil (Petroleum Base, Industrial)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Hydraulic Oils (Synthetic Base)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hydrazine	**E0540-80**	2	2	1	4	1	1	X	2	2	X	4	1	X	X	1	2	4	2
Hydrazine (Anhydrous)	**E0540-80**	4	4	2	4	1	1	2	2	1	4	4	2	4	4	4	2	4	X
Hydrazine Dihydrochloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hydrazine Hydrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hydriodic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hydroabietyl Alcohol	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrobromic Acid	**E0540-80**	4	4	1	1	1	1	X	4	4	4	4	1	4	1	1	1	3	4
Hydrobromic Acid 40%	**E0540-80**	4	4	1	1	1	1	X	2	4	4	4	1	4	1	1	1	3	4
Hydrocarbons, Saturated	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	3	1	4
Hydrochloric Acid (cold) 37%	**V1164-75**	4	X	3	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X

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Hydrochloric Acid (hot) 37%	**V1164-75**	4	X	3	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hydrochloric Acid, 3 Molar to 158°F	**V1164-75**	2	2	1	1	1	1	X	2	3	3	4	1	X	X	3	1	3	4
Hydrochloric Acid, Concentrated Room Temp.	**V0834-70**	2	2	2	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrochloric Acid, Concentrated to 158°F	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	X	X	4	X	4	4
Hydrocyanic Acid	**E0540-80**	2	2	1	1	1	1	X	2	2	4	X	1	2	1	1	1	2	3
Hydro-Drive MIH-10 (Petroleum Base)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	2
Hydro-Drive MIH-50 (Petroleum Base)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	2
Hydrofluoric Acid (Anhydrous)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrofluoric Acid (conc.) Cold	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrofluoric Acid (conc.) Hot	**V3819-75**	4	X	4	3	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrofluosilic Acid	**E0540-80**	2	2	1	1	1	1	X	2	2	X	X	1	X	1	1	1	4	4
Hydrogen Bromide (Anhydrous)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Chloride (Anhydrous)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Chloride gas	**E0540-80**	4	X	1	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Hydrogen Cyanide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Fluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Fluoride (Anhydrous)	**E0540-80**	4	4	1	4	1	1	2	X	4	4	X	1	4	4	4	X	4	X
Hydrogen Gas, Cold	**E0540-80**	1	1	1	1	1	1	X	1	2	2	1	1	1	1	2	1	3	3
Hydrogen Gas, Hot	**E0540-80**	1	1	1	1	1	1	X	1	2	2	1	1	1	1	2	1	3	3
Hydrogen Iodide (Anhydrous)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Peroxide	**V1164-75**	2	2	1	1	1	1	X	1	2	4	X	1	2	2	2	2	1	1
Hydrogen Peroxide 90%	**V1164-75**	4	4	3	1	1	1	X	4	4	4	X	3	4	4	4	3	2	2
Hydrogen Selenide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogen Sulfide Dry Cold	**E0540-80**	1	1	1	4	1	1	X	1	1	4	X	1	1	1	1	1	3	3
Hydrogen Sulfide Dry Hot	**E0540-80**	4	4	1	4	1	1	X	2	4	4	X	1	4	4	4	3	3	3
Hydrogen Sulfide Wet Cold	**E0540-80**	4	4	1	4	1	1	X	1	4	4	X	1	4	4	4	2	3	3
Hydrogen Sulfide Wet Hot	**E0540-80**	4	4	1	4	1	1	X	2	4	4	X	1	4	4	4	3	3	3
Hydrolube-Water/Ethylene Glycol	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	2	X	X	X	X	2	2
Hydrooxycitronellal	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Hydroquinol	**V1164-75**	4	4	4	1	2	2	X	4	X	X	X	X	X	X	X	X	X	X
Hydroquinone	**V1164-75**	3	3	2	2	1	1	X	4	4	4	X	4	4	2	2	4	2	X
Hydroxyacetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Hydyne	**E0540-80**	2	2	1	4	1	1	X	2	2	4	X	2	2	2	2	X	4	4
Hyjet	**E1235-80**	4	4	1	4	1	1	2	4	X	X	X	X	X	X	X	X	X	X
Hyjet IV and IVA	**E1235-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	4	4	4	4	4
Hyjet S4	**E1235-80**	4	X	1	4	1	1	2	4	X	X	X	X	X	X	X	X	X	X
Hyjet W	**E1235-80**	4	4	1	4	1	1	2	4	X	X	X	X	X	X	X	X	X	X
Hypochlorous Acid	**V0834-70**	4	4	2	1	1	1	X	4	4	4	X	2	4	2	2	1	X	X
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Indole	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Industron FF44	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Industron FF48	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Industron FF53	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Industron FF80	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Insulin	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Iodic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Iodine	**V1164-75**	2	2	2	1	1	1	X	4	2	X	X	2	X	4	X	2	1	X
Iodine Pentafluoride	**Zatkoff**	4	4	4	4	2	2	X	4	4	4	4	4	4	4	4	4	4	4
Iodoform	**V1164-75**	X	X	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Isoamyl Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isoamyl Butyrate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isoamyl Valerate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isoboreol	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Isobutane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Isobutyl Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isobutyl Alcohol	**E0540-80**	2	2	1	1	1	1	X	1	2	4	4	1	2	1	1	1	2	1
Isobutyl Chloride	**V1164-75**	4	4	4	1	1	1	4	4	X	X	X	X	X	X	X	X	X	X
Isobutyl Ether	**V3819-75**	2	2	4	4	2	1	4	3	X	X	X	X	X	X	X	X	X	X
Isobutyl Methyl Ketone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isobutyl n-Butyrate	**E0540-80**	4	4	1	1	1	1	X	4	4	4	X	1	4	4	4	4	1	X
Isobutyl Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Isobutylene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Isobutyraldehyde	**E0540-80**	3	2	2	4	2	2	4	3	X	X	X	X	X	X	X	X	X	X
Isobutyric Acid	**N0674-70**	1	1	2	4	1	1	3	4	X	X	X	X	X	X	X	X	X	2
Isocrotyl Chloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Isodecanol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Isododecane	**N0674-70**	1	1	4	1	1	1	X	2	4	4	X	4	4	4	4	2	1	4
Isoeugenol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Isooctane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	1	1	4
Isopentane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Isophorone (Ketone)	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Isopropanol	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	1	1	1	2	1
Isopropyl Acetate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	2	4
Isopropyl Alcohol	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	1	1	1	2	1
Isopropyl Chloride	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Isopropyl Ether	**N0674-70**	2	2	4	4	1	1	X	3	4	3	2	4	4	4	4	3	3	4
Isopropylacetone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Isopropylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
— J —																			
Jet Fuel A	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Zatkoff SEALS & PACKINGS

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Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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JP-10	**V1164-75**	3	3	4	1	1	1	X	4	4	4	3	4	X	X	4	X	1	4
JP-3 (MIL-J-5624)	**N0674-70**	1	1	4	1	1	1	2	4	X	X	X	X	X	X	X	X	X	X
JP-4 (MIL-T-5624)	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
JP-5 (MIL-T-5624)	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
JP-6 (MIL-J-25656)	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
JP-8 (MIL-T-83133)	**N0602-70**	1	1	4	1	1	1	X	3	4	1	1	4	X	X	4	X	2	4
JP-9 (MIL-F-81912)	**V1164-75**	3	3	4	1	1	1	X	4	4	4	3	4	X	X	4	X	2	4
JP-9 -11	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	X	X	4	X	2	4
JPX(MIL-F-25604)	**N0674-70**	1	1	4	4	1	1	2	2	X	X	X	X	X	X	X	X	X	X
— K —																			
Kel F Liquids	**E0540-80**	1	1	1	2	1	1	X	X	1	X	X	1	X	X	X	1	2	1
Kerosene (Similar to RP-1 and JP-1)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Keystone #87HX-Grease	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
— L —																			
Lacquer Solvents	**V3819-75**	4	4	4	4	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Lacquers	**V3819-75**	4	4	4	4	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Lactams-Amino Acids	**E0540-80**	4	4	2	4	4	4	X	2	4	X	X	2	4	4	4	2	4	X
Lactic Acid Cold	**N0674-70**	1	1	1	1	1	1	X	1	1	4	X	1	1	1	1	1	1	1
Lactic Acid Hot	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	3	2	2
Lactones (Cyclic Esters)	**E0540-80**	4	4	2	4	4	4	X	4	4	4	4	2	4	4	4	4	4	2
Lard Animal Fat	**N0674-70**	1	1	2	1	1	1	X	2	4	1	1	2	4	4	4	4	1	2
Lauric Acid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Lavender Oil	**V1164-75**	2	2	4	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
LB 135	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Lead (Molten)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Lead Acetate	**E0540-80**	2	2	1	4	1	1	X	2	4	4	4	1	4	1	1	4	4	4
Lead Arsenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Azide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Lead Bromide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Chromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Dioxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Linoleate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Lead Nitrate	**N0674-70**	1	1	1	X	1	1	X	1	1	X	X	1	1	1	1	1	1	2
Lead Oxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lead Sulfamate	**C0873-70**	2	2	1	1	1	1	X	1	2	4	X	1	2	2	2	1	1	2
Lehigh X1169	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Lehigh X1170	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4

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Light Grease	**N0674-70**	1	1	4	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Ligroin (Petroleum Ether or Benzene)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	3	1	4
Lime Bleach	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Lime Sulfur	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Lindol, Hydraulic Fluid(Phosphate ester type)	**E0540-80**	4	4	1	2	1	1	X	4	4	4	4	1	4	4	4	4	3	3
Linoleic Acid	**S0604-70**	2	2	4	2	1	1	X	2	4	X	X	4	4	4	4	2	X	2
Linseed Oil	**N0674-70**	1	1	3	1	1	1	X	3	4	1	2	3	4	4	4	2	1	1
Liquid Oxygen (LOX)	**Zatkoff**	4	4	4	4	4	4	X	4	4	4	4	4	4	4	4	4	4	4
Liquid Petroleum Gas (LPG)	**N0674-70**	1	1	4	1	1	1	X	2	4	3	1	4	4	4	4	4	3	3
Liquimoly	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Lithium Bromide (Brine)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Hydroxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Hypochlorite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Nitrite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Perchlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithium Salicylate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lithopone	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Lubricating Oils (Crude & Refined)	**V1164-75**	2	2	4	1	1	1	1	3	X	X	X	X	X	X	X	X	X	X
Lubricating Oils (Synthetic base)	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Lubricating Oils, Di-ester	**V1164-75**	2	2	4	1	1	1	X	3	4	2	X	4	4	4	4	X	2	4
Lubricating Oils, petroleum base	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Lubricating Oils, SAE 10, 20, 30, 40, 50	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Lye Solutions	**E0540-80**	2	2	1	2	1	1	X	2	2	4	4	1	2	2	1	1	2	2
— M —																			
Magnesium Chloride	**N0674-70**	1	1	1	1	1	1	X	1	1	X	1	1	1	1	1	1	1	1
Magnesium Hydroxide	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	2	2	1	X	X
Magnesium Salts	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Magnesium Sulfite and Sulfate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	X	1	2	2	2	1	1	1
Magnesium Trisilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Malathion	**V1164-75**	2	2	4	1	1	1	X	X	4	X	X	4	4	4	4	X	2	4
Maleic Acid	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	4	X	X
Maleic Anhydride	**E0540-80**	4	4	2	4	1	1	X	4	4	4	X	2	4	4	4	4	X	X
Maleic Hydrazide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Malic Acid	**V1164-75**	1	1	2	1	1	1	X	2	2	4	X	4	2	1	3	2	1	2
Mandelic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Manganese Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Dioxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Gluconate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Hypophosphite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Linoleate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Manganese Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganese Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganous Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganous Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Manganous Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mannitol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
MCS 312	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	X	1	1
MCS 352	**E1235-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	4	4	4	3	3
MCS 463	**E1235-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	4	4	4	3	3
MDI (Methylene di-p-phenylene isocyanate)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercaptan	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Mercaptobenzothiazole (MBT)	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Mercuric Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercuric Chloride	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	X	X
Mercuric Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercuric Iodide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercuric Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercuric Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercuric Sulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercurous Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercury	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	X	X
Mercury Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercury Fulminate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercury Salts	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mercury Vapors	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	X	X
Mesityl Oxide (Ketone)	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Meta-Cresol	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Metaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Meta-Nitroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Meta-Toluidine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methacrylic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methallyl Chloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	2	3	4

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Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
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Methanol	**E0540-80**	4	4	1	4	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Methoxychlor	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Methoxyethanol (DGMMA)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Abietate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Acetate	**E0540-80**	4	4	2	4	2	1	X	2	4	4	4	2	4	4	4	4	4	4
Methyl Acetoacetate	**E0540-80**	4	4	2	4	1	1	X	4	X	4	4	2	X	X	X	4	4	2
Methyl Acetophenone	**V1164-75**	X	X	X	1	2	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Acrylate	**E0540-80**	4	4	2	4	1	1	X	2	4	4	4	2	4	4	4	4	4	4
Methyl Alcohol	**E0540-80**	4	4	1	4	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Methyl Amylketone	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Anthranilate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Benzoate	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
Methyl Bromide	**V1164-75**	2	2	4	1	1	1	X	4	4	3	X	4	4	4	4	4	1	X
Methyl Butyl Ketone	**E0540-80**	4	4	1	4	2	1	X	4	4	4	4	1	4	4	4	4	4	4
Methyl Butyrate Cellosolve	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Butyrate Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Carbonate	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Methyl Cellosolve	**E0540-80**	3	3	2	4	1	1	X	3	4	4	4	2	4	4	4	2	4	4
Methyl Cellulose	**N0674-70**	2	2	2	4	1	1	X	2	2	4	2	2	2	2	2	2	4	2
Methyl Chloride	**V1164-75**	4	4	3	1	1	1	X	4	4	4	4	3	4	4	4	4	2	4
Methyl Chloroacetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Chloroform	**V1164-75**	4	4	4	1	1	1	4	4	X	X	X	X	X	X	X	X	X	X
Methyl Chloroformate	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Methyl Chlorosilanes	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Methyl Cyanide (Acetonitrile)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Cyclohexanone	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Methyl Dichloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Ether	**N0674-70**	1	1	4	1	2	1	X	3	4	4	X	4	1	1	4	4	1	1
Methyl Ethyl Ketone (MEK)	**E0540-80**	4	4	1	4	2	1	X	4	4	4	4	1	4	4	4	4	4	4
Methyl Ethyl Ketone Peroxide	**S0604-70**	4	4	4	4	1	1	X	4	4	4	4	4	4	4	4	4	4	2
Methyl Ethyl Oleate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Formate	**C0873-70**	4	4	2	X	1	1	X	2	4	X	X	2	4	4	4	2	X	X
Methyl Hexyl Ketone (2-Octanone)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Iodide	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Methyl Isobutyl Ketone (MIBK)	**Zatkoff**	4	4	3	4	1	1	X	4	4	4	4	3	4	4	4	4	4	4
Methyl Isocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Isopropyl Ketone	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Methyl Isovalerate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methyl Mercaptan	**E0540-80**	X	X	1	X	1	1	X	X	X	X	X	1	X	X	X	X	X	X

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Methyl Methacrylate	**Zatkoff**	4	X	4	4	1	1	X	4	4	4	X	4	4	4	4	4	4	4
Methyl Oleate	**V1164-75**	4	4	2	1	1	1	X	4	4	X	X	2	4	X	4	4	2	X
Methyl Pentadiene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Phenylacetate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl Salicylate	**E0540-80**	4	4	2	X	1	1	X	4	3	X	X	2	X	X	3	4	X	X
Methyl Tertiary Butyl Ether (MTBE)	**V3819-75**	3	3	3	3	2	1	2	3	X	X	X	X	X	X	X	X	X	X
Methyl Valerate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methyl-2-Pyrrolidone or n-Methyl-2-Pyrrolidone	**E0540-80**	X	X	2	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Methylacrylic Acid	**E0540-80**	4	4	2	3	1	1	X	2	4	4	4	2	4	4	4	4	4	4
Methylal	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Methylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methylamyl Acetate	**E0540-80**	3	3	1	3	2	1	X	1	1	4	4	1	1	1	1	1	1	2
Methylcyclopentane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Methylene Bromide	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methylene Chloride	**V1164-75**	4	4	4	2	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Methylene Iodide	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methylglycerol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Methylisobutyl Carbinol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Methylpyrrolidine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methylpyrrolidone	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Methylsulfuric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
MIL-A-6091	**E1235-80**	2	2	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
MIL-C-4339	**N0304-75**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	3
MIL-C-7024	**N0602-70**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	4	1	4
MIL-C-8188	**V1164-75**	2	2	4	2	1	1	X	4	4	3	4	4	4	4	4	4	2	4
MIL-E-9500	**E1235-80**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
MIL-F-16884	**N0304-75**	1	1	4	1	1	1	X	3	4	1	3	4	4	4	4	3	1	4
MIL-F-17111	**N0304-75**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	2	2	4
MIL-F-25558 (RJ-1)	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-F-25656	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
MIL-F-5566	**E1235-80**	2	2	1	1	1	1	X	2	2	4	2	1	2	1	1	1	1	1
MIL-F-81912 (JP-9)	**V1164-75**	3	3	4	1	1	1	X	4	4	4	3	4	X	X	4	X	2	4
MIL-F-82522 (RJ-4)	**N0602-70**	2	2	4	1	1	1	X	4	4	1	1	4	1	1	1	X	1	4
MIL-G-10924	**N0304-75**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	2	1	4
MIL-G-15793	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	2	4
MIL-G-21568	**E1235-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	4
MIL-G-25013	**V1164-75**	1	1	1	1	1	1	X	2	1	1	3	1	4	4	2	2	1	4
MIL-G-25537	**N0304-75**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	2	1	4
MIL-G-25760	**V1164-75**	2	2	4	1	1	1	X	2	4	2	2	4	4	4	4	2	2	4
MIL-G-3278	**L1120-70**	2	2	4	1	1	1	X	4	4	1	2	4	4	4	4	4	2	4

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MIL-G-3545	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-G-4343	**V1164-75**	2	2	3	1	1	1	X	2	1	1	1	3	1	1	1	1	1	3
MIL-G-5572	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	1	4
MIL-G-7118	**N0304-75**	2	2	4	1	1	1	X	2	4	3	3	4	4	4	4	2	1	4
MIL-G-7187	**N0304-75**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
MIL-G-7421	**L1120-70**	2	2	4	1	1	1	X	2	4	4	2	4	4	4	4	2	2	4
MIL-G-7711	**N0304-75**	1	1	4	1	1	1	X	4	4	2	1	4	4	4	4	4	1	2
MIL-H-13910	**E1235-80**	1	1	1	1	1	1	X	1	1	2	4	1	1	1	1	1	2	4
MIL-H-19457	**V1164-75**	4	4	2	1	1	1	X	4	4	4	4	1	4	4	4	4	4	3
MIL-H-22251	**E1235-80**	2	2	1	X	X	X	X	2	2	X	X	1	X	X	X	2	X	4
MIL-H-27601	**V1164-75**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	3	2	4
MIL-H-46170 -15°F to +400°F	**V1164-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-46170 -20°F to +275°F	**N0756-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-46170 -55°F to +275°F	**N0756-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-46170 -65°F to +275°F	**N0756-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-5606 -65°F to +235°F	**N0304-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-5606 -65°F to +275°F	**N0756-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-H-6083	**N0304-75**	1	1	4	1	1	1	X	1	4	1	1	4	4	4	2	2	1	4
MIL-H-7083	**E1235-80**	1	1	1	2	1	1	X	2	2	4	4	1	3	3	2	2	1	1
MIL-H-8446 (MLO-8515)	**V1164-75**	2	2	4	1	1	1	X	1	4	3	4	4	4	4	4	X	1	4
MIL-J-5161	**N0602-70**	2	2	4	1	1	1	X	4	4	1	2	4	4	4	4	4	1	4
Milk	**N0508-75**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
MIL-L-15016	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	2	4
MIL-L-15017	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	2	4
MIL-L-17331	**V1164-75**	1	1	4	1	1	1	X	X	4	X	X	4	4	4	4	X	X	4
MIL-L-2104	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	3	1	4
MIL-L-21260	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-L-23699	**V1164-75**	2	2	4	1	1	1	X	3	4	3	3	4	4	4	4	3	2	4
MIL-L-25681	**V1164-75**	2	2	1	1	1	1	X	2	2	2	3	1	2	2	2	2	2	4
MIL-L-3150	**N0304-75**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
MIL-L-6081	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-L-6082	**N0304-75**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	3
MIL-L-6085	**V1164-75**	2	2	4	1	1	1	X	4	4	2	3	4	4	4	4	4	2	4
MIL-L-6387	**V1164-75**	2	2	4	1	1	1	X	4	4	2	1	4	4	4	4	4	2	4
MIL-L-7808	**V1164-75**	2	2	4	1	1	1	X	4	4	2	4	4	4	4	4	4	2	4
MIL-L-7870	**N0304-75**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
MIL-L-9000	**N0304-75**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	2	2	4
MIL-L-9236	**V1164-75**	2	2	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
MIL-O-3503	**N0304-75**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	2	1	4
MIL-P-27402	**E1235-80**	2	2	1	X	X	X	X	2	2	X	X	1	X	X	X	2	X	4

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MIL-R-25576 (RP-1)	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-S-3136, Type I Fuel	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
MIL-S-3136, Type II Fuel	**N0602-70**	2	2	4	1	1	1	X	4	4	3	2	4	4	4	4	4	2	4
MIL-S-3136, Type III Fuel	**N0602-70**	2	2	4	1	1	1	X	4	4	3	2	4	4	4	4	4	2	4
MIL-S-3136, Type IV Oil High Swell	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	2
MIL-S-3136, Type IV Oil Low Swell	**N0674-70**	1	1	4	1	1	1	X	1	4	1	1	4	4	4	4	1	1	3
MIL-S-3136, Type V Oil Medium Swell	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
MIL-S-81087	**E1235-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
MIL-T-5624, JP-4, JP-5	**N0602-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
MIL-T-83133	**N0602-70**	1	1	4	1	1	1	X	3	4	1	1	4	X	X	4	X	2	4
Mineral Oils	**N0674-70**	1	1	3	1	1	1	X	2	4	1	1	3	4	4	4	2	1	2
Mixed Acids	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
MLO-7277 Hydr.	**V1164-75**	3	3	4	1	1	1	X	4	4	3	3	4	4	4	4	4	3	4
MLO-7557	**V1164-75**	3	3	4	1	1	1	X	4	4	3	3	4	4	4	4	4	3	4
MLO-8200 Hydr.	**V1164-75**	2	2	4	1	1	1	X	1	4	X	1	4	4	4	4	4	2	4
MLO-8515	**V1164-75**	2	2	4	1	1	1	X	1	4	3	1	4	4	4	4	3	1	4
Mobil 24dte	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobil 254 Lubricant	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Mobil Delvac 1100, 1110, 1120, 1130	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobil HF	**N0674-70**	1	1	4	1	1	1	X	2	X	X	X	X	X	X	X	X	X	X
Mobil Nivac 20, 30	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Mobil SHC 500 Series	**V1164-75**	3	3	4	1	1	1	X	2	X	1	2	4	X	X	X	2	2	2
Mobil SHC 600 Series	**V1164-75**	3	3	4	1	1	1	X	2	4	1	1	4	X	X	X	2	2	3
Mobil Therm 600	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobil Velocite c	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobilgas WA200 ATF	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobilgear 600 Series	**V1164-75**	3	3	3	1	1	1	X	1	4	1	2	3	3	4	4	2	1	1
Mobilgear SHC ISO Series	**V1164-75**	3	3	3	1	1	1	X	2	4	1	2	3	3	4	4	2	1	1
Mobilgrease HP	**V1164-75**	2	2	4	1	1	1	X	2	4	1	1	4	X	4	4	3	1	2
Mobilgrease HTS	**V1164-75**	2	2	4	1	1	1	X	2	4	1	1	4	X	4	4	3	1	2
Mobilgrease SM	**V1164-75**	2	2	4	1	1	1	X	2	4	1	1	4	X	4	4	3	1	2
Mobilith AW Series	**V1164-75**	2	2	4	1	1	1	X	2	4	1	1	4	X	4	4	3	1	2
Mobilith SHC Series	**V1164-75**	2	2	4	1	1	1	X	3	4	1	1	4	X	4	4	3	1	2
Mobiljet II Lubricant	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Mobilmistlube Series	**V1164-75**	3	3	3	1	1	1	X	1	4	1	2	3	3	4	4	2	1	1
Mobiloil SAE 20	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Mobilux	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Molybdenum Disulfide Grease	**N0674-70**	1	X	4	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Molybdenum Oxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Molybdenum Trioxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Molybdic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monobromobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Monobromotoluene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Monobutyl Paracresol	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Monochloroacetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monochlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Monochlorobutene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Monochlorohydrin	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Monoethanolamine (MEA)	**E0540-80**	4	4	2	4	2	1	X	4	2	4	4	2	2	2	2	4	4	2
Monoethyl Amine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monoisopropylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monomethyl Aniline	**E0540-80**	4	X	1	2	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monomethyl Ether (Dimethyl Ether)	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Monomethyl Ether (Methyl Ether)	**N0674-70**	1	X	4	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Monomethyl Hydrazine	**E0540-80**	2	2	1	X	1	1	X	2	2	X	X	1	X	X	X	2	X	4
Monomethylamine (MMA)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Monomethylaniline	**V1164-75**	4	4	2	2	1	1	X	4	4	4	4	2	4	4	4	4	X	X
Mononitrotoluene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Mononitrotoluene & Dinitrotoluene(40/60 Mixture)	**E0540-80**	4	4	1	3	2	2	X	4	4	4	4	4	4	4	4	4	3	4
Monovinyl Acetylene	**E0540-80**	1	1	1	1	1	1	X	2	2	X	X	1	2	2	2	2	X	2
Mopar Brake Fluid	**E0603-70**	3	3	1	4	4	4	X	2	1	X	X	2	X	X	X	2	4	3
Morpholine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Motor Oils	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Mustard Gas	**E1235-80**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Myristic Acid	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
— N —																			
Naphthalene	**V1164-75**	4	4	4	1	1	1	X	4	4	X	2	4	4	4	4	4	1	4
Naphthalene Chloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Naphthalene Sulfonic Acid	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Naphthalenic Acid	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Naphthalonic Acid	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Naphthenic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	4
Naphthylamine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Naptha	**V1164-75**	2	2	4	1	1	1	X	4	4	2	2	4	4	4	4	4	2	4
Natural Gas	**N0674-70**	1	1	4	1	1	1	X	1	2	2	2	4	2	2	2	1	3	4
Neatsfoot Oil	**N0674-70**	1	1	2	1	1	1	X	4	4	1	1	2	4	4	4	4	1	2
Neon	**B0612-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Neville Acid	**V1164-75**	4	4	2	1	1	1	X	4	4	4	X	2	4	4	4	4	2	4
Nickel Acetate	**E0540-80**	2	2	1	4	1	1	X	2	4	4	4	1	4	1	1	4	4	4
Nickel Ammonium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Nickel Chloride	**N0674-70**	1	1	1	1	1	1	X	2	1	3	3	1	1	1	1	1	1	1
Nickel Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nickel Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nickel Salts	**N0674-70**	1	1	1	1	1	1	X	2	1	3	3	1	1	1	1	1	1	1
Nickel Sulfate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	3	1	2	2	2	1	1	1
Nicotinamide (Niacinamide)	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Nicotinamide Hydrochloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nicotine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Nicotine Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Niter Cake	**N0674-70**	1	1	1	1	1	1	X	1	1	4	1	1	1	1	1	1	1	1
Nitric Acid - Red Fuming	**V3819-75**	4	4	4	2	1	1	3	4	X	X	X	X	X	X	X	X	X	X
Nitric Acid - White Fuming	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Nitric Acid (0 - 50%)	**V1164-75**	4	X	2	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitric Acid (50 - 100%)	**V3819-75**	4	X	4	3	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitric Acid 3 Molar to 158°F	**E0540-80**	4	4	2	3	2	2	X	4	3	4	4	2	X	X	X	2	4	4
Nitric Acid Concentrated Room Temp.	**V0834-70**	X	X	4	2	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitric Acid Concentrated to 158°F	**Zatkoff**	4	4	4	4	4	4	X	4	4	4	4	4	X	X	4	X	4	4
Nitroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrobenzene	**E0540-80**	4	4	1	2	1	1	X	4	4	4	4	1	4	4	4	4	4	4
Nitrobenzoic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrocellulose	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrochlorobenzene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrochloroform	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrodiethylaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrodiphenyl Ether	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitroethane	**E0540-80**	4	4	2	4	1	1	X	2	2	4	4	2	2	2	2	2	4	4
Nitrofluorobenzene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrogen	**B0612-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Nitrogen Oxides	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrogen Tetroxide (N2O4)	**Zatkoff**	4	3	4	4	2	2	X	4	4	4	4	3	4	4	4	4	4	4
Nitrogen Trifluoride	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Nitroglycerine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrogylcerol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitroisopropylbenzene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitromethane	**E0540-80**	4	4	2	4	1	1	X	3	3	4	4	2	2	2	2	2	4	4
Nitrophenol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitropropane	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Nitrosyl Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitrosylsulfuric Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Nitrothiophene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Nitrotoluene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrous Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Nitrous Oxide	**E0540-80**	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	1
Nonane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Noryl GE Phenolic	**N0674-70**	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nyvac FR200 Mobil	**N0674-70**	1	1	1	1	1	1	X	2	4	X	X	4	4	X	4	3	X	X
— O —																			
Octachloro Toluene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Octadecane	**N0674-70**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	2	1	4
Octanal (n-Octanaldehyde)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Octane or n-Octane	**V1164-75**	1	1	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Octyl Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Octyl Alcohol	**V1164-75**	2	2	3	1	1	1	X	2	2	4	4	2	2	2	2	2	2	2
Octyl Chloride	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Octyl Phthalate	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Olefins	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Oleic Acid	**V0834-70**	3	3	4	2	1	1	X	4	4	4	2	4	4	4	4	4	X	4
Oleum (Fuming Sulfuric Acid)	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	X	4
Oleum Spirits	**V1164-75**	2	2	4	1	1	1	X	3	4	X	3	4	4	4	4	2	2	4
Oleyl Alcohol	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Olive Oil	**N0674-70**	1	1	2	1	1	1	X	2	4	1	1	2	4	4	4	2	1	3
Oronite 8200	**V1164-75**	2	2	4	1	1	1	X	1	4	X	1	4	4	4	4	4	1	4
Oronite 8515	**V1164-75**	2	2	4	1	1	1	X	1	4	X	1	4	4	4	4	4	1	4
Ortho-Chloro Ethyl Benzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ortho-Chloroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ortho-Chlorophenol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ortho-Cresol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Ortho-Dichlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Ortho-Nitrotoluene	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Orthophos Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
OS 45 Type III (OS45)	**V1164-75**	2	2	4	1	1	1	X	1	4	X	4	4	4	4	4	2	2	4
OS 45 Type IV (OS45-1)	**V1164-75**	2	2	4	1	1	1	X	1	4	X	4	4	4	4	4	2	2	4
OS 70	**V1164-75**	2	2	4	1	1	1	X	1	4	X	4	4	4	4	4	2	2	4
Oxalic Acid	**E0540-80**	2	2	1	1	1	1	X	2	2	X	X	1	2	2	2	2	1	2
Oxygen, 200-300°F (Evaluate for specific applications)	**V1164-75**	4	4	4	2	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Oxygen, 300-400°F (Evaluate for specific applications)	**S0604-70**	4	4	4	2	1	1	X	4	4	4	4	4	4	4	4	4	4	1
Oxygen, Cold (Evaluate for specific applications)	**0873-70**	2	2	1	1	1	1	X	1	2	2	1	1	2	2	2	1	1	1
Oxygen, Liquid	**V3819-75**	4	4	4	4	4	4	4	4	X	X	X	X	X	X	X	X	X	X

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Ozonated Deionized Water	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	1	2
Ozone	**E0540-80**	4	3	1	1	1	1	X	2	4	2	1	2	4	4	4	1	1	1
— P —																			
Paint Thinner, Duco	**V1164-75**	4	4	4	2	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Palmitic Acid	**N0674-70**	1	1	2	1	1	1	X	2	2	X	1	2	2	2	2	3	1	4
Para-Aminobenzoic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Para-Aminosalicylic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Para-Bromobenzylphenyl Ether	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Para-Chlorophenol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Paracymene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Para-Dichlorobenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Paraffins	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Para-Formaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Paraldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Par-al-Ketone	**Zatkoff**	4	4	4	4	4	4	X	4	4	4	4	4	4	4	4	4	4	4
Para-Nitroaniline	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Para-Nitrobenzoic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Para-Nitrophenol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Parathion	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Para-Toluene Sulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Parker O Lube	**N0674-70**	1	1	4	1	1	1	X	1	2	1	1	4	4	4	4	1	1	2
Peanut Oil	**N0674-70**	1	1	3	1	1	1	X	3	4	1	2	3	4	4	4	2	1	1
Pectin (Liquor)	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Pelagonic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Penicillin (Liquid)	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Pentachloroethane	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Pentachlorophenol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pentaerythritol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pentaerythritol Tetranitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pentafluoroethane (F-125)	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Pentane or n-Pentane	**N0674-70**	1	1	4	1	1	1	X	1	3	1	4	4	4	4	4	2	3	4
Pentane, 2 Methyl	**N0674-70**	1	1	4	1	1	1	X	2	4	1	4	4	4	4	4	2	3	4
Pentane, 2-4 dimethyl	**N0674-70**	1	1	4	1	1	1	X	2	4	1	4	4	4	4	4	2	3	4
Pentane, 3-Methyl	**N0674-70**	1	1	4	1	1	1	X	2	4	1	4	4	4	4	4	2	3	4
Pentoxone	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Pentyl Pentanoate	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Peracetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Perchloric Acid - 2N	**E0540-80**	4	4	1	1	1	1	X	2	4	4	4	2	4	4	4	2	1	2
Perchloroethylene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Perfluoropropane	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Perfluorotriethylamine	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Permanganic Acid	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Persulfuric Acid (Caro's Acid)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Petrolatum	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Petrolatum Ether	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Petroleum Oil, Above 250°F	**V1164-75**	4	4	4	2	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Petroleum Oil, Below 250°F	**N0674-70**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	2	2
Petroleum Oil, Crude	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Phenol	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Phenol, 70%/30% H2O	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Phenol, 85%/15% H2O	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Phenolic Sulfonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenolsulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenylacetamide	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Phenylacetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenylacetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenylbenzene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Phenylene Diamine	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phenylethyl Alcohol	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Phenylethyl Ether	**V8545-75**	4	4	4	4	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Phenylethyl Malonic Ester	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Phenylglycerine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenylhydrazine	**V1164-75**	4	4	2	1	1	1	X	4	2	4	X	4	2	1	1	4	X	X
Phenylhydrazine Hydrochloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phenylmercuric Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phorone	**Zatkoff**	4	4	3	4	1	1	X	4	4	4	4	3	4	4	4	4	4	4
Phosgene	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphine	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphoric Acid 3 Molar to 158°F	**E0540-80**	1	1	1	1	1	1	X	2	2	3	4	1	X	X	X	1	2	2
Phosphoric Acid Concentrated Room Temp	**E0540-80**	2	2	1	1	1	1	X	2	1	2	4	1	X	X	X	1	3	3
Phosphoric Acid Concentrated to 158°F	**E0540-80**	4	4	1	1	1	1	X	3	2	3	4	1	X	X	X	1	3	4
Phosphoric Acid, 20%	**E0540-80**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphoric Acid, 45%	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphorus (Molten)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphorus Oxychloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Phosphorus Trichloride	**E0540-80**	4	4	1	1	1	1	X	4	4	X	X	1	X	X	4	4	1	X
Phosphorus Trichloride Acid	**E0540-80**	4	4	1	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Phthalic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Phthalic Anhydride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pickling Solution	**V0834-70**	4	4	3	2	1	1	X	4	4	4	4	3	4	4	4	2	4	4

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Zatkoff SEALS & PACKINGS

Compatibility Tables For Gases, Fluids & Solids

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Hydrogenated Nitrile	-32°C to 149°C (-23°F to 300°F)*	Polyacrylate	-21°C to 177°C (- 5°F to 350°F)*
Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Picric Acid (aq)	**C0873-70**	1	1	1	1	1	1	X	1	2	X	X	1	2	2	1	1	2	X
Picric Acid Molten	**V0834-70**	2	2	2	1	1	1	X	2	2	X	X	2	2	2	2	2	2	4
Pine Oil	**N0674-70**	1	1	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	4
Pine Tar	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Pinene	**V1164-75**	2	2	4	1	1	1	X	3	4	4	2	4	4	4	4	4	1	4
Piperazine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Piperidine	**V1164-75**	4	4	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	4
Piranha (H2SO4:H2O2)(70:30)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Plating Solution (Co,Cu,Au,In,Fe,Pb,Ni,Ag,Sn,Zn)	**N0674-70**	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X
Plating Solutions Chrome	**V1164-75**	4	4	2	1	1	1	X	4	4	4	4	2	4	4	4	4	2	2
Plating Solutions Others	**E0540-80**	1	1	1	1	1	1	X	4	4	X	X	1	X	X	4	1	X	4
Pneumatic Service	**N0674-70**	1	1	1	1	1	1	X	1	4	4	1	1	4	4	4	1	4	4
Polyethylene Glycol	**E0540-80**	2	2	1	3	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Polyglycerol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Polyglycol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Polyvinyl Acetate Emulsion	**E0540-80**	X	X	1	X	1	1	X	2	4	X	X	1	X	X	2	2	X	X
Potassium (Molten)	**Zatkoff**	X	X	X	X	4	4	X	X	X	X	X	X	X	X	X	X	X	X
Potassium Acetate	**E0540-80**	2	2	1	4	1	1	X	2	4	4	4	1	4	1	1	1	4	4
Potassium Acid Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Alum	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Aluminum Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Antimonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bicarbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bichromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bifluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bisulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bisulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bitartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Bromide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Chlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Chloride	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Potassium Chromates	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Cupro Cyanide	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Potassium Cyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Cyanide	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Potassium Dichromate	**N0674-70**	1	1	1	1	1	1	X	1	1	1	2	1	1	1	1	1	1	1
Potassium Diphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Ferricyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Potassium Fluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Glucocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Hydroxide 50%	**E0540-80**	2	2	1	4	1	1	X	2	2	4	4	1	2	2	2	1	3	3
Potassium Hypochlorite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Iodate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Iodide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Metabisulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Metachromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Metasilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Potassium Monochromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Nitrate	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Potassium Nitrite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Perchlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Perfluoro Acetate	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Potassium Permanganate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Peroxide	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Potassium Persulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Phosphate (Acid)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Phosphate (Alkaline)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Phosphate (Di/Tri Basic)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Pyrosulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Salts	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Potassium Silicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Potassium Sodium Tartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Stannate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Stearate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Sulfate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	1	1	1	2	2	2	1	1
Potassium Sulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Sulfite	**N0674-70**	1	1	1	1	1	1	X	1	2	4	1	1	1	2	2	2	1	1
Potassium Tartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Thiocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Thiosulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Potassium Triphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Prestone Antifreeze	**N0674-70**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
PRL-High Temp. Hydr. Oil	**V1164-75**	2	2	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	2
Producer Gas	**N0674-70**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	2	2	2
Propane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	3	4	4	4	4	2	2	4
Propionaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Propionic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Propionitrile	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Propyl Acetate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Propyl Acetone or n-Propyl Acetone	**E0540-80**	4	4	1	4	1	1	X	4	4	4	4	1	4	4	4	4	4	4
Propyl Alcohol	**N0674-70**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Propyl Nitrate	**E0540-80**	4	4	2	4	1	1	X	4	4	4	X	2	4	4	4	4	4	4
Propyl Propionate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Propylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Propylbenzene	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Propylene	**V1164-75**	3	3	4	1	1	1	X	4	4	4	4	4	4	4	4	4	3	4
Propylene Chloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Propylene Chlorohydrin	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Propylene Dichloride	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Propylene Glycol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Propylene Imine	**V1164-75**	X	X	X	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Propylene Oxide	**E0540-80**	4	4	2	4	1	1	X	4	4	4	4	2	4	4	4	4	4	4
Pydraul 90e	**E0540-80**	4	4	1	1	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Pydraul, 10E	**E0540-80**	4	4	1	4	1	1	X	4	4	4	4	1	4	4	4	4	4	1
Pydraul, 115E	**V1164-75**	4	4	1	1	1	1	X	4	4	4	4	1	4	4	4	4	3	4
Pydraul, 230C, 312C, 540C, A200	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Pydraul, 29ELT 30E, 50E, 65E	**V1164-75**	4	4	1	1	1	1	X	4	4	4	4	1	4	4	4	4	1	1
Pyranol Transformer Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	2	1	4
Pyridine	**V1164-75**	4	4	2	1	2	1	X	4	4	4	3	4	4	4	4	4	2	X
Pyridine Oil	**E0540-80**	4	4	2	4	4	4	X	4	4	4	X	2	4	4	4	4	4	4
Pyridine Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pyridine Sulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pyrogallol (Pyrogallic Acid)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Pyrogard 42, 43, 55	**E0540-80**	4	4	1	1	1	1	2	4	X	X	X	X	X	X	X	X	X	X
Pyrogard 53, Mobil Phosphate Ester	**E0540-80**	4	4	1	1	1	1	X	4	4	4	4	1	4	4	4	4	4	4
Pyrogard D, Mobil Water-in-Oil Emulsion	**N0674-70**	1	1	4	4	4	4	X	2	4	X	1	4	4	4	4	1	2	3
Pyroligneous Acid	**E0540-80**	4	4	2	4	1	1	X	2	4	4	4	2	4	4	4	2	4	X
Pyrolube	**V1164-75**	4	4	2	1	1	1	X	4	4	4	4	2	4	4	4	4	2	2
Pyrosulfuric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Pyrosulfuryl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Pyrrole	**E0540-80**	4	4	4	4	1	1	X	4	2	4	X	4	2	2	2	2	4	2
Pyruvic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
— Q —																			
Quinidine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Quinine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Quinine Bisulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Quinine Hydrochloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
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Quinine Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Quinine Tartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Quinizarin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Quinoline	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Quinone	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
— R —																			
Radiation (GAMMA, 1.0 E+07 RADS)	**E0740-75**	3	3	2	4	4	4	X	X	X	X	4	4	X	X	4	X	4	2
Raffinate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Rapeseed Oil	**E0540-80**	2	2	1	1	1	1	X	2	4	2	2	1	4	4	4	2	1	4
Red Line 100 Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Red Oil (MIL-H-5606)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Resorcinol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Rhodium	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Riboflavin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Ricinoleic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
RJ-1 (MIL-F-25558)	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
RJ-4 (MIL-F-82522)	**N0602-70**	2	2	4	1	1	1	X	4	4	2	2	4	X	X	4	X	1	4
Rosin	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
RP-1 (MIL-R-25576)	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
— S —																			
Saccharin Solution	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sal Ammoniac	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	2
Salicylic Acid	**E0540-80**	2	2	1	1	1	1	X	X	2	X	X	1	2	1	1	X	1	X
Santo Safe 300	**V1164-75**	4	4	3	1	1	1	X	4	4	4	X	3	4	4	4	X	1	1
Sea (Salt) Water	**N0674-70**	1	1	1	1	1	1	X	2	1	4	2	1	1	1	1	1	1	1
Sebacic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Selenic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Selenous Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sewage	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	1	1	1	1	1	1	1
SF 1154 GE Silicone Fluid	**E0740-75**	2	2	1	1	1	1	X	1	1	1	2	1	X	1	1	1	1	4
SF1147 GE Silicone Fluid	**V1164-75**	2	2	3	1	1	1	X	X	X	X	X	3	X	X	X	X	X	4
SF96 GE SIlicone Fluid	**E0740-75**	2	2	1	1	1	1	X	1	1	1	2	1	1	1	1	1	1	4
Shell 3XF Mine Fluid (Fire resist hydr.)	**N0674-70**	1	1	4	1	1	1	X	2	4	4	4	4	4	4	4	2	1	X
Shell Alvania Grease #2	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	2
Shell Carnea 19 and 29	**N0674-70**	1	1	4	1	1	1	X	4	4	1	2	4	4	4	4	4	1	X
Shell Diala	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Shell Irus 905	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Shell Lo Hydrax 27 and 29	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Shell Macome 72	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Shell Tellus #32 Pet. Base	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4

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Zatkoff SEALS & PACKINGS

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Shell Tellus #68	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Shell Tellus 27 (Petroleum Base)	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Shell Tellus 33	**N0674-70**	1	1	4	1	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Shell UMF (5% Aromatic)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Shellac	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Silane	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Silicate Esters	**V1164-75**	2	2	4	1	1	1	X	1	4	X	1	4	4	4	4	X	1	4
Silicon Fluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Silicon Tetrachloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Silicon Tetrafluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Silicone Greases	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	2	3
Silicone Oils	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	3	3
Silver Bromide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Silver Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Silver Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Silver Nitrate	**E0540-80**	2	2	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Silver Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sinclair Opaline CX-EP Lube	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Skelly, Solvent B, C, E	**N0674-70**	1	1	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	X
Skydrol 500 B4	**E1267-80**	4	4	1	4	1	1	X	4	4	4	4	2	4	4	4	4	3	3
Skydrol 7000	**E1267-80**	4	4	1	2	1	1	1	4	X	X	X	X	X	X	X	X	X	X
Skydrol LD-4	**E1267-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	4	4	4	3	3
Soap Solutions	**E0540-80**	1	1	1	1	1	1	X	2	2	4	4	1	1	1	2	1	1	1
Socony Mobile Type A	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Socony Vacuum AMV AC781 (grease)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Socony Vacuum PD959B	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Soda Ash	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Sodium (Molten)	**Zatkoff**	X	X	X	X	4	4	X	X	X	X	X	X	X	X	X	X	X	X
Sodium Acetate	**E0540-80**	2	2	1	4	1	1	X	2	4	3	3	1	4	1	1	1	4	4
Sodium Acid Bisulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Acid Fluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Acid Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Aluminate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Aluminate Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Anthraquinone Disulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Antimonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Arsenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Arsenite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Benzoate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Bicarbonate (Baking Soda)	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1

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		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Sodium Bichromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Bifluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Bisulfate or Bisulfite	**N0674-70**	1	1	1	1	1	1	X	1	2	4	X	1	2	2	1	1	1	1
Sodium Bisulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Bitartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Borate	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Sodium Bromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Bromide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Carbonate (Soda Ash)	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Sodium Chlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Chloride	**N0674-70**	1	1	1	1	1	1	X	1	1	X	1	1	1	1	1	1	X	1
Sodium Chlorite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Chloroacetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Chromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Cyanamide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Cyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Cyanide	**N0674-70**	1	1	1	X	1	1	X	1	1	X	X	1	1	1	1	1	X	1
Sodium Diacetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Diphenyl Sulfonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Diphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Disilicate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Ethylate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Ferricyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Ferrocyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Fluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Fluorosilicate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Glutamate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hydride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Sodium Hydrogen Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hydrosulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hydrosulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hydroxide, 3 Molar	**E0540-80**	2	2	1	2	1	1	X	2	2	4	2	1	1	1	1	1	2	1
Sodium Hypochlorite	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	2	2	1	2	2
Sodium Hypophosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hypophosphite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Hyposulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Iodide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Lactate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Metaphosphate	**N0674-70**	1	1	1	1	1	1	X	2	1	X	X	1	1	1	1	2	1	X

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
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Sodium Metasilicate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Methylate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Monophosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Nitrate	**E0540-80**	2	2	1	X	1	1	X	2	2	X	X	1	1	1	2	1	X	4
Sodium Oleate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Orthosilicate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Oxalate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Perborate	**E0540-80**	2	2	1	1	1	1	X	2	2	X	X	1	2	2	2	2	1	2
Sodium Percarbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Perchlorate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Peroxide	**E0540-80**	2	2	1	1	1	1	X	2	2	4	4	1	2	2	2	2	1	4
Sodium Persulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Phenolate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Phenoxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Phosphate (Dibasic)	**N0674-70**	1	1	1	1	1	1	X	2	1	1	1	1	1	1	1	1	X	4
Sodium Phosphate (Mono)	**N0674-70**	1	1	1	1	1	1	X	2	1	1	1	1	1	1	1	1	X	4
Sodium Phosphate (Tribasic)	**N0674-70**	1	1	1	1	1	1	X	2	1	1	1	1	1	1	1	1	X	1
Sodium Plumbite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Pyrophosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Resinate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Salicylate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Salts	**N0674-70**	1	1	1	1	1	1	X	2	1	1	1	1	1	1	1	1	1	1
Sodium Sesquisilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Sodium Silicate	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	X	X
Sodium Silicofluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Sodium Stannate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Sulfate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	1	1	2	2	2	1	1	1
Sodium Sulfide and Sulfite	**N0674-70**	1	1	1	1	1	1	X	1	2	4	1	1	2	2	2	1	1	1
Sodium Sulfocyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Tartrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Tetraborate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Tetraphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Tetrasulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Thioarsenate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Thiocyanate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Thiosulfate	**E0540-80**	2	2	1	1	1	1	X	1	2	4	1	1	2	2	2	1	1	1
Sodium Trichloroacetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sodium Triphosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Solvesso 100, 150	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Sorbitol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Sour Crude Oil	**V1238-95**	3	3	4	1	1	1	X	4	4	4	4	4	4	4	4	X	4	4
Sour Natural Gas	**V1238-95**	3	3	4	1	1	1	X	4	4	4	4	4	4	4	4	X	4	4
Sovasol No. 1, 2, and 3	**N0674-70**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
Sovasol No. 73 and 74	**V1164-75**	2	2	4	1	1	1	X	2	4	2	2	4	4	4	4	2	1	4
Soybean Oil	**N0674-70**	1	1	3	1	1	1	X	3	4	1	X	3	4	4	4	3	1	1
Spry	**N0674-70**	1	1	2	1	1	1	X	2	4	1	1	2	4	4	4	4	1	1
SR-10 Fuel	**N0674-70**	1	1	4	1	1	1	X	4	4	2	2	4	4	4	4	4	1	4
SR-6 Fuel	**V1164-75**	2	2	4	1	1	1	X	4	4	2	2	4	4	4	4	4	1	4
Standard Oil Mobilube GX90-EP Lube	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Stannic Ammonium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stannic Chloride	**N0674-70**	1	1	1	1	1	1	X	4	1	X	X	1	1	1	1	4	1	2
Stannic Chloride, 50%	**N0674-70**	1	1	1	1	1	1	X	4	1	X	X	1	1	1	1	4	1	2
Stannic Tetrachloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stannous Bisulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stannous Bromide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stannous Chloride (15%)	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	2
Stannous Fluoride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stannous Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Stauffer 7700	**V1164-75**	2	2	4	1	1	1	X	4	4	2	X	4	4	4	4	4	2	4
Steam Below 400°F	**E0692-75**	4	4	1	4	1	1	X	4	4	4	4	2	4	4	4	4	4	3
Steam, 400°-500°F	**E0962-90**	4	4	3	4	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Steam, Above 500°F	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Stearic Acid	**N0674-70**	2	2	2	X	1	1	X	2	2	X	X	2	2	2	2	2	X	2
Stoddard Solvent	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Strontium Acetate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Strontium Carbonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Strontium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Strontium Hydroxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Strontium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Styrene (Monomer)	**V1164-75**	4	4	4	2	1	1	X	4	4	4	X	4	4	4	4	4	3	4
Succinic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sucrose Solutions	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	1	1	1	1	2	1	1
Sulfamic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sulfanilic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sulfanilic Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Sulfanilimide	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Sulfite Liquors	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sulfolane	**E0540-80**	2	2	1	2	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Sulfonated Oils	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Sulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2

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Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

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Sulfonyl Choride	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	1	2
Sulfur	**E0540-80**	4	4	1	1	1	1	X	1	4	4	X	1	4	4	4	X	1	X
Sulfur (Molten)	**V1164-75**	4	4	3	1	1	1	X	3	4	4	4	3	4	4	4	4	3	3
Sulfur Chloride	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	4	1	3
Sulfur Dioxide, Dry	**E0540-80**	4	4	1	4	1	1	X	4	2	4	X	2	2	2	2	4	2	2
Sulfur Dioxide, Liquidified under pressure	**E0540-80**	4	4	1	4	1	1	X	4	4	4	X	2	4	4	4	4	2	2
Sulfur Dioxide, Wet	**E0540-80**	4	4	1	4	1	1	X	2	4	4	X	1	4	4	4	3	2	2
Sulfur Hexafluoride	**E0540-80**	2	2	1	3	2	2	3	1	X	X	X	X	X	X	X	X	X	X
Sulfur Liquors	**V0834-70**	2	2	2	1	1	1	X	2	2	4	X	2	2	2	2	2	2	4
Sulfur Monochloride	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Sulfur Tetrafluoride	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Sulfur Trioxide Dry	**V1164-75**	4	4	2	1	1	1	X	4	3	4	X	2	2	2	2	4	2	2
Sulfuric Acid (20% Oleum)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sulfuric Acid, 3 Molar to 158°F	**E0540-80**	2	2	1	1	1	1	X	2	3	2	4	1	X	X	X	1	1	1
Sulfuric Acid, Concentrated Room Temp	**V1164-75**	X	X	3	1	1	1	X	X	X	X	3	X	X	X	X	X	X	X
Sulfuric Acid, Concentrated to 158°F	**V1164-75**	4	X	4	1	1	1	X	4	4	4	4	4	X	X	X	X	4	4
Sulfuric Chlorohydrin (Chlorosulfonic Acid)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Sulfurous Acid	**V1164-75**	2	2	2	1	1	1	X	2	2	4	3	2	2	2	2	1	X	4
Sunoco #3661	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Sunoco All purpose grease	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Sunoco SAE 10	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Sunsafe (Fire resist. hydr. fluid)	**N0674-70**	1	1	4	1	1	1	X	2	4	4	4	4	4	4	4	2	1	X
Super Shell Gas	**N0497-70**	1	1	4	1	1	1	X	2	4	2	2	4	4	4	4	4	2	4
Surfuryl Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Swan Finch EP Lube	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
Swan Finch Hypoid-90	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
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Tallow	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Tannic Acid (10%)	**N0674-70**	1	1	1	1	1	1	X	1	2	4	X	1	1	1	1	1	1	2
Tar, bituminous	**V1164-75**	2	2	4	1	1	1	X	3	4	4	X	4	4	2	3	4	1	2
Tartaric Acid	**N0674-70**	1	1	2	1	1	1	X	2	4	X	1	2	2	1	3	1	1	1
Tellone II	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Terephthalic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Terpineol	**V1164-75**	2	2	3	1	1	1	X	4	4	X	2	3	4	4	4	4	1	X
Terpinyl Acetate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Tertiary Amyl Methyl Ether (TAME)	**V3819-75**	X	X	X	X	2	1	X	X	X	X	X	X	X	X	X	X	X	X
Tertiary Butyl Catechol or	**V1164-75**	4	4	2	1	1	1	X	2	2	4	4	2	2	4	4	2	1	X
P-Tertiary Butyl Catechol																			
Tertiary Butyl Mercaptan	**V1164-75**	4	4	4	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Tetrabromoethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	4	2	4

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Compatibility Tables For Gases, Fluids & Solids

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Tetrabromomethane	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Tetrabutyl Titanate	**E0540-80**	2	2	1	1	1	1	X	2	2	X	X	2	2	2	2	4	4	4
Tetrachloroethylene	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	4
Tetrachoroethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	X
Tetraethyl Lead	**V1164-75**	2	2	4	1	1	1	X	2	4	X	X	4	4	4	4	2	X
Tetraethyl Lead "Blend"	**V1164-75**	2	2	4	1	1	1	X	4	4	X	X	4	4	4	4	2	X
Tetraethyl Orthosilicate (TEOS)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Tetrahydrofuran	**V8545-75**	4	4	2	4	1	1	X	4	4	4	3	2	4	4	4	4	4	4
Tetralin	**V1164-75**	4	4	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	4
Tetramethyl Ammonium Hydroxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Tetramethylcyclotetrasiloxane (TMCTS)	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Tetramethyldihydropyridine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Tetramethyldihydropyridine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Tetraphosphoglucosate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Tetraphosphoric Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Texaco 3450 Gear Oil	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
Texaco Capella A and AA	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Texaco Meropa 220 (No Lead)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	1	4
Texaco Regal B	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
Texaco Uni-Temp Grease	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	2
Texamatic "A" 1581 Fluid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Texamatic "A" 3401 Fluid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Texamatic "A" 3525 Fluid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Texamatic "A" 3528 Fluid	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Texamatic "A" Transmission Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	2	4	4	4	4	4	2	4
Texas 1500 Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	2
Therminol 44	**V1164-75**	4	4	4	1	1	1	X	4	X	4	X	4	X	X	X	X	X	4
Therminol 55	**V1164-75**	2	2	4	1	1	1	X	4	X	2	X	4	X	X	X	X	X	4
Therminol 66	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Therminol FR	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Therminol VP-1, 60, 65	**V1164-75**	4	4	4	1	1	1	X	4	X	4	X	4	X	X	X	X	X	2
Thio Acid Chloride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Thioamyl Alcohol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Thiodiacetic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Thioethanol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Thioglycolic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Thiokol TP-90B	**E0540-80**	4	4	1	1	1	1	X	2	4	X	X	1	X	X	X	2	2	X
Thiokol TP-95	**E0540-80**	4	4	1	1	1	1	X	2	4	X	X	1	X	X	X	2	2	X
Thionyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Thiophene (Thiofuran)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Thiophosphoryl Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Thiourea	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Thorium Nitrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Tidewater Multigear, 140 EP Lube	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Tidewater Oil-Beedol	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	2
Tin Ammonium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Tin Chloride	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Tin Tetrachloride	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Titanic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Titanium Dioxide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Titanium Sulfate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Titanium Tetrachloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Toluene	**V1164-75**	4	4	4	1	2	1	X	4	4	4	4	4	4	4	4	4	2	4
Toluene Bisodium Sulfite	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Toluene Diisocyanate (TDI)	**E0540-80**	4	4	2	4	1	1	X	4	4	4	X	2	4	4	4	4	4	4
Toluene Sulfonyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Toluenesulfonic Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Toluidine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Toluol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Toluquinone	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Tolylaldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Transformer Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	2	1	4	4	4	4	4	1	2
Transmission Fluid Type A	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Triacetin	**E0540-80**	2	2	1	4	1	1	X	2	3	4	4	1	2	2	2	2	4	X
Triaryl Phosphate	**E0540-80**	4	4	1	1	1	1	X	4	4	4	4	1	4	4	4	4	2	3
Tribromomethylbenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Tributoxyethyl Phosphate	**E0540-80**	4	4	1	1	1	1	X	4	2	4	4	1	2	4	2	4	2	X
Tributyl Citrate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Tributyl Mercaptan	**V1164-75**	4	4	4	1	1	1	X	4	4	4	X	4	4	4	4	4	3	4
Tributyl Phosphate	**E0540-80**	4	4	1	4	4	4	X	4	4	4	4	2	4	2	2	4	4	4
Tributylamine	**V8545-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Trichloroacetic Acid	**E0540-80**	2	2	2	3	1	1	X	4	2	4	4	2	2	2	2	4	4	X
Trichloroacetyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Trichlorobenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Trichloroethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Trichloroethanolamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Trichloroethylene	**V1164-75**	3	3	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Trichloromethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	2	4
Trichloronitromethane (Chloropicrin)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Trichlorophenylsilane	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X

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Compatibility Tables For Gases, Fluids & Solids

Approximate Service Temperature Ranges for Commonly Used Basic Polymer Types*

Nitrile (General Service)	-34°C to 121°C (-30°F to 250°F)*	AFLAS	-4°C to 232°C (25°F to 450°F)*
Nitrile (Low Temperature)	-55°C to 107°C (-65°F to 225°F)*	Neoprene	-37°C to 107°C (-35°F to 225°F)*
Hydrogenated Nitrile	-32°C to 149°C (-23°F to 300°F)*	Polyacrylate	-21°C to 177°C (- 5°F to 350°F)*
Ethylene Propylene	-57°C to 121°C (-70°F to 250°F)*	Polyurethane	-40°C to 82°C (-40°F to 180°F)*
Fluorocarbon	-26°C to 205°C (-15°F to 400°F)*	Butyl	-59°C to 120°C (-75°F to 250°F)*
Hifluor	-26°C to 205°C (-15°F to 400°F)*	Fluorosilicone	-73°C to 177°C (-100°F to 350°F)*
Perfluoroelastomer (Parofluor)	-26°C to 260°C (-15°F to 500°F)*	Silicone	-54°C to 232°C (-65°F to 450°F)*

NOTE: *These temperature ranges will apply to the majority of media for which the material is potentially recommended. With some media however, the service temperature range may be significantly different. ALWAYS TEST UNDER ACTUAL SERVICE CONDITIONS.

Compound Compatibility Rating
1 - Satisfactory
2 - Fair (usually OK for static seal)
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4 - Unsatisfactory
X - Insufficient Data

		Nitrile NBR	Hydrogenated Nitrile HNBR	Ethylene Propylene EPDM	Fluorocarbon FKM	Hifluor FKM	Perfluoroelastomer FFKM	Aflas (TFE/Propylene) FEPM	Neoprene/Chloroprene CR	Styrene-Butadiene SBR	Polyacrylate ACM	Polyurethane AU, EU	Butyl IIR	Butadiene BR	Isoprene IR	Natural Rubber NR	Epichlorohydrin CO, ECO	Fluorosilicone FVMQ	Silicone MQ, VMQ, PVMQ
Trichloropropane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	4
Trichlorosilane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	4
Tricresyl Phosphate	**E0540-80**	4	4	1	2	1	1	X	3	2	4	4	1	4	4	4	2	3
Triethanol Amine	**E0540-80**	3	3	2	4	1	1	X	2	2	4	4	2	2	2	2	4	X
Triethyl Phosphate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Triethylaluminum	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X
Triethylborane	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X
Triethylene Glycol	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Triethylenetetramine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Trifluoroacetic Acid	**E0540-80**	3	3	1	3	2	2	X	1	1	4	4	1	1	1	1	1	2
Trifluoroethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	4
Trifluoromethane	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	2	4
Trifluorovinylchloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Triisopropylbenzylchloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Trimethylamine	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Trimethylamine (TMA)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Trimethylbenzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Trimethylborate (TMB)	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	2	X
Trimethylpentane	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	1	2
Trinitrololuene (TNT)	**V1164-75**	4	4	4	2	1	1	X	2	4	4	X	4	4	4	4	2	X
Trioctyl Phosphate	**E0540-80**	4	4	1	2	1	1	X	4	4	4	4	1	4	4	4	2	3
Triphenylphosphite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Tripoly Phosphate	**E0540-80**	4	4	1	2	1	1	X	3	4	4	4	1	4	4	4	1	3
Tripotassium Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Trisodium Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	2
Tritium	**Factory**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tung Oil (China Wood Oil)	**N0674-70**	1	1	4	1	1	1	X	2	4	X	3	3	4	4	4	3	2	4
Tungsten Hexafluoride	**V3819-75**	X	X	X	X	2	2	X	X	X	X	X	X	X	X	X	X	X	X
Tungstic Acid	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Turbine Oil	**N0674-70**	1	1	4	1	1	1	X	4	4	1	1	4	4	4	4	4	1	4
Turbine Oil #15 (MIL-L-7808A)	**V1164-75**	2	2	4	1	1	1	X	4	4	2	4	4	4	4	4	4	2	4
Turbo Oil #35	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Turpentine	**N0674-70**	1	1	4	1	1	1	X	4	4	2	4	4	4	4	4	4	2	4
Type I Fuel (MIL-S-3136)(ASTM Ref. Fuel A)	**N0602-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Type II Fuel MIL-S-3136	**N0602-70**	2	2	4	1	1	1	X	4	4	3	2	4	4	4	4	4	2	4
Type III Fuel MIL-S-3136(ASTM Ref. Fuel B)	**N0602-70**	2	2	4	1	1	1	X	4	4	3	2	4	4	4	4	4	2	4
— U —																			
Ucon Hydrolube J-4	**N0674-70**	1	1	1	1	1	1	X	2	1	4	4	1	2	X	X	X	2	1
Ucon Lubricant 50-HB-100	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant 50-HB-260	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1

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Ucon Lubricant 50-HB-5100	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant 50-HB55	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant 50-HB-660	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-1145	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-135	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-285	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-300X	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-625	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Lubricant LB-65	**N0674-70**	1	1	1	1	1	1	X	1	2	X	X	1	2	2	2	2	1	1
Ucon Oil 50-HB-280x	**E0540-80**	2	2	1	3	1	1	1	2	X	X	X	X	X	X	X	X	X	X
Ucon Oil Heat Transfer Fluid 500 (Polyalkalene Glycol)	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Oil LB-385	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Ucon Oil LB-400X	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	1
Undecylenic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Undecylic Acid	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Univis 40 (Hydr. Fluid)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	4
Univolt #35 (Mineral Oil)	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Unsymmetrical Dimethyl Hydrazine (UDMH)	**E0540-80**	2	2	1	4	1	1	X	2	2	X	X	1	1	1	1	1	4	4
UPDI(Ultrapure Deionized Water)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Uranium Hexachloride	**V1164-75**	X	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Uranium Hexafluoride	**Zatkoff**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Uranium Sulfate	**Zatkoff**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Uric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
— V —																			
Valeraldehyde	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Valeric Acid	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Vanadium Oxide	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Vanadium Pentoxide	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	2	1	2
Varnish	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	4
Vegetable Oil	**N0674-70**	1	1	3	1	1	1	X	3	4	1	X	3	4	4	4	X	1	1
Versilube F44, F55	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
Versilube F-50	**E0540-80**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	3
Vinegar	**E0540-80**	2	2	2	3	1	1	X	2	2	4	4	2	2	2	2	X	3	3
Vinyl Acetate	**E0540-80**	2	2	1	3	2	1	1	2	X	X	X	X	X	X	X	X	X	X
Vinyl Benzene	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Vinyl Benzoate	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Vinyl Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Vinyl Fluoride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Vinylidene Chloride	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X
Vinylpyridine	**V1164-75**	2	2	4	1	1	1	X	4	4	4	3	4	4	4	4	4	2	X

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Vitriol (White)	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
VV-H-910	**E0540-80**	3	3	1	1	1	1	X	2	1	2	4	2	2	2	2	2	2	2
— W —																			
Wagner 21B Brake Fluid	**E0667-70**	3	3	1	4	1	1	X	2	1	X	X	2	X	X	2	2	4	3
Water	**E0540-80**	1	2	1	2	1	1	X	2	1	4	4	1	1	1	1	1	1	1
Wemco C	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
Whiskey and Wines	**N0508-75**	1	1	1	1	1	1	X	1	1	4	4	1	1	1	1	1	1	1
White Liquor	**N0674-70**	1	1	1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X
White Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	1	4	4	4	4	4	1	4
White Pine Oil	**V1164-75**	2	2	4	1	1	1	X	4	4	X	X	4	4	4	4	4	1	4
Wolmar Salt	**N0674-70**	1	1	1	1	1	1	X	2	1	2	1	1	1	1	1	1	1	1
Wood Alcohol	**N0674-70**	1	1	1	4	1	1	X	1	1	4	4	1	1	1	1	1	1	1
Wood Oil	**N0674-70**	1	1	4	1	1	1	X	2	4	1	3	3	4	4	4	3	2	4
— X —																			
Xenon	**N0674-70**	1	1	1	1	1	1	X	1	1	1	1	1	1	1	1	1	1	1
Xylene	**V1164-75**	4	1	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
Xylidenes-Mixed-Aromatic Amines	**E0540-80**	3	3	1	4	1	1	X	4	4	4	4	4	4	4	4	4	4	4
Xylol	**V1164-75**	4	4	4	1	1	1	X	4	4	4	4	4	4	4	4	4	1	4
— Z —																			
Zeolites	**N0674-70**	1	1	1	1	1	1	X	1	1	X	X	1	1	1	1	1	1	X
Zinc Acetate	**E0540-80**	2	2	1	4	1	1	X	2	4	4	4	1	4	1	1	4	4	4
Zinc Ammonium Chloride	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Chloride	**N0674-70**	1	1	1	1	1	1	X	1	1	4	X	1	1	1	1	1	1	X
Zinc Chromate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Cyanide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Diethyldithiocarbamate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Dihydrogen Phosphate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Fluorosilicate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Zinc Hydrosulfite	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Naphthenate	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Zinc Nitrate	**N0674-70**	1	1	1	1	1	1	X	X	1	4	X	1	1	1	1	1	1	X
Zinc Oxide	**N0674-70**	1	1	1	1	1	1	X	X	1	4	X	1	1	1	1	1	1	X
Zinc Phenolsulfonate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Phosphate	**N0674-70**	1	1	1	1	1	1	X	1	1	4	1	1	1	1	1	1	1	1
Zinc Salts	**N0674-70**	1	1	1	1	1	1	X	1	1	4	1	1	1	1	1	1	1	1
Zinc Silicofluoride	**V3819-75**	X	X	X	X	1	1	X	X	X	X	X	X	X	X	X	X	X	X
Zinc Stearate	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zinc Sulfate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	4	1	2	2	2	1	1	1
Zinc Sulfide	**E0540-80**	3	3	1	3	1	1	X	1	1	4	4	1	1	1	1	1	1	2
Zirconium Nitrate	**N0674-70**	1	1	1	1	1	1	X	1	2	4	4	1	2	2	2	1	1	1

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International O-Ring Standards & Test Methods

GERMANY

DIN 3770
Sealing rings (O-Rings) with special accuracy made of elastomeric materials. This standard should not be used for new designs.

DIN 3771 Part 1
Fluid systems, O-Rings, sizes to ISO 3601-1. This standard contains sizes and tolerances of O-Rings with special accuracy for general applications in fluid systems.

DIN 3771 Part 2
Fluid systems, O-Rings, testing, marking. This standard applies to DIN 3771 Part 1, testing and marking of O-Rings.

DIN 3771 Part 3
Fluid systems, O-Rings, field of application, materials. This standard covers materials, their hardness range and fields of application of O-Rings to DIN 3771 Part 1.

DIN 3771 Part 4
Fluid systems, O-Rings, quality acceptance criteria, surface finish and form. This standard covers acceptance criteria for surface finish and form.

DIN 7715
Rubber parts; tolerances, molded shapes from soft rubber (elastomers).

DIN 7716
Products from rubber; requirements for storage, cleaning and servicing.

DIN 9088
Aerospace; shelf-lives of parts from elastomers (under preparation).

DIN 24 320
Fire resistant hydraulic fluids, group HFA-1, properties and requirements.

DIN 40 080
Procedures and tables for inspection by attributes – statistical sampling.

DIN 50 049
Certification of material testing.

DIN 51 524
Hydraulic fluids, hydraulic oils H and H-L; minimum requirements.

DIN 51 525
Hydraulic fluids; hydraulic oils H-LP; minimum requirements.

DIN 51 600
Liquid fuels, leaded petroleum oils; minimum requirements.

DIN 51 601
Liquid fuels, Diesel oil; minimum requirements.

DIN 51 603 Part 1
Liquid fuels; heating oils, heating oil EL; minimum requirements.

DIN 51 603 Part 2
Liquid fuels; heating oils, heating oils L. M and S; minimum requirements.

DIN 53 479
Testing of plastics and elastomers; measurement of specific gravity.

DIN 53 504
Testing of elastomers; measurement of tensile strength, maximum stress, elongation at break and stress values at tensile test.

DIN 53 505
Testing of elastomers; Shore A and D hardness tests.

DIN 53 507
Testing of elastomers; determination of tear growth, strip specimen.

DIN 53 512
Testing of rubbers; determination of rebound resilience.

DIN 53 516
Testing of rubbers and elastomers; determination of abrasion resistance.

DIN 53 517
Testing of elastomers - determination of compression set.

DIN 53 519 Part 1
Testing of elastomers; determination of indentation hardness of soft rubber (IRHD),hardness test on samples.

DIN 53 519 Part 2
Testing of elastomers; determination of indentation hardness of soft rubber (IRHD), microhardness on samples of minor dimensions.

DIN 53 521
Testing of rubber and elastomers; determination of the resistance to liquids, vapors and gases.

DIN 53 522
Testing of elastomers; determination of resistance to flex-cracking and crack growth.

DIN 53 538
Standard reference elastomer; nitrile-butadiene rubber (NBR), cross-linked by peroxide to characterize working fluids with respect to their reaction on NBR.

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DIN 53 545
Testing of rubber; determination of the behavior at low temperature (behaviour to cold), principles, testing methods.

DIN 53 670
Testing of rubber or elastomers; testing of rubber in standard text mixtures, equipment and procedures.

DIN ISO 1629
Rubber and latex; difference and abbreviations.

VDMA 24 317
Fluid systems; hydraulic, fire-resistant hydraulic fluids, guidelines.

LN 9214
Aerospace; toroidal sealing rings (O-Rings) for solderless tube fittings with coupling sleeves, flareless.

INTERNATIONAL

ISO 3601/1
Fluid systems, O-rings - Part 1. Inner diameters, cross-sections, tolerances and size coding.

ISO 3601/2 (under preparation)
Fluid systems, O-rings - Part 2. Design criteria for O-ring grooves.

ISO 3601/3 (under preparation)
Fluid systems, O-rings - Part 3. Quality acceptance levels.

ISO 3601/4 (under preparation)
Fluid systems, O-rings - Part 4. O-ring grooves with back-up rings.

ISO 3601/5 (under preparation)
Fluid systems, O-rings - Part 5. O-rings for connectors to ISO 6149.

UNITED KINGDOM

BS 1806
Specifies dimensions (inches) for inner diameters and cross-sections and their tolerances including grooves. O-ring dimensions are identical with the Parker 2-xxx series.

BS 4518
Specifies dimensions and tolerances together with groove dimensions. Cross-section diameters are: 1.6 / 2.4 / 3.0 / 5.7 and 8.4 mm

FRANCE

The following French standards base upon ISO 3601 Parts 1 to 3:
NF-T-47-501 is comparable with ISO 3601 Part 1.
NF-T-47-502 is comparable with ISO 3601 Part 2.
NF-T-47-503 is comparable with ISO 3601 Part 3.
French purchase codes R 1 to R 27 are identical with Parker sizes 5-578 to 5-606. R 28 to R 88 are identical with Parker sizes 2-325 to 2-349 and 2-425 to 2-460.

ITALY

A committee for seal and hose standardization exists in the UNI which recommends the use of the American AS 568 A standard specification. In certain areas the French R 1 to R 88 are used.

SWEDEN

O-Rings are standardized under SMS 1586, Swedish military standard. Cross sections 1.6 / 2.4 / 3.0 / 5.7 and 8.4 mm are recommended.

UNITED STATES

AS 568 B (Aerospace Standard)
Published by the SAE (Society of Automotive Engineers) specifies sizes and tolerances. The cross-section tolerances correspond to ISO 3601/1 and DIN 3771 Part 1 (within a few hundredths of a millimeter).

ORDERING ADDRESSES

DIN & DIN ISO standard specifications and VDMA recommendations can be obtained from:
Beuth Verlag GmbH • Burggrafenstrasse 4-10, D-10787 Berlin

AMS and SAE specifications can be obtained from:
SAE
400 Commonwealth Dr. • Warrendale, PA 15096-0001

ASTM standard specifications can be obtained from:
ASTM
100 Barr Harbor Dr. • West Conshohocken, PA 19428

Military specifications can be obtained from:
Defense Automated Printing Service • Attn: DODSSP
700 Robbins Ave., Building 4/D
Philadelphia, PA 19111-5094

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Zatkoff SEALS & PACKINGS

Table 9-1: Parker Series 2-XXX O-Ring Sizes

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-001	-001	1/32	3/32	1/16	.029	.004	.040	.003	.0003	0,74	0,10	1,02	0,08	2-001
2-002	-002	3/64	9/64	3/64	.042	.004	.050	.003	.0006	1,07	0,10	1,27	0,08	2-002
2-003	-003	1/16	3/16	1/16	.056	.004	.060	.003	.0010	1,42	0,10	1,52	0,08	2-003
2-004	-004	5/64	13/64	1/16	.070	.005	.070	.003	.0017	1,78	0,13	1,78	0,08	2-004
2-005	-005	3/32	7/32	1/16	.101	.005	.070	.003	.0021	2,57	0,13	1,78	0,08	2-005
2-006	-006	1/8	1/4	1/16	.114	.005	.070	.003	.0022	2,90	0,13	1,78	0,08	2-006
2-007	-007	5/32	9/32	1/16	.145	.005	.070	.003	.0026	3,68	0,13	1,78	0,08	2-007
2-008	-008	3/16	5/16	1/16	.176	.005	.070	.003	.0030	4,47	0,13	1,78	0,08	2-008
2-009	-009	7/32	11/32	1/16	.208	.005	.070	.003	.0034	5,28	0,13	1,78	0,08	2-009
2-010	-010	1/4	3/8	1/16	.239	.005	.070	.003	.0037	6,07	0,13	1,78	0,08	2-010
2-011	-011	5/16	7/16	1/16	.301	.005	.070	.003	.0045	7,65	0,13	1,78	0,08	2-011
2-012	-012	3/8	1/2	1/16	.364	.005	.070	.003	.0052	9,25	0,13	1,78	0,08	2-012
2-013	-013	7/16	9/16	1/16	.426	.005	.070	.003	.0060	10,82	0,13	1,78	0,08	2-013
2-014	-014	1/2	5/8	1/16	.489	.005	.070	.003	.0068	12,42	0,13	1,78	0,08	2-014
2-015	-015	9/16	11/16	1/16	.551	.007	.070	.003	.0075	14,00	0,18	1,78	0,08	2-015
2-016	-016	5/8	3/4	1/16	.614	.009	.070	.003	.0083	15,60	0,23	1,78	0,08	2-016
2-017	-017	11/16	13/16	1/16	.676	.009	.070	.003	.0090	17,17	0,23	1,78	0,08	2-017
2-018	-018	3/4	7/8	1/16	.739	.009	.070	.003	.0098	18,77	0,23	1,78	0,08	2-018
2-019	-019	13/16	15/16	1/16	.801	.009	.070	.003	.0105	20,35	0,23	1,78	0,08	2-019
2-020	-020	7/8	1	1/16	.864	.009	.070	.003	.0113	21,95	0,23	1,78	0,08	2-020
2-021	-021	15/16	1 1/16	1/16	.926	.009	.070	.003	.0120	23,52	0,23	1,78	0,08	2-021
2-022	-022	1	1 1/8	1/16	.989	.010	.070	.003	.0128	25,12	0,25	1,78	0,08	2-022
2-023	-023	1 1/16	1 3/16	1/16	1.051	.010	.070	.003	.0136	26,70	0,25	1,78	0,08	2-023
2-024	-024	1 1/8	1 1/4	1/16	1.114	.010	.070	.003	.0143	28,30	0,25	1,78	0,08	2-024
2-025	-025	1 3/16	1 5/16	1/16	1.176	.011	.070	.003	.0151	29,87	0,28	1,78	0,08	2-025
2-026	-026	1 1/4	1 3/8	1/16	1.239	.011	.070	.003	.0158	31,47	0,28	1,78	0,08	2-026
2-027	-027	1 5/16	1 7/16	1/16	1.301	.011	.070	.003	.0166	33,05	0,28	1,78	0,08	2-027
2-028	-028	1 3/8	1 1/2	1/16	1.364	.013	.070	.003	.0173	34,65	0,33	1,78	0,08	2-028
2-029	-029	1 1/2	1 5/8	1/16	1.489	.013	.070	.003	.0188	37,82	0,33	1,78	0,08	2-029
2-030	-030	1 5/8	1 3/4	1/16	1.614	.013	.070	.003	.0204	41,00	0,33	1,78	0,08	2-030
2-031	-031	1 3/4	1 7/8	1/16	1.739	.015	.070	.003	.0219	44,17	0,38	1,78	0,08	2-031
2-032	-032	1 7/8	2	1/16	1.864	.015	.070	.003	.0234	47,35	0,38	1,78	0,08	2-032
2-033	-033	2	2 1/8	1/16	1.989	.018	.070	.003	.0249	50,52	0,46	1,78	0,08	2-033
2-034	-034	2 1/8	2 1/4	1/16	2.114	.018	.070	.003	.0264	53,70	0,46	1,78	0,08	2-034
2-035	-035	2 1/4	2 3/8	1/16	2.239	.018	.070	.003	.0279	56,87	0,46	1,78	0,08	2-035
2-036	-036	2 3/8	2 1/2	1/16	2.364	.018	.070	.003	.0294	60,05	0,46	1,78	0,08	2-036
2-037	-037	2 1/2	2 5/8	1/16	2.489	.018	.070	.003	.0309	63,22	0,46	1,78	0,08	2-037
2-038	-038	2 5/8	2 3/4	1/16	2.614	.020	.070	.003	.0324	66,40	0,51	1,78	0,08	2-038
2-039	-039	2 3/4	2 7/8	1/16	2.739	.020	.070	.003	.0340	69,57	0,51	1,78	0,08	2-039
2-040	-040	2 7/8	3	1/16	2.864	.020	.070	.003	.0355	72,75	0,51	1,78	0,08	2-040

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page1-23 for more information.

.040 Area = .001256
.050 Area = .001964
.060 Area = .002827
.070 Area = .003848
(sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes *- continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-041	-041	3	3 1/8	1/16	2.989	.024	.070	.003	.0370	75,92	0,61	1,78	0,08	2-041
2-042	-042	3 1/4	3 3/8	1/16	3.239	.024	.070	.003	.0400	82,27	0,61	1,78	0,08	2-042
2-043	-043	3 1/2	3 5/8	1/16	3.489	.024	.070	.003	.0430	88,62	0,61	1,78	0,08	2-043
2-044	-044	3 3/4	3 7/8	1/16	3.739	.027	.070	.003	.0460	94,97	0,69	1,78	0,08	2-044
2-045	-045	4	4 1/8	1/16	3.989	.027	.070	.003	.0491	101,32	0,69	1,78	0,08	2-045
2-046	-046	4 1/4	4 3/8	1/16	4.239	.030	.070	.003	.0521	107,67	0,76	1,78	0,08	2-046
2-047	-047	4 1/2	4 5/8	1/16	4.489	.030	.070	.003	.0551	114,02	0,76	1,78	0,08	2-047
2-048	-048	4 3/4	4 7/8	1/16	4.739	.030	.070	.003	.0581	120,37	0,76	1,78	0,08	2-048
2-049	-049	5	5 1/8	1/16	4.989	.037	.070	.003	.0612	126,72	0,94	1,78	0,08	2-049
2-050	-050	5 1/4	5 3/8	1/16	5.239	.037	.070	.003	.0642	133,07	0,94	1,78	0,08	2-050
2-102	-102	1/16	1/4	3/32	.049	.005	.103	.003	.0040	1,24	0,13	2,62	0,08	2-102
2-103	-103	3/32	9/32	3/32	.081	.005	.103	.003	.0048	2,06	0,13	2,62	0,08	2-103
2-104	-104	1/8	5/16	3/32	.112	.005	.103	.003	.0056	2,84	0,13	2,62	0,08	2-104
2-105	-105	5/32	11/32	3/32	.143	.005	.103	.003	.0064	3,63	0,13	2,62	0,08	2-105
2-106	-106	3/16	3/8	3/32	.174	.005	.103	.003	.0072	4,42	0,13	2,62	0,08	2-106
2-107	-107	7/32	13/32	3/32	.206	.005	.103	.003	.0081	5,23	0,13	2,62	0,08	2-107
2-108	-108	1/4	7/16	3/32	.237	.005	.103	.003	.0089	6,02	0,13	2,62	0,08	2-108
2-109	-109	5/16	1/2	3/32	.299	.005	.103	.003	.0105	7,59	0,13	2,62	0,08	2-109
2-110	-110	3/8	9/16	3/32	.362	.005	.103	.003	.0122	9,19	0,13	2,62	0,08	2-110
2-111	-111	7/16	5/8	3/32	.424	.005	.103	.003	.0138	10,77	0,13	2,62	0,08	2-111
2-112	-112	1/2	11/16	3/32	.487	.005	.103	.003	.0154	12,37	0,13	2,62	0,08	2-112
2-113	-113	9/16	3/4	3/32	.549	.007	.103	.003	.0171	13,94	0,18	2,62	0,08	2-113
2-114	-114	5/8	13/16	3/32	.612	.009	.103	.003	.0187	15,54	0,23	2,62	0,08	2-114
2-115	-115	11/16	7/8	3/32	.674	.009	.103	.003	.0203	17,12	0,23	2,62	0,08	2-115
2-116	-116	3/4	15/16	3/32	.737	.009	.103	.003	.0220	18,72	0,23	2,62	0,08	2-116
2-117	-117	13/16	1	3/32	.799	.010	.103	.003	.0236	20,30	0,25	2,62	0,08	2-117
2-118	-118	7/8	1 1/16	3/32	.862	.010	.103	.003	.0253	21,89	0,25	2,62	0,08	2-118
2-119	-119	15/16	1 1/8	3/32	.924	.010	.103	.003	.0269	23,47	0,25	2,62	0,08	2-119
2-120	-120	1	1 3/16	3/32	.987	.010	.103	.003	.0285	25,07	0,25	2,62	0,08	2-120
2-121	-121	1 1/16	1 1/4	3/32	1.049	.010	.103	.003	.0302	26,64	0,25	2,62	0,08	2-121
2-122	-122	1 1/8	1 5/16	3/32	1.112	.010	.103	.003	.0318	28,24	0,25	2,62	0,08	2-122
2-123	-123	1 3/16	1 3/8	3/32	1.174	.012	.103	.003	.0334	29,82	0,30	2,62	0,08	2-123
2-124	-124	1 1/4	1 7/16	3/32	1.237	.012	.103	.003	.0351	31,42	0,30	2,62	0,08	2-124
2-125	-125	1 5/16	1 1/2	3/32	1.299	.012	.103	.003	.0367	32,99	0,30	2,62	0,08	2-125
2-126	-126	1 3/8	1 9/16	3/32	1.362	.012	.103	.003	.0383	34,59	0,30	2,62	0,08	2-126
2-127	-127	1 7/16	1 5/8	3/32	1.424	.012	.103	.003	.0400	36,17	0,30	2,62	0,08	2-127
2-128	-128	1 1/2	1 11/16	3/32	1.487	.012	.103	.003	.0416	37,77	0,30	2,62	0,08	2-128
2-129	-129	1 9/16	1 3/4	3/32	1.549	.015	.103	.003	.0432	39,34	0,38	2,62	0,08	2-129
2-130	-130	1 5/8	1 13/16	3/32	1.612	.015	.103	.003	.0449	40,94	0,38	2,62	0,08	2-130
2-131	-131	1 11/16	1 7/8	3/32	1.674	.015	.103	.003	.0465	42,52	0,38	2,62	0,08	2-131

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.070 Area = .003848
.103 Area = .008332
(sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes *- continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-132	-132	1 3/4	1 15/16	3/32	1.737	.015	.103	.003	.0482	44,12	0,38	2,62	0,08	2-132
2-133	-133	1 13/16	2	3/32	1.799	.015	.103	.003	.0498	45,69	0,38	2,62	0,08	2-133
2-134	-134	1 7/8	2 1/16	3/32	1.862	.015	.103	.003	.0514	47,29	0,38	2,62	0,08	2-134
2-135	-135	1 15/16	2 1/8	3/32	1.925	.017	.103	.003	.0531	48,90	0,43	2,62	0,08	2-135
2-136	-136	2	2 3/16	3/32	1.987	.017	.103	.003	.0547	50,47	0,43	2,62	0,08	2-136
2-137	-137	2 1/16	2 1/4	3/32	2.050	.017	.103	.003	.0564	52,07	0,43	2,62	0,08	2-137
2-138	-138	2 1/8	2 5/16	3/32	2.112	.017	.103	.003	.0580	53,64	0,43	2,62	0,08	2-138
2-139	-139	2 3/16	2 3/8	3/32	2.175	.017	.103	.003	.0596	55,25	0,43	2,62	0,08	2-139
2-140	-140	2 1/4	2 7/16	3/32	2.237	.017	.103	.003	.0612	56,82	0,43	2,62	0,08	2-140
2-141	-141	2 5/16	2 1/2	3/32	2.300	.020	.103	.003	.0629	58,42	0,51	2,62	0,08	2-141
2-142	-142	2 3/8	2 9/16	3/32	2.362	.020	.103	.003	.0645	59,99	0,51	2,62	0,08	2-142
2-143	-143	2 7/16	2 5/8	3/32	2.425	.020	.103	.003	.0662	61,60	0,51	2,62	0,08	2-143
2-144	-144	2 1/2	2 11/16	3/32	2.487	.020	.103	.003	.0678	63,17	0,51	2,62	0,08	2-144
2-145	-145	2 9/16	2 3/4	3/32	2.550	.020	.103	.003	.0694	64,77	0,51	2,62	0,08	2-145
2-146	-146	2 5/8	2 13/16	3/32	2.612	.020	.103	.003	.0711	66,34	0,51	2,62	0,08	2-146
2-147	-147	2 11/16	2 7/8	3/32	2.675	.022	.103	.003	.0727	67,95	0,56	2,62	0,08	2-147
2-148	-148	2 3/4	2 15/16	3/32	2.737	.022	.103	.003	.0743	69,52	0,56	2,62	0,08	2-148
2-149	-149	2 13/16	3	3/32	2.800	.022	.103	.003	.0760	71,12	0,56	2,62	0,08	2-149
2-150	-150	2 7/8	3 1/16	3/32	2.862	.022	.103	.003	.0776	72,69	0,56	2,62	0,08	2-150
2-151	-151	3	3 3/16	3/32	2.987	.024	.103	.003	.0809	75,87	0,61	2,62	0,08	2-151
2-152	-152	3 1/4	3 7/16	3/32	3.237	.024	.103	.003	.0874	82,22	0,61	2,62	0,08	2-152
2-153	-153	3 1/2	3 11/16	3/32	3.487	.024	.103	.003	.0940	88,57	0,61	2,62	0,08	2-153
2-154	-154	3 3/4	3 15/16	3/32	3.737	.028	.103	.003	.1005	94,92	0,71	2,62	0,08	2-154
2-155	-155	4	4 3/16	3/32	3.987	.028	.103	.003	.1071	101,27	0,71	2,62	0,08	2-155
2-156	-156	4 1/4	4 7/16	3/32	4.237	.030	.103	.003	.1136	107,62	0,76	2,62	0,08	2-156
2-157	-157	4 1/2	4 11/16	3/32	4.487	.030	.103	.003	.1202	113,97	0,76	2,62	0,08	2-157
2-158	-158	4 3/4	4 15/16	3/32	4.737	.030	.103	.003	.1267	120,32	0,76	2,62	0,08	2-158
2-159	-159	5	5 3/16	3/32	4.987	.035	.103	.003	.1332	126,67	0,89	2,62	0,08	2-159
2-160	-160	5 1/4	5 7/16	3/32	5.237	.035	.103	.003	.1398	133,02	0,89	2,62	0,08	2-160
2-161	-161	5 1/2	5 11/16	3/32	5.487	.035	.103	.003	.1463	139,37	0,89	2,62	0,08	2-161
2-162	-162	5 3/4	5 15/16	3/32	5.737	.035	.103	.003	.1529	145,72	0,89	2,62	0,08	2-162
2-163	-163	6	6 3/16	3/32	5.987	.035	.103	.003	.1594	152,07	0,89	2,62	0,08	2-163
2-164	-164	6 1/4	6 7/16	3/32	6.237	.040	.103	.003	.1660	158,42	1,02	2,62	0,08	2-164
2-165	-165	6 1/2	6 11/16	3/32	6.487	.040	.103	.003	.1725	164,77	1,02	2,62	0,08	2-165
2-166	-166	6 3/4	6 15/16	3/32	6.737	.040	.103	.003	.1790	171,12	1,02	2,62	0,08	2-166
2-167	-167	7	7 3/16	3/32	6.987	.040	.103	.003	.1856	177,47	1,02	2,62	0,08	2-167
2-168	-168	7 1/4	7 7/16	3/32	7.237	.045	.103	.003	.1921	183,82	1,14	2,62	0,08	2-168
2-169	-169	7 1/2	7 11/16	3/32	7.487	.045	.103	.003	.1987	190,17	1,14	2,62	0,08	2-169
2-170	-170	7 3/4	7 15/16	3/32	7.737	.045	.103	.003	.2052	196,52	1,14	2,62	0,08	2-170
2-171	-171	8	8 3/16	3/32	7.987	.045	.103	.003	.2118	202,87	1,14	2,62	0,08	2-171

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.103 Area = .008332 (sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes - *continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-172	-172	8 1/4	8 7/16	3/32	8.237	.050	.103	.003	.2183	209,22	1,27	2,62	0,08	2-172
2-173	-173	8 1/2	8 11/16	3/32	8.487	.050	.103	.003	.2249	215,57	1,27	2,62	0,08	2-173
2-174	-174	8 3/4	8 15/16	3/32	8.737	.050	.103	.003	.2314	221,92	1,27	2,62	0,08	2-174
2-175	-175	9	9 3/16	3/32	8.987	.050	.103	.003	.2379	228,27	1,27	2,62	0,08	2-175
2-176	-176	9 1/4	9 7/16	3/32	9.237	.055	.103	.003	.2445	234,62	1,40	2,62	0,08	2-176
2-177	-177	9 1/2	9 11/16	3/32	9.487	.055	.103	.003	.2510	240,97	1,40	2,62	0,08	2-177
2-178	-178	9 3/4	9 15/16	3/32	9.737	.055	.103	.003	.2576	247,32	1,40	2,62	0,08	2-178
2-201	-201	3/16	7/16	1/8	.171	.005	.139	.004	.0148	4,34	0,13	3,53	0,10	2-201
2-202	-202	1/4	1/2	1/8	.234	.005	.139	.004	.0178	5,94	0,13	3,53	0,10	2-202
2-203	-203	5/16	9/16	1/8	.296	.005	.139	.004	.0207	7,52	0,13	3,53	0,10	2-203
2-204	-204	3/8	5/8	1/8	.359	.005	.139	.004	.0237	9,12	0,13	3,53	0,10	2-204
2-205	-205	7/16	11/16	1/8	.421	.005	.139	.004	.0267	10,69	0,13	3,53	0,10	2-205
2-206	-206	1/2	3/4	1/8	.484	.005	.139	.004	.0297	12,29	0,13	3,53	0,10	2-206
2-207	-207	9/16	13/16	1/8	.546	.007	.139	.004	.0327	13,87	0,18	3,53	0,10	2-207
2-208	-208	5/8	7/8	1/8	.609	.009	.139	.004	.0357	15,47	0,23	3,53	0,10	2-208
2-209	-209	11/16	15/16	1/8	.671	.010	.139	.004	.0386	17,04	0,23	3,53	0,10	2-209
2-210	-210	3/4	1	1/8	.734	.010	.139	.004	.0416	18,64	0,25	3,53	0,10	2-210
2-211	-211	13/16	1 1/16	1/8	.796	.010	.139	.004	.0446	20,22	0,25	3,53	0,10	2-211
2-212	-212	7/8	1 1/8	1/8	.859	.010	.139	.004	.0476	21,82	0,25	3,53	0,10	2-212
2-213	-213	15/16	1 3/16	1/8	.921	.010	.139	.004	.0505	23,39	0,25	3,53	0,10	2-213
2-214	-214	1	1 1/4	1/8	.984	.010	.139	.004	.0535	24,99	0,25	3,53	0,10	2-214
2-215	-215	1 1/16	1 5/16	1/8	1.046	.010	.139	.004	.0565	26,57	0,25	3,53	0,10	2-215
2-216	-216	1 1/8	1 3/8	1/8	1.109	.012	.139	.004	.0595	28,17	0,30	3,53	0,10	2-216
2-217	-217	1 3/16	1 7/16	1/8	1.171	.012	.139	.004	.0624	29,74	0,30	3,53	0,10	2-217
2-218	-218	1 1/4	1 1/2	1/8	1.234	.012	.139	.004	.0654	31,34	0,30	3,53	0,10	2-218
2-219	-219	1 5/16	1 9/16	1/8	1.296	.012	.139	.004	.0684	32,92	0,30	3,53	0,10	2-219
2-220	-220	1 3/8	1 5/8	1/8	1.359	.012	.139	.004	.0714	34,52	0,30	3,53	0,10	2-220
2-221	-221	1 7/16	1 11/16	1/8	1.421	.012	.139	.004	.0744	36,09	0,30	3,53	0,10	2-221
2-222	-222	1 1/2	1 3/4	1/8	1.484	.015	.139	.004	.0774	37,69	0,38	3,53	0,10	2-222
2-223	-223	1 5/8	1 7/8	1/8	1.609	.015	.139	.004	.0833	40,87	0,38	3,53	0,10	2-223
2-224	-224	1 3/4	2	1/8	1.734	.015	.139	.004	.0893	44,04	0,38	3,53	0,10	2-224
2-225	-225	1 7/8	2 1/8	1/8	1.859	.018	.139	.004	.0952	47,22	0,46	3,53	0,10	2-225
2-226	-226	2	2 1/4	1/8	1.984	.018	.139	.004	.1012	50,39	0,46	3,53	0,10	2-226
2-227	-227	2 1/8	2 3/8	1/8	2.109	.018	.139	.004	.1072	53,57	0,46	3,53	0,10	2-227
2-228	-228	2 1/4	2 1/2	1/8	2.234	.020	.139	.004	.1131	56,74	0,51	3,53	0,10	2-228
2-229	-229	2 3/8	2 5/8	1/8	2.359	.020	.139	.004	.1191	59,92	0,51	3,53	0,10	2-229
2-230	-230	2 1/2	2 3/4	1/8	2.484	.020	.139	.004	.1250	63,09	0,51	3,53	0,10	2-230
2-231	-231	2 5/8	2 7/8	1/8	2.609	.020	.139	.004	.1310	66,27	0,51	3,53	0,10	2-231
2-232	-232	2 3/4	3	1/8	2.734	.024	.139	.004	.1370	69,44	0,61	3,53	0,10	2-232
2-233	-233	2 7/8	3 1/8	1/8	2.859	.024	.139	.004	.1429	72,62	0,61	3,53	0,10	2-233

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.103 Area = .008332
.139 Area = .015175
(sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes - *continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-234	-234	3	3 1/4	1/8	2.984	.024	.139	.004	.1489	75,79	0,61	3,53	0,10	2-234
2-235	-235	3 1/8	3 3/8	1/8	3.109	.024	.139	.004	.1548	78,97	0,61	3,53	0,10	2-235
2-236	-236	3 1/4	3 1/2	1/8	3.234	.024	.139	.004	.1608	82,14	0,61	3,53	0,10	2-236
2-237	-237	3 3/8	3 5/8	1/8	3.359	.024	.139	.004	.1668	85,32	0,61	3,53	0,10	2-237
2-238	-238	3 1/2	3 3/4	1/8	3.484	.024	.139	.004	.1727	88,49	0,61	3,53	0,10	2-238
2-239	-239	3 5/8	3 7/8	1/8	3.609	.028	.139	.004	.1787	91,67	0,71	3,53	0,10	2-239
2-240	-240	3 3/4	4	1/8	3.734	.028	.139	.004	.1846	94,84	0,71	3,53	0,10	2-240
2-241	-241	3 7/8	4 1/8	1/8	3.859	.028	.139	.004	.1906	98,02	0,71	3,53	0,10	2-241
2-242	-242	4	4 1/4	1/8	3.984	.028	.139	.004	.1966	101,19	0,71	3,53	0,10	2-242
2-243	-243	4 1/8	4 3/8	1/8	4.109	.028	.139	.004	.2025	104,37	0,71	3,53	0,10	2-243
2-244	-244	4 1/4	4 1/2	1/8	4.234	.030	.139	.004	.2085	107,54	0,76	3,53	0,10	2-244
2-245	-245	4 3/8	4 5/8	1/8	4.359	.030	.139	.004	.2144	110,72	0,76	3,53	0,10	2-245
2-246	-246	4 1/2	4 3/4	1/8	4.484	.030	.139	.004	.2204	113,89	0,76	3,53	0,10	2-246
2-247	-247	4 5/8	4 7/8	1/8	4.609	.030	.139	.004	.2264	117,07	0,76	3,53	0,10	2-247
2-248	-248	4 3/4	5	1/8	4.734	.030	.139	.004	.2323	120,24	0,76	3,53	0,10	2-248
2-249	-249	4 7/8	5 1/8	1/8	4.859	.035	.139	.004	.2383	123,42	0,89	3,53	0,10	2-249
2-250	-250	5	5 1/4	1/8	4.984	.035	.139	.004	.2442	126,59	0,89	3,53	0,10	2-250
2-251	-251	5 1/8	5 3/8	1/8	5.109	.035	.139	.004	.2502	129,77	0,89	3,53	0,10	2-251
2-252	-252	5 1/4	5 1/2	1/8	5.234	.035	.139	.004	.2561	132,94	0,89	3,53	0,10	2-252
2-253	-253	5 3/8	5 5/8	1/8	5.359	.035	.139	.004	.2621	136,12	0,89	3,53	0,10	2-253
2-254	-254	5 1/2	5 3/4	1/8	5.484	.035	.139	.004	.2681	139,29	0,89	3,53	0,10	2-254
2-255	-255	5 5/8	5 7/8	1/8	5.609	.035	.139	.004	.2740	142,47	0,89	3,53	0,10	2-255
2-256	-256	5 3/4	6	1/8	5.734	.035	.139	.004	.2800	145,64	0,89	3,53	0,10	2-256
2-257	-257	5 7/8	6 1/8	1/8	5.859	.035	.139	.004	.2859	148,82	0,89	3,53	0,10	2-257
2-258	-258	6	6 1/4	1/8	5.984	.035	.139	.004	.2919	151,99	0,89	3,53	0,10	2-258
2-259	-259	6 1/4	6 1/2	1/8	6.234	.040	.139	.004	.3038	158,34	1,02	3,53	0,10	2-259
2-260	-260	6 1/2	6 3/4	1/8	6.484	.040	.139	.004	.3157	164,69	1,02	3,53	0,10	2-260
2-261	-261	6 3/4	7	1/8	6.734	.040	.139	.004	.3277	171,04	1,02	3,53	0,10	2-261
2-262	-262	7	7 1/4	1/8	6.984	.040	.139	.004	.3396	177,39	1,02	3,53	0,10	2-262
2-263	-263	7 1/4	7 1/2	1/8	7.234	.045	.139	.004	.3515	183,74	1,14	3,53	0,10	2-263
2-264	-264	7 1/2	7 3/4	1/8	7.484	.045	.139	.004	.3634	190,09	1,14	3,53	0,10	2-264
2-265	-265	7 3/4	8	1/8	7.734	.045	.139	.004	.3753	196,44	1,14	3,53	0,10	2-265
2-266	-266	8	8 1/4	1/8	7.984	.045	.139	.004	.3872	202,79	1,14	3,53	0,10	2-266
2-267	-267	8 1/4	8 1/2	1/8	8.234	.050	.139	.004	.3992	209,14	1,27	3,53	0,10	2-267
2-268	-268	8 1/2	8 3/4	1/8	8.484	.050	.139	.004	.4111	215,49	1,27	3,53	0,10	2-268
2-269	-269	8 3/4	9	1/8	8.734	.050	.139	.004	.4230	221,84	1,27	3,53	0,10	2-269
2-270	-270	9	9 1/4	1/8	8.984	.050	.139	.004	.4349	228,19	1,27	3,53	0,10	2-270
2-271	-271	9 1/4	9 1/2	1/8	9.234	.055	.139	.004	.4468	234,54	1,40	3,53	0,10	2-271
2-272	-272	9 1/2	9 3/4	1/8	9.484	.055	.139	.004	.4588	240,89	1,40	3,53	0,10	2-272
2-273	-273	9 3/4	10	1/8	9.734	.055	.139	.004	.4707	247,24	1,40	3,53	0,10	2-273

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.139 Area = .015175 (sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes *- continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-274	-274	10	10 1/4	1/8	9.984	.055	.139	.004	.4826	253,59	1,40	3,53	0,10	2-274
2-275	-275	10 1/2	10 3/4	1/8	10.484	.055	.139	.004	.5064	266,29	1,40	3,53	0,10	2-275
2-276	-276	11	11 1/4	1/8	10.984	.065	.139	.004	.5303	278,99	1,65	3,53	0,10	2-276
2-277	-277	11 1/2	11 3/4	1/8	11.484	.065	.139	.004	.5541	291,69	1,65	3,53	0,10	2-277
2-278	-278	12	12 1/4	1/8	11.984	.065	.139	.004	.5779	304,39	1,65	3,53	0,10	2-278
2-279	-279	13	13 1/4	1/8	12.984	.065	.139	.004	.6256	329,79	1,65	3,53	0,10	2-279
2-280	-280	14	14 1/4	1/8	13.984	.065	.139	.004	.6733	355,19	1,65	3,53	0,10	2-280
2-281	-281	15	15 1/4	1/8	14.984	.065	.139	.004	.7210	380,59	1,65	3,53	0,10	2-281
2-282	-282	16	16 1/4	1/8	15.955	.075	.139	.004	.7672	405,26	1,91	3,53	0,10	2-282
2-283	-283	17	17 1/4	1/8	16.955	.080	.139	.004	.8149	430,66	2,03	3,53	0,10	2-283
2-284	-284	18	18 1/4	1/8	17.955	.085	.139	.004	.8626	456,06	2,16	3,53	0,10	2-284
2-309	-309	7/16	13/16	3/16	.412	.005	.210	.005	.0677	10,46	0,13	5,33	0,13	2-309
2-310	-310	1/2	7/8	3/16	.475	.005	.210	.005	.0745	12,07	0,13	5,33	0,13	2-310
2-311	-311	9/16	15/16	3/16	.537	.007	.210	.005	.0813	13,64	0,18	5,33	0,13	2-311
2-312	-312	5/8	1	3/16	.600	.009	.210	.005	.0881	15,24	0,23	5,33	0,13	2-312
2-313	-313	11/16	1 1/16	3/16	.662	.009	.210	.005	.0949	16,81	0,23	5,33	0,13	2-313
2-314	-314	3/4	1 1/8	3/16	.725	.010	.210	.005	.1017	18,42	0,25	5,33	0,13	2-314
2-315	-315	13/16	1 3/16	3/16	.787	.010	.210	.005	.1085	19,99	0,25	5,33	0,13	2-315
2-316	-316	7/8	1 1/4	3/16	.850	.010	.210	.005	.1153	21,59	0,25	5,33	0,13	2-316
2-317	-317	15/16	1 5/16	3/16	.912	.010	.210	.005	.1221	23,16	0,25	5,33	0,13	2-317
2-318	-318	1	1 3/8	3/16	.975	.010	.210	.005	.1289	24,77	0,25	5,33	0,13	2-318
2-319	-319	1 1/16	1 7/16	3/16	1.037	.010	.210	.005	.1357	26,34	0,25	5,33	0,13	2-319
2-320	-320	1 1/8	1 1/2	3/16	1.100	.012	.210	.005	.1425	27,94	0,30	5,33	0,13	2-320
2-321	-321	1 3/16	1 9/16	3/16	1.162	.012	.210	.005	.1493	29,51	0,30	5,33	0,13	2-321
2-322	-322	1 1/4	1 5/8	3/16	1.225	.012	.210	.005	.1561	31,12	0,30	5,33	0,13	2-322
2-323	-323	1 5/16	1 11/16	3/16	1.287	.012	.210	.005	.1629	32,69	0,30	5,33	0,13	2-323
2-324	-324	1 3/8	1 3/4	3/16	1.350	.012	.210	.005	.1697	34,29	0,30	5,33	0,13	2-324
2-325	-325	1 1/2	1 7/8	3/16	1.475	.015	.210	.005	.1833	37,47	0,38	5,33	0,13	2-325
2-326	-326	1 5/8	2	3/16	1.600	.015	.210	.005	.1970	40,64	0,38	5,33	0,13	2-326
2-327	-327	1 3/4	2 1/8	3/16	1.725	.015	.210	.005	.2106	43,82	0,38	5,33	0,13	2-327
2-328	-328	1 7/8	2 1/4	3/16	1.850	.015	.210	.005	.2242	46,99	0,38	5,33	0,13	2-328
2-329	-329	2	2 3/8	3/16	1.975	.018	.210	.005	.2378	50,17	0,46	5,33	0,13	2-329
2-330	-330	2 1/8	2 1/2	3/16	2.100	.018	.210	.005	.2514	53,34	0,46	5,33	0,13	2-330
2-331	-331	2 1/4	2 5/8	3/16	2.225	.018	.210	.005	.2650	56,52	0,46	5,33	0,13	2-331
2-332	-332	2 3/8	2 3/4	3/16	2.350	.018	.210	.005	.2786	59,69	0,46	5,33	0,13	2-332
2-333	-333	2 1/2	2 7/8	3/16	2.475	.020	.210	.005	.2922	62,87	0,51	5,33	0,13	2-333
2-334	-334	2 5/8	3	3/16	2.600	.020	.210	.005	.3058	66,04	0,51	5,33	0,13	2-334
2-335	-335	2 3/4	3 1/8	3/16	2.725	.020	.210	.005	.3194	69,22	0,51	5,33	0,13	2-335
2-336	-336	2 7/8	3 1/4	3/16	2.850	.020	.210	.005	.3330	72,39	0,51	5,33	0,13	2-336
2-337	-337	3	3 3/8	3/16	2.975	.024	.210	.005	.3466	75,57	0,61	5,33	0,13	2-337

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.139 Area = .015175
.210 Area = .034636
(sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes *- continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-338	-338	3 1/8	3 1/2	3/16	3.100	.024	.210	.005	.3602	78,74	0,61	5,33	0,13	2-338
2-339	-339	3 1/4	3 5/8	3/16	3.225	.024	.210	.005	.3738	81,92	0,61	5,33	0,13	2-339
2-340	-340	3 3/8	3 3/4	3/16	3.350	.024	.210	.005	.3874	85,09	0,61	5,33	0,13	2-340
2-341	-341	3 1/2	3 7/8	3/16	3.475	.024	.210	.005	.4010	88,27	0,61	5,33	0,13	2-341
2-342	-342	3 5/8	4	3/16	3.600	.028	.210	.005	.4146	91,44	0,71	5,33	0,13	2-342
2-343	-343	3 3/4	4 1/8	3/16	3.725	.028	.210	.005	.4282	94,62	0,71	5,33	0,13	2-343
2-344	-344	3 7/8	4 1/4	3/16	3.850	.028	.210	.005	.4418	97,79	0,71	5,33	0,13	2-344
2-345	-345	4	4 3/8	3/16	3.975	.028	.210	.005	.4554	100,97	0,71	5,33	0,13	2-345
2-346	-346	4 1/8	4 1/2	3/16	4.100	.028	.210	.005	.4690	104,14	0,71	5,33	0,13	2-346
2-347	-347	4 1/4	4 5/8	3/16	4.225	.030	.210	.005	.4826	107,32	0,76	5,33	0,13	2-347
2-348	-348	4 3/8	4 3/4	3/16	4.350	.030	.210	.005	.4962	110,49	0,76	5,33	0,13	2-348
2-349	-349	4 1/2	4 7/8	3/16	4.475	.030	.210	.005	.5098	113,67	0,76	5,33	0,13	2-349
2-350	-350	4 5/8	5	3/16	4.600	.030	.210	.005	.5234	116,84	0,76	5,33	0,13	2-350
2-351	-351	4 3/4	5 1/8	3/16	4.725	.030	.210	.005	.5370	120,02	0,76	5,33	0,13	2-351
2-352	-352	4 7/8	5 1/4	3/16	4.850	.030	.210	.005	.5506	123,19	0,76	5,33	0,13	2-352
2-353	-353	5	5 3/8	3/16	4.975	.037	.210	.005	.5642	126,37	0,94	5,33	0,13	2-353
2-354	-354	5 1/8	5 1/2	3/16	5.100	.037	.210	.005	.5778	129,54	0,94	5,33	0,13	2-354
2-355	-355	5 1/4	5 5/8	3/16	5.225	.037	.210	.005	.5914	132,72	0,94	5,33	0,13	2-355
2-356	-356	5 3/8	5 3/4	3/16	5.350	.037	.210	.005	.6050	135,89	0,94	5,33	0,13	2-356
2-357	-357	5 1/2	5 7/8	3/16	5.475	.037	.210	.005	.6186	139,07	0,94	5,33	0,13	2-357
2-358	-358	5 5/8	6	3/16	5.600	.037	.210	.005	.6322	142,24	0,94	5,33	0,13	2-358
2-359	-359	5 3/4	6 1/8	3/16	5.725	.037	.210	.005	.6458	145,42	0,94	5,33	0,13	2-359
2-360	-360	5 7/8	6 1/4	3/16	5.850	.037	.210	.005	.6594	148,59	0,94	5,33	0,13	2-360
2-361	-361	6	6 3/8	3/16	5.975	.037	.210	.005	.6730	151,77	0,94	5,33	0,13	2-361
2-362	-362	6 1/4	6 5/8	3/16	6.225	.040	.210	.005	.7002	158,12	1,02	5,33	0,13	2-362
2-363	-363	6 1/2	6 7/8	3/16	6.475	.040	.210	.005	.7274	164,47	1,02	5,33	0,13	2-363
2-364	-364	6 3/4	7 1/8	3/16	6.725	.040	.210	.005	.7546	170,82	1,02	5,33	0,13	2-364
2-365	-365	7	7 3/8	3/16	6.975	.040	.210	.005	.7818	177,17	1,02	5,33	0,13	2-365
2-366	-366	7 1/4	7 5/8	3/16	7.225	.045	.210	.005	.8090	183,52	1,14	5,33	0,13	2-366
2-367	-367	7 1/2	7 7/8	3/16	7.475	.045	.210	.005	.8362	189,87	1,14	5,33	0,13	2-367
2-368	-368	7 3/4	8 1/8	3/16	7.725	.045	.210	.005	.8634	196,22	1,14	5,33	0,13	2-368
2-369	-369	8	8 3/8	3/16	7.975	.045	.210	.005	.8906	202,57	1,14	5,33	0,13	2-369
2-370	-370	8 1/4	8 5/8	3/16	8.225	.050	.210	.005	.9178	208,92	1,27	5,33	0,13	2-370
2-371	-371	8 1/2	8 7/8	3/16	8.475	.050	.210	.005	.9450	215,27	1,27	5,33	0,13	2-371
2-372	-372	8 3/4	9 1/8	3/16	8.725	.050	.210	.005	.9722	221,62	1,27	5,33	0,13	2-372
2-373	-373	9	9 3/8	3/16	8.975	.050	.210	.005	.9994	227,97	1,27	5,33	0,13	2-373
2-374	-374	9 1/4	9 5/8	3/16	9.225	.055	.210	.005	1.0266	234,32	1,40	5,33	0,13	2-374
2-375	-375	9 1/2	9 7/8	3/16	9.475	.055	.210	.005	1.0538	240,67	1,40	5,33	0,13	2-375
2-376	-376	9 3/4	10 1/8	3/16	9.725	.055	.210	.005	1.0810	247,02	1,40	5,33	0,13	2-376
2-377	-377	10	10 3/8	3/16	9.975	.055	.210	.005	1.1083	253,37	1,40	5,33	0,13	2-377

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.210 Area = .034636 (sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes - *continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-378	-378	10 1/2	10 7/8	3/16	10.475	.060	.210	.005	1.1627	266,07	1,52	5,33	0,13	2-378
2-379	-379	11	11 3/8	3/16	10.975	.060	.210	.005	1.2171	278,77	1,52	5,33	0,13	2-379
2-380	-380	11 1/2	11 7/8	3/16	11.475	.065	.210	.005	1.2715	291,47	1,65	5,33	0,13	2-380
2-381	-381	12	12 3/8	3/16	11.975	.065	.210	.005	1.3259	304,17	1,65	5,33	0,13	2-381
2-382	-382	13	13 3/8	3/16	12.975	.065	.210	.005	1.4347	329,57	1,65	5,33	0,13	2-382
2-383	-383	14	14 3/8	3/16	13.975	.070	.210	.005	1.5435	354,97	1,78	5,33	0,13	2-383
2-384	-384	15	15 3/8	3/16	14.975	.070	.210	.005	1.6523	380,37	1,78	5,33	0,13	2-384
2-385	-385	16	16 3/8	3/16	15.955	.075	.210	.005	1.7590	405,26	1,91	5,33	0,13	2-385
2-386	-386	17	17 3/8	3/16	16.955	.080	.210	.005	1.8678	430,66	2,03	5,33	0,13	2-386
2-387	-387	18	18 3/8	3/16	17.955	.085	.210	.005	1.9766	456,06	2,16	5,33	0,13	2-387
2-388	-388	19	19 3/8	3/16	18.955	.090	.210	.005	2.0854	481,41	2,29	5,33	0,13	2-388
2-389	-389	20	20 3/8	3/16	19.955	.095	.210	.005	2.1942	506,81	2,41	5,33	0,13	2-389
2-390	-390	21	21 3/8	3/16	20.955	.095	.210	.005	2.3030	532,21	2,41	5,33	0,13	2-390
2-391	-391	22	22 3/8	3/16	21.955	.100	.210	.005	2.4118	557,61	2,54	5,33	0,13	2-391
2-392	-392	23	23 3/8	3/16	22.940	.105	.210	.005	2.5190	582,68	2,67	5,33	0,13	2-392
2-393	-393	24	24 3/8	3/16	23.940	.110	.210	.005	2.6278	608,08	2,79	5,33	0,13	2-393
2-394	-394	25	25 3/8	3/16	24.940	.115	.210	.005	2.7366	633,48	2,92	5,33	0,13	2-394
2-395	-395	26	26 3/8	3/16	25.940	.120	.210	.005	2.8454	658,88	3,05	5,33	0,13	2-395
2-425	-425	4 1/2	5	1/4	4.475	.033	.275	.006	.8863	113,67	0,84	6,99	0,15	2-425
2-426	-426	4 5/8	5 1/8	1/4	4.600	.033	.275	.006	.9097	116,84	0,84	6,99	0,15	2-426
2-427	-427	4 3/4	5 1/4	1/4	4.725	.033	.275	.006	.9330	120,02	0,84	6,99	0,15	2-427
2-428	-428	4 7/8	5 3/8	1/4	4.850	.033	.275	.006	.9563	123,19	0,84	6,99	0,15	2-428
2-429	-429	5	5 1/2	1/4	4.975	.037	.275	.006	.9796	126,37	0,94	6,99	0,15	2-429
2-430	-430	5 1/8	5 5/8	1/4	5.100	.037	.275	.006	1.0030	129,54	0,94	6,99	0,15	2-430
2-431	-431	5 1/4	5 3/4	1/4	5.225	.037	.275	.006	1.0263	132,72	0,94	6,99	0,15	2-431
2-432	-432	5 3/8	5 7/8	1/4	5.350	.037	.275	.006	1.0496	135,89	0,94	6,99	0,15	2-432
2-433	-433	5 1/2	6	1/4	5.475	.037	.275	.006	1.0729	139,07	0,94	6,99	0,15	2-433
2-434	-434	5 5/8	6 1/8	1/4	5.600	.037	.275	.006	1.0963	142,24	0,94	6,99	0,15	2-434
2-435	-435	5 3/4	6 1/4	1/4	5.725	.037	.275	.006	1.1196	145,42	0,94	6,99	0,15	2-435
2-436	-436	5 7/8	6 3/8	1/4	5.850	.037	.275	.006	1.1429	148,59	0,94	6,99	0,15	2-436
2-437	-437	6	6 1/2	1/4	5.975	.037	.275	.006	1.1662	151,77	0,94	6,99	0,15	2-437
2-438	-438	6 1/4	6 3/4	1/4	6.225	.040	.275	.006	1.2129	158,12	1,02	6,99	0,15	2-438
2-439	-439	6 1/2	7	1/4	6.475	.040	.275	.006	1.2595	164,47	1,02	6,99	0,15	2-439
2-440	-440	6 3/4	7 1/4	1/4	6.725	.040	.275	.006	1.3062	170,82	1,02	6,99	0,15	2-440
2-441	-441	7	7 1/2	1/4	6.975	.040	.275	.006	1.3528	177,17	1,02	6,99	0,15	2-441
2-442	-442	7 1/4	7 3/4	1/4	7.225	.045	.275	.006	1.3995	183,52	1,14	6,99	0,15	2-442
2-443	-443	7 1/2	8	1/4	7.475	.045	.275	.006	1.4461	189,87	1,14	6,99	0,15	2-443
2-444	-444	7 3/4	8 1/4	1/4	7.725	.045	.275	.006	1.4928	196,22	1,14	6,99	0,15	2-444
2-445	-445	8	8 1/2	1/4	7.975	.045	.275	.006	1.5394	202,57	1,14	6,99	0,15	2-445
2-446	-446	8 1/2	9	1/4	8.475	.055	.275	.006	1.6327	215,27	1,40	6,99	0,15	2-446

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.210 Area = .034636
.275 Area = .059396
(sq. in.)

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Table 9-1: Parker Series 2-XXX O-Ring Sizes - *continued*

1	2	3			4				5	6				7
	Size Only	Nominal Size			Standard O-Ring Size (Units are in Inches)				(Ref. Only)	Metric O-Ring Size (Units are in Millimeters)				
	(Size Only)	(Inches)			Actual (b) Per AS 568B					Actual (b) Per AS 568B				
Parker Size No. (Size Only)	AS 568B Uniform	(Ref. Only)				Tolerance			Basic Volume		Tolerance			Parker Size No. (Size Only)
(a)	Dash No.	I.D.	O.D.	W.	I.D.	±	W	±	Cu. In.	I.D.	±	W	±	(a)
2-447	-447	9	9 1/2	1/4	8.975	.055	.275	.006	1.7260	227,97	1,40	6,99	0,15	2-447
2-448	-448	9 1/2	10	1/4	9.475	.055	.275	.006	1.8193	240,67	1,40	6,99	0,15	2-448
2-449	-449	10	10 1/2	1/4	9.975	.055	.275	.006	1.9126	253,37	1,40	6,99	0,15	2-449
2-450	-450	10 1/2	11	1/4	10.475	.060	.275	.006	2.0059	266,07	1,52	6,99	0,15	2-450
2-451	-451	11	11 1/2	1/4	10.975	.060	.275	.006	2.0992	278,77	1,52	6,99	0,15	2-451
2-452	-452	11 1/2	12	1/4	11.475	.060	.275	.006	2.1925	291,47	1,52	6,99	0,15	2-452
2-453	-453	12	12 1/2	1/4	11.975	.060	.275	.006	2.2858	304,17	1,52	6,99	0,15	2-453
2-454	-454	12 1/2	13	1/4	12.475	.060	.275	.006	2.3791	316,87	1,52	6,99	0,15	2-454
2-455	-455	13	13 1/2	1/4	12.975	.060	.275	.006	2.4724	329,57	1,52	6,99	0,15	2-455
2-456	-456	13 1/2	14	1/4	13.475	.070	.275	.006	2.5657	342,27	1,78	6,99	0,15	2-456
2-457	-457	14	14 1/2	1/4	13.975	.070	.275	.006	2.6590	354,97	1,78	6,99	0,15	2-457
2-458	-458	14 1/2	15	1/4	14.475	.070	.275	.006	2.7523	367,67	1,78	6,99	0,15	2-458
2-459	-459	15	15 1/2	1/4	14.975	.070	.275	.006	2.8456	380,37	1,78	6,99	0,15	2-459
2-460	-460	15 1/2	16	1/4	15.475	.070	.275	.006	2.9389	393,07	1,78	6,99	0,15	2-460
2-461	-461	16	16 1/2	1/4	15.955	.075	.275	.006	3.0285	405,26	1,91	6,99	0,15	2-461
2-462	-462	16 1/2	17	1/4	16.455	.075	.275	.006	3.1218	417,96	1,91	6,99	0,15	2-462
2-463	-463	17	17 1/2	1/4	16.955	.080	.275	.006	3.2151	430,66	2,03	6,99	0,15	2-463
2-464	-464	17 1/2	18	1/4	17.455	.085	.275	.006	3.3084	443,36	2,16	6,99	0,15	2-464
2-465	-465	18	18 1/2	1/4	17.955	.085	.275	.006	3.4017	456,06	2,16	6,99	0,15	2-465
2-466	-466	18 1/2	19	1/4	18.455	.085	.275	.006	3.4950	468,76	2,16	6,99	0,15	2-466
2-467	-467	19	19 1/2	1/4	18.955	.090	.275	.006	3.5883	481,46	2,29	6,99	0,15	2-467
2-468	-468	19 1/2	20	1/4	19.455	.090	.275	.006	3.6816	494,16	2,29	6,99	0,15	2-468
2-469	-469	20	20 1/2	1/4	19.955	.095	.275	.006	3.7749	506,86	2,41	6,99	0,15	2-469
2-470	-470	21	21 1/2	1/4	20.955	.095	.275	.006	3.9615	532,26	2,41	6,99	0,15	2-470
2-471	-471	22	22 1/2	1/4	21.955	.100	.275	.006	4.1481	557,66	2,54	6,99	0,15	2-471
2-472	-472	23	23 1/2	1/4	22.940	.105	.275	.006	4.3319	582,68	2,67	6,99	0,15	2-472
2-473	-473	24	24 1/2	1/4	23.940	.110	.275	.006	4.5185	608,08	2,79	6,99	0,15	2-473
2-474	-474	25	25 1/2	1/4	24.940	.115	.275	.006	4.7051	633,48	2,92	6,99	0,15	2-474
2-475	-475	26	26 1/2	1/4	25.940	.120	.275	.006	4.8917	658,88	3,05	6,99	0,15	2-475

(a) The rubber compound must be added when ordering by the 2-size number (i.e., 2-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.
(c) When ordering O-Rings to a Military, AMS or NAS material Specification, see page 1-23 for more information.

.275 Area = .059396 (sq. in.)

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Table 9-2: Parker Series 3-XXX O-Ring Sizes

These O-Rings are intended for use with internal straight thread fluid connection bosses and tube fittings.
Ref. MS33656, MS33657, SAE straight thread O-Ring boss and mating swivel and adjustable style fittings.

1	2	3	4	5	6		7	8	9	10		11
			O-Ring Size — Actual (b) per AS568B (Units are in Inches)					Metric O-Ring Size per AS568B (b) (Units are in Millimeters)				
3-XXX (a) Size No.	AS568B Dash No.	Tube O.D. (Ref.)	I.D.	Tolerance ±	W	±	Basic Volume (cu. in.)	I.D.	Tolerance ±	W	±	3-XXX (a) Size No.
3-901	-901	3/32	.185	.005	.056	.003	.0019	4,70	0,13	1,42	0,08	3-901
3-902	-902	1/8	.239	.005	.064	.003	.0031	6,07	0,13	1,63	0,08	3-902
3-903	-903	3/16	.301	.005	.064	.003	.0037	7,65	0,13	1,63	0,08	3-903
3-904	-904	1/4	.351	.005	.072	.003	.0055	8,92	0,13	1,83	0,08	3-904
3-905	-905	5/16	.414	.005	.072	.003	.0063	10,52	0,13	1,83	0,08	3-905
3-906	-906	3/8	.468	.005	.078	.003	.0082	11,89	0,13	1,98	0,08	3-906
3-907	-907	7/16	.530	.007	.082	.003	.0102	13,46	0,18	2,08	0,08	3-907
3-908	-908	1/2	.644	.009	.087	.003	.0137	16,36	0,23	2,21	0,08	3-908
3-909	-909	9/16	.706	.009	.097	.003	.0187	17,93	0,23	2,46	0,08	3-909
3-910	-910	5/8	.755	.009	.097	.003	.0198	19,18	0,23	2,46	0,08	3-910
3-911	-911	11/16	.863	.009	.116	.004	.0326	21,92	0,23	2,95	0,10	3-911
3-912	-912	3/4	.924	.009	.116	.004	.0346	23,47	0,23	2,95	0,10	3-912
3-913	-913	13/16	.986	.010	.116	.004	.0366	25,04	0,26	2,95	0,10	3-913
3-914	-914	7/8	1.047	.010	.116	.004	.0387	26,59	0,26	2,95	0,10	3-914
3-916	-916	1	1.171	.010	.116	.004	.0428	29,74	0,26	2,95	0,10	3-916
3-918	-918	1 1/8	1.355	.012	.116	.004	.0489	34,42	0,30	2,95	0,10	3-918
3-920	-920	1 1/4	1.475	.014	.118	.004	.0548	37,47	0,36	3,00	0,10	3-920
3-924	-924	1 1/2	1.720	.014	.118	.004	.0632	43,69	0,36	3,00	0,10	3-924
3-928	-928	1 3/4	2.090	.018	.118	.004	.0759	53,09	0,46	3,00	0,10	3-928
3-932	-932	2	2.337	.018	.118	.004	.0844	59,36	0,46	3,00	0,10	3-932

(a) The rubber compound must be added when ordering by the 3-size number (i.e.,3-910 N552-90).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. These correspond to AS568B dimensions. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

.056 Area = .00246
.064 Area = .00322
.072 Area = .00407
.078 Area = .00478
.082 Area = .00528
.087 Area = .00594
.097 Area = .00739
.116 Area = .01057
.118 Area = .01094
(sq. in.)

Boss O-Ring Kit – 206 Pieces – 20 Sizes

P/N	I.D.	C/S	P/N	I.D.	C/S	P/N	I.D.	C/S	P/N	I.D.	C/S	P/N	I.D.	C/S
3-901	0.185	0.056	3-905	0.414	0.072	3-909	0.706	0.097	3-913	0.986	0.116	3-920	1.475	0.118
3-902	0.239	0.064	3-906	0.468	0.078	3-910	0.755	0.097	3-914	1.047	0.116	3-924	1.720	0.118
3-903	0.301	0.064	3-907	0.530	0.082	3-911	0.863	0.116	3-916	1.171	0.116	3-928	2.090	0.118
3-904	0.351	0.072	3-908	0.644	0.087	3-912	0.924	0.116	3-918	1.355	0.116	3-932	2.337	0.118

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Parker Series 5-XXX O-Ring Sizes

The following 5-XXX sizes are O-Rings of non-standard dimensions for which Parker tooling was available as of November 1, 1997. This tooling will be maintained while volume demand continues. A mold scrapped as defective will not be replaced unless demand justifies the expense.

Note: These molds are cut to allow for standard "AN" shrinkage, and in materials having standard shrinkage they will normally produce rings to the dimensions listed. Materials with other than standard shrinkage will give different dimensions and tolerances. Please consult your nearest Zatkoff location for the availability of special sizes not included in this list as of this writing.

Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-118	.059	.004	.040	.003	5-118	1.50	0.10	1.02	.08
5-187	.070	.005	.036	.003	5-187	1.78	0.13	0.91	.08
5-051	.070	.005	.040	.003	5-051	1.78	0.13	1.02	.08
5-101	.100	.005	.038	.003	5-101	2.54	0.13	0.97	.08
5-578	.102	.005	.074	.003	5-578	2.59	0.13	1.88	.08
5-632	.110	.005	.040	.003	5-632	2.79	0.13	1.02	.08
5-102	.116	.005	.038	.003	5-102	2.95	0.13	0.97	.08
5-178	.120	.005	.040	.003	5-178	3.05	0.13	1.02	.08
5-683	.122	.005	.063	.003	5-683	3.10	0.13	1.60	.08
5-646	.126	.005	.040	.003	5-646	3.20	0.13	1.02	.08
5-103	.128	.005	.050	.003	5-103	3.25	0.13	1.27	.08
5-190	.132	.005	.070	.003	5-190	3.35	0.13	1.78	.08
5-579	.133	.005	.074	.003	5-579	3.39	0.13	1.88	.08
5-669	.146	.005	.040	.003	5-669	3.71	0.13	1.02	.08
5-148	.154	.005	.038	.003	5-148	3.91	0.13	0.97	.08
5-105	.154	.005	.050	.003	5-105	3.91	0.13	1.27	.08
5-106	.154	.005	.066	.003	5-106	3.91	0.13	1.68	.08
5-580	.165	.005	.074	.003	5-580	4.19	0.13	1.88	.08
5-193	.176	.005	.040	.003	5-193	4.47	0.13	1.02	.08
5-108	.176	.005	.050	.003	5-108	4.47	0.13	1.27	.08
5-124	.176	.005	.056	.003	5-124	4.47	0.13	1.42	.08
5-107	.176	.005	.066	.003	5-107	4.47	0.13	1.68	.08
5-125	.180	.005	.040	.003	5-125	4.57	0.13	1.02	.08
5-581	.192	.005	.074	.003	5-581	4.88	0.13	1.88	.08
5-685	.208	.005	.094	.003	5-685	5.28	0.13	2.39	.08
5-582	.224	.005	.074	.003	5-582	5.69	0.13	1.88	.08
5-194	.228	.005	.040	.003	5-194	5.79	0.13	1.02	.08
5-638	.233	.005	.076	.003	5-638	5.92	0.13	1.93	.08
5-179	.239	.005	.040	.003	5-179	6.07	0.13	1.02	.08
5-151	.239	.005	.051	.003	5-151	6.07	0.13	1.30	.08
5-127	.239	.005	.074	.003	5-127	6.07	0.13	1.88	.08
5-1002	.239	.005	.174	.005	5-1002	6.07	0.13	4.42	.13
5-197	.242	.005	.040	.003	5-197	6.15	0.13	1.02	.08
5-180	.248	.005	.048	.003	5-180	6.30	0.13	1.22	.08
5-686	.248	.005	.094	.003	5-686	6.30	0.13	2.39	.08
5-583	.251	.005	.074	.003	5-583	6.38	0.13	1.88	.08
5-200	.265	.005	.139	.004	5-200	6.73	0.13	3.53	.10
5-052	.270	.005	.070	.003	5-052	6.86	0.13	1.78	.08
5-202	.278	.005	.046	.003	5-202	7.06	0.13	1.17	.08
5-698	.283	.005	.040	.003	5-698	7.19	0.13	1.02	.08
5-584	.283	.005	.074	.003	5-584	7.19	0.13	1.88	.08
5-687	.287	.005	.094	.003	5-687	7.29	0.13	2.39	.08
5-1004	.290	.005	.045	.003	5-1004	7.39	0.13	1.14	.08
5-152	.301	.005	.025	.003	5-152	7.65	0.13	0.64	.08
5-056	.301	.005	.038	.003	5-056	7.65	0.13	0.97	.08
5-710	.301	.005	.054	.003	5-710	7.65	0.13	1.37	.08
5-673	.305	.005	.074	.003	5-673	7.75	0.13	1.88	.08
5-204	.312	.005	.036	.003	5-204	7.92	0.13	0.91	.08
5-205	.312	.005	.092	.003	5-205	7.92	0.13	2.34	.08
5-160	.312	.005	.103	.003	5-160	7.92	0.13	2.62	.08
5-712	.313	.005	.051	.003	5-712	7.95	0.13	1.30	.08
5-585	.314	.005	.074	.003	5-585	7.98	0.13	1.88	.08
5-664	.320	.005	.070	.003	5-664	8.13	0.13	1.78	.08
5-1006	.322	.005	.070	.003	5-1006	8.18	0.13	1.78	.08
5-206	.326	.005	.103	.003	5-206	8.28	0.13	2.62	.08
5-1007	.330	.005	.050	.003	5-1007	8.38	0.13	1.27	.08
5-133	.332	.005	.031	.003	5-133	8.43	0.13	0.79	.08
5-612	.344	.005	.070	.003	5-612	8.74	0.13	1.78	.08
5-586	.350	.005	.074	.003	5-586	8.89	0.13	1.88	.08
5-587	.350	.005	.106	.004	5-587	8.89	0.13	2.69	.10
5-018	.352	.005	.113	.004	5-018	8.94	0.13	2.87	.10
5-699	.353	.005	.094	.003	5-699	8.97	0.13	2.39	.08
5-700	.354	.005	.118	.004	5-700	8.99	0.13	3.00	.10
5-716	.362	.005	.118	.004	5-716	9.19	0.13	3.00	.10
5-057	.364	.005	.045	.003	5-057	9.25	0.13	1.14	.08
5-209	.370	.005	.040	.003	5-209	9.40	0.13	1.02	.08
5-211	.375	.005	.187	.005	5-211	9.53	0.13	4.75	.13
5-212	.384	.005	.070	.003	5-212	9.75	0.13	1.78	.08
5-614	.391	.005	.103	.003	5-614	9.93	0.13	2.62	.08
5-718	.395	.005	.040	.003	5-718	10.03	0.13	1.02	.08

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table *- continued*

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-134	.410	.005	.031	.003	5-134	10.41	0.13	0.79	.08
5-588	.413	.005	.106	.004	5-588	10.49	0.13	2.69	.10
5-002	.416	.005	.059	.003	5-002	10.57	0.13	1.50	.08
5-215	.418	.005	.094	.003	5-215	10.62	0.13	2.39	.08
5-218	.425	.005	.025	.003	5-218	10.80	0.13	0.64	.08
5-682	.426	.005	.040	.003	5-682	10.82	0.13	1.02	.08
5-058	.426	.005	.050	.003	5-508	10.82	0.13	1.27	.08
5-613	.437	.005	.070	.003	5-613	11.10	0.13	1.78	.08
5-1011	.447	.005	.103	.003	5-1011	11.35	0.13	2.62	.08
5-222	.455	.005	.128	.004	5-222	11.56	0.13	3.25	.10
5-223	.458	.005	.053	.003	5-223	11.63	0.13	1.35	.08
5-225	.469	.006	.094	.003	5-225	11.91	0.15	2.39	.08
5-615	.469	.006	.103	.003	5-615	11.91	0.15	2.62	.15
5-652	.473	.006	.071	.003	5-652	12.01	0.15	1.80	.08
5-726	.484	.006	.056	.003	5-726	12.29	0.15	1.42	.08
5-566	.489	.006	.055	.003	5-566	12.42	0.15	1.40	.08
5-230	.500	.006	.125	.004	5-230	12.70	0.15	3.18	.10
5-231	.501	.006	.062	.003	5-231	12.73	0.15	1.57	.08
5-675	.508	.006	.049	.003	5-675	12.90	0.15	1.24	.08
5-616	.516	.006	.103	.003	5-616	13.11	0.15	2.62	.08
5-1014	.525	.007	.071	.003	5-1014	13.34	0.18	1.80	.08
5-135	.526	.007	.031	.003	5-135	13.36	0.18	0.79	.08
5-590	.535	.007	.106	.004	5-590	13.59	0.18	2.69	.10
5-001	.547	.007	.051	.003	5-001	13.89	0.18	1.30	.08
5-162	.554	.007	.070	.003	5-162	14.07	0.18	1.78	.08
5-236	.562	.007	.062	.003	5-236	14.27	0.18	1.57	.08
5-239	.570	.007	.106	.004	5-239	14.48	0.18	2.69	.10
5-156	.575	.007	.060	.003	5-156	14.61	0.18	1.52	.08
5-563	.583	.007	.040	.003	5-563	14.81	0.18	1.02	.08
5-735	.583	.007	.103	.003	5-735	14.81	0.18	2.62	.08
5-736	.590	.007	.070	.003	5-736	14.99	0.18	1.78	.08
5-591	.594	.007	.106	.004	5-591	15.09	0.18	2.69	.10
5-609	.600	.007	.094	.003	5-609	15.24	0.18	2.39	.08
5-242	.600	.007	.105	.004	5-242	15.24	0.18	2.67	.10
5-021	.603	.007	.125	.004	5-021	15.32	0.18	3.18	.10
5-243	.604	.007	.103	.003	5-243	15.34	0.18	2.62	.08
5-676	.610	.007	.058	.003	5-676	15.49	0.18	1.47	.08
5-247	.623	.007	.125	.004	5-247	15.82	0.18	3.18	.10
5-248	.625	.007	.050	.003	5-248	15.88	0.18	1.27	.08
5-617	.625	.007	.103	.003	5-617	15.88	0.18	2.62	.08
5-250	.627	.007	.062	.003	5-250	15.93	0.18	1.57	.08
5-251	.631	.007	.062	.003	5-251	16.03	0.18	1.57	.08
5-005	.640	.007	.080	.003	5-005	16.26	0.18	2.03	.08
5-136	.643	.007	.031	.003	5-136	16.33	0.18	0.79	.08
5-643	.650	.007	.045	.003	5-643	16.51	0.18	1.14	.08
5-252	.652	.007	.070	.003	5-252	16.56	0.18	1.78	.08
5-254	.660	.007	.064	.003	5-254	16.76	0.18	1.63	.08
5-743	.660	.007	.141	.004	5-743	16.76	0.18	3.58	.10
5-592	.665	.007	.106	.004	5-592	16.89	0.18	2.69	.10
5-256	.707	.008	.103	.003	5-256	17.96	0.20	2.62	.08
5-1017	.709	.008	.079	.003	5-1017	18.01	0.20	2.01	.08
5-594	.720	.008	.141	.004	5-594	18.29	0.20	3.58	.10
5-257	.722	.008	.113	.004	5-257	18.34	0.20	2.87	.10
5-593	.724	.008	.106	.004	5-593	18.39	0.20	2.69	.10
5-181	.725	.008	.040	.003	5-181	18.42	0.20	1.02	.08
5-964	.744	.008	.109	.004	5-964	18.90	0.20	2.77	.10
5-263	.750	.008	.061	.003	5-263	19.05	0.20	1.55	.08
5-264	.752	.008	.070	.003	5-264	19.10	0.20	1.78	.08
5-266	.766	.008	.080	.003	5-266	19.46	0.20	2.03	.08
5-137	.775	.008	.031	.003	5-137	19.69	0.20	0.79	.08
5-595	.779	.008	.141	.004	5-595	19.79	0.20	3.58	.10
5-006	.796	.008	.080	.003	5-006	20.22	0.20	2.03	.08
5-751	.820	.009	.150	.005	5-751	20.83	0.23	3.81	.13
5-003	.836	.009	.059	.003	5-003	21.23	0.23	1.50	.08
5-596	.838	.009	.141	.004	5-596	21.29	0.23	3.58	.10
5-708	.850	.009	.045	.003	5-708	21.59	0.23	1.14	.08
5-753	.857	.009	.123	.004	5-753	21.77	0.23	3.12	.10
5-049	.871	.009	.140	.004	5-049	22.12	0.23	3.56	.10
5-273	.879	.009	.040	.003	5-273	22.33	0.23	1.02	.08
5-022	.890	.009	.125	.004	5-022	22.61	0.23	3.18	.10
5-138	.898	.009	.031	.003	5-138	22.81	0.23	0.79	.08
5-597	.905	.009	.141	.004	5-597	22.99	0.23	3.58	.10
5-598	.968	.010	.141	.004	5-598	24.59	0.25	3.58	.10
5-278	.979	.010	.103	.003	5-278	24.87	0.25	2.62	.08
5-139	.987	.010	.031	.003	5-139	25.07	0.25	0.79	.08
5-709	1.000	.010	.055	.003	5-709	25.40	0.25	1.40	.08
5-677	1.004	.010	.081	.003	5-677	25.50	0.25	2.06	.08
5-279	1.004	.010	.218	.005	5-279	25.50	0.25	5.54	.13
5-761	1.010	.010	.062	.003	5-761	25.65	0.25	1.57	.08
5-618	1.016	.010	.139	.004	5-618	25.81	0.25	3.53	.10
5-599	1.031	.010	.141	.004	5-599	26.19	0.25	3.58	.10
5-004	1.070	.010	.065	.003	5-004	27.18	0.25	1.65	.08
5-763	1.080	.010	.050	.003	5-763	27.43	0.25	1.27	.08
5-600	1.094	.010	.141	.004	5-600	27.79	0.25	3.58	.10
5-140	1.112	.010	.031	.003	5-140	28.24	0.25	0.79	.08
5-601	1.153	.012	.141	.004	5-601	29.29	0.30	3.58	.10
5-769	1.176	.012	.183	.005	5-769	29.87	0.30	4.65	.13
5-290	1.180	.012	.210	.005	5-290	29.97	0.30	5.33	.13

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table *- continued*

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-291	1.186	.012	.070	.003	5-291	30.12	0.30	1.78	.08
5-1028	1.190	.012	.250	.006	5-1028	30.23	0.30	6.35	.15
5-602	1.212	.012	.141	.004	5-602	30.78	0.30	3.58	.10
5-294	1.213	.012	.149	.004	5-294	30.81	0.30	3.78	.10
5-295	1.225	.012	.275	.006	5-295	31.12	0.30	6.99	.15
5-141	1.226	.012	.031	.003	5-141	31.14	0.30	0.79	.08
5-296	1.229	.012	.070	.003	5-296	31.22	0.30	1.78	.08
5-297	1.230	.012	.197	.005	5-297	31.24	0.30	5.00	.13
5-301	1.259	.012	.092	.003	5-301	31.98	0.30	2.34	.08
5-603	1.279	.012	.141	.004	5-603	32.49	0.30	3.58	.10
5-157	1.338	.012	.092	.003	5-157	33.99	0.30	2.34	.08
5-604	1.342	.012	.141	.004	5-604	34.09	0.30	3.58	.10
5-605	1.401	.014	.141	.004	5-605	35.59	0.36	3.58	.10
5-780	1.412	.014	.073	.003	5-780	35.86	0.36	1.85	.08
5-008	1.421	.014	.080	.003	5-008	36.09	0.36	2.03	.08
5-309	1.436	.014	.063	.003	5-309	36.47	0.36	1.60	.08
5-670	1.437	.014	.070	.003	5-670	36.40	0.36	1.78	.08
5-142	1.450	.014	.047	.003	5-142	36.83	0.36	1.19	.08
5-312	1.454	.014	.105	.004	5-312	36.93	0.36	2.67	.10
5-657	1.465	.014	.103	.003	5-657	37.21	0.36	2.62	.08
5-606	1.468	.014	.141	.004	5-606	37.29	0.36	3.58	.10
5-980	1.475	.014	.275	.006	5-980	37.47	0.36	6.99	.15
5-024	1.515	.015	.125	.004	5-024	38.48	0.38	3.18	.10
5-320	1.540	.015	.070	.003	5-320	39.12	0.38	1.78	.08
5-158	1.550	.015	.092	.003	5-158	39.37	0.38	2.34	.08
5-009	1.553	.015	.080	.003	5-009	39.45	0.38	2.03	.08
5-321	1.559	.015	.139	.004	5-321	39.60	0.38	3.53	.10
5-788	1.591	.015	.071	.003	5-788	40.41	0.38	1.80	.08
5-034	1.559	.015	.139	.004	5-034	40.61	0.38	3.53	.10
5-327	1.640	.015	.139	.004	5-327	41.66	0.38	3.53	.10
5-143	1.670	.015	.047	.003	5-143	42.42	0.38	1.19	.08
5-329	1.670	.015	.070	.003	5-329	42.42	0.38	1.78	.08
5-1018	1.671	.015	.139	.004	5-1018	42.44	0.38	3.53	.10
5-330	1.674	.015	.210	.005	5-330	42.52	0.38	5.33	.13
5-671	1.680	.015	.080	.003	5-671	42.67	0.38	2.03	.08
5-332	1.687	.015	.139	.004	5-332	42.85	0.38	3.53	.10
5-025	1.765	.016	.125	.004	5-025	44.83	0.41	3.18	.10
5-035	1.786	.016	.139	.004	5-035	45.36	0.41	3.53	.10
5-1023	1.788	.016	.070	.003	5-1023	45.42	0.41	1.78	.08
5-335	1.802	.016	.062	.003	5-335	45.77	0.41	1.57	.08
5-794	1.812	.016	.070	.003	5-794	46.02	0.41	1.78	.08
5-1042	1.817	.016	.257	.006	5-1042	46.15	0.41	6.53	.15
5-795	1.850	.016	.070	.003	5-795	46.99	0.41	1.78	.08
5-981	1.850	.016	.275	.006	5-981	46.99	0.41	6.99	.15
5-011	1.860	.016	.080	.003	5-011	47.24	0.41	2.03	.08

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-337	1.873	.016	.062	.003	5-337	47.57	0.41	1.57	.08
5-1043	1.882	.017	.118	.004	5-1043	47.80	0.43	3.00	.10
5-144	1.891	.017	.047	.003	5-144	48.03	0.43	1.19	.08
5-796	1.913	.017	.070	.003	5-796	48.59	0.43	1.78	.08
5-338	1.925	.017	.210	.005	5-338	48.90	0.43	5.33	.13
5-701	1.937	.017	.139	.004	5-701	49.20	0.43	3.53	.10
5-342	1.980	.017	.038	.003	5-342	50.29	0.43	0.97	.08
5-343	2.000	.018	.075	.003	5-343	50.80	0.46	1.91	.08
5-655	2.020	.018	.070	.003	5-655	51.31	0.46	1.78	.08
5-037	2.036	.018	.139	.004	5-037	51.71	0.46	3.53	.10
5-346	2.046	.018	.139	.004	5-346	51.97	0.46	3.53	.10
5-642	2.051	.018	.070	.003	5-642	52.10	0.46	1.78	.08
5-1044	2.060	.018	.139	.004	5-1044	52.32	0.46	3.53	.10
5-027	2.140	.018	.125	.004	5-027	54.36	0.46	3.18	.10
5-1046	2.140	.018	.315	.010	5-1046	54.36	0.46	8.00	.25
5-145	2.141	.018	.047	.003	5-145	54.38	0.46	1.19	.08
5-347	2.163	.018	.062	.003	5-347	54.94	0.46	1.57	.08
5-348	2.172	.018	.070	.003	5-348	55.17	0.46	1.78	.08
5-800	2.225	.018	.275	.006	5-800	56.52	0.46	6.99	.15
5-1047	2.281	.020	.093	.003	5-1047	57.94	0.51	2.36	.08
5-015	2.296	.020	.080	.003	5-015	58.32	0.51	2.03	.08
5-702	2.312	.020	.139	.004	5-702	58.72	0.51	3.53	.10
5-039	2.411	.020	.139	.004	5-039	61.24	0.51	3.53	.10
5-354	2.471	.020	.070	.003	5-354	62.76	0.51	1.78	.08
5-355	2.524	.020	.103	.003	5-355	64.11	0.51	2.62	.08
5-805	2.535	.020	.070	.003	5-805	64.39	0.51	1.78	.08
5-703	2.563	.020	.139	.004	5-703	65.10	0.51	3.53	.10
5-358	2.576	.020	.082	.003	5-358	65.43	0.51	2.08	.08
5-361	2.671	.022	.139	.004	5-361	67.84	0.56	3.53	.10
5-159	2.683	.022	.115	.004	5-159	68.15	0.56	2.92	.10
5-982	2.725	.022	.275	.006	5-982	69.22	0.56	6.99	.15
5-807	2.782	.022	.103	.003	5-807	70.66	0.56	2.62	.08
5-704	2.812	.022	.139	.004	5-704	71.42	0.56	3.53	.10
5-042	2.846	.022	.139	.004	5-042	72.29	0.56	3.53	.10
5-697	2.878	.022	.080	.003	5-697	73.10	0.56	2.03	.08
5-367	2.924	.022	.103	.003	5-367	74.27	0.56	2.62	.08
5-705	2.937	.022	.139	.004	5-705	74.60	0.56	3.53	.10
5-938	2.975	.024	.275	.006	5-938	75.57	0.61	6.99	.15
5-368	3.020	.024	.103	.003	5-368	76.71	0.61	2.62	.08
5-044	3.036	.024	.139	.004	5-044	77.11	0.61	3.53	.10
5-369	3.037	.024	.103	.003	5-369	77.14	0.61	2.62	.08
5-810	3.041	.024	.062	.003	5-810	77.24	0.61	1.57	.08
5-811	3.060	.024	.112	.004	5-811	77.72	0.61	2.84	.10
5-1052	3.080	.024	.111	.004	5-1052	78.23	0.61	2.82	.10
5-374	3.112	.024	.070	.003	5-374	79.04	0.61	1.78	.08

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table *- continued*

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-557	3.125	.024	.103	.003	5-557	79.38	0.61	2.62	.08
5-813	3.130	.024	.100	.003	5-813	79.50	0.61	2.54	.08
5-815	3.156	.024	.060	.003	5-815	80.16	0.61	1.52	.08
5-045	3.161	.024	.139	.004	5-045	80.29	0.61	3.53	.10
5-816	3.162	.024	.070	.003	5-816	80.31	0.61	1.78	.08
5-819	3.210	.024	.103	.003	5-819	81.53	0.61	2.62	.08
5-984	3.225	.024	.275	.006	5-984	81.92	0.61	6.99	.15
5-821	3.300	.026	.070	.003	5-821	83.82	0.66	1.78	.08
5-825	3.350	.026	.275	.006	5-825	85.09	0.66	6.99	.15
5-1053	3.354	.026	.070	.003	5-1053	85.19	0.66	1.78	.08
5-380	3.363	.026	.155	.005	5-380	85.42	0.66	3.94	.13
5-979	3.443	.026	.275	.006	5-979	87.45	0.66	6.99	.15
5-381	3.475	.026	.275	.006	5-381	88.27	0.66	6.99	.15
5-985	3.600	.026	.275	.006	5-985	91.44	0.66	6.99	.15
5-385	3.603	.026	.220	.005	5-385	91.52	0.66	5.59	.13
5-031	3.640	.028	.125	.004	5-031	92.46	0.71	3.18	.10
5-828	3.661	.028	.090	.003	5-828	92.99	0.71	2.29	.08
5-986	3.725	.028	.275	.006	5-986	94.62	0.71	6.99	.15
5-390	3.957	.028	.147	.004	5-390	100.51	0.71	3.73	.10
5-987	3.975	.028	.275	.006	5-987	100.97	0.71	6.99	.15
5-831	4.020	.030	.147	.004	5-831	102.11	0.76	3.73	.10
5-1054	4.080	.030	.209	.005	5-1054	103.63	0.76	5.31	.13
5-833	4.085	.030	.103	.003	5-833	103.76	0.76	2.62	.08
5-394	4.096	.030	.070	.003	5-394	104.04	0.76	1.78	.08
5-988	4.100	.030	.275	.006	5-988	104.14	0.76	6.99	.15
5-395	4.117	.030	.070	.003	5-395	104.57	0.76	1.78	.08
5-396	4.171	.030	.070	.003	5-396	105.94	0.76	1.78	.08
5-989	4.225	.030	.275	.006	5-989	107.32	0.76	6.99	.15
5-060	4.390	.030	.044	.003	5-060	111.51	0.76	1.12	.08
5-836	4.427	.030	.140	.004	5-836	112.45	0.76	3.56	.10
5-1056	4.484	.030	.172	.005	5-1056	113.89	0.76	4.37	.13
5-401	4.531	.030	.070	.003	5-401	115.09	0.76	1.78	.08
5-840	4.630	.033	.139	.004	5-840	117.60	0.84	3.53	.10
5-842	4.664	.035	.122	.004	5-842	118.47	0.89	3.10	.10
5-843	4.674	.035	.103	.003	5-843	118.72	0.89	2.62	.08
5-844	4.682	.035	.140	.004	5-844	118.92	0.89	3.56	.10
5-402	4.750	.035	.188	.005	5-402	120.65	0.89	4.78	.13
5-848	4.875	.035	.060	.003	5-848	123.83	0.89	1.52	.08
5-850	4.925	.035	.260	.006	5-850	125.10	0.89	6.60	.15
5-403	4.930	.035	.103	.003	5-403	125.22	0.89	2.62	.08
5-851	4.984	.035	.147	.004	5-851	126.59	0.89	3.73	.10
5-852	5.030	.035	.210	.005	5-852	127.76	0.89	5.33	.13
5-853	5.057	.035	.233	.006	5-853	128.45	0.89	5.92	.15
5-559	5.236	.035	.214	.005	5-559	133.00	0.89	5.44	.13
5-407	5.249	.035	.123	.004	5-407	133.32	0.89	3.12	.10
5-408	5.265	.035	.139	.004	5-408	133.73	0.89	3.53	.10
5-410	5.340	.035	.070	.003	5-410	135.64	0.89	1.78	.08
5-412	5.414	.035	.103	.003	5-412	137.52	0.89	2.62	.08
5-855	5.444	.035	.124	.004	5-855	138.28	0.89	3.15	.10
5-856	5.465	.035	.070	.003	5-856	138.81	0.89	1.78	.08
5-413	5.475	.035	.164	.005	5-413	139.07	0.89	4.17	.13
5-414	5.487	.035	.062	.003	5-414	139.37	0.89	1.57	.08
5-858	5.500	.035	.168	.005	5-858	139.70	0.89	4.27	.13
5-416	5.553	.035	.120	.004	5-416	141.05	0.89	3.05	.10
5-062	5.604	.040	.070	.003	5-062	142.34	1.02	1.78	.08
5-417	5.616	.040	.127	.004	5-417	142.65	1.02	3.23	.10
5-063	5.750	.040	.070	.003	5-063	146.05	1.02	1.78	.08
5-862	5.789	.040	.252	.006	5-862	147.04	1.02	6.40	.15
5-863	5.815	.040	.140	.004	5-863	147.70	1.02	3.56	.10
5-420	5.826	.040	.314	.010	5-420	147.98	1.02	7.98	.25
5-969	5.875	.040	.103	.003	5-969	149.23	1.02	2.62	.08
5-421	5.882	.040	.110	.004	5-421	149.40	1.02	2.79	.10
5-573	5.968	.040	.070	.003	5-573	151.59	1.02	1.78	.08
5-567	5.985	.040	.070	.003	5-567	152.02	1.02	1.78	.08
5-1041	6.023	.040	.103	.003	5-1041	152.98	1.02	2.62	.08
5-064	6.350	.040	.275	.006	5-064	161.29	1.02	6.99	.15
5-428	6.361	.040	.108	.004	5-428	161.57	1.02	2.74	.10
5-430	6.482	.040	.170	.005	5-430	164.64	1.02	4.32	.13
5-666	6.520	.040	.070	.003	5-666	165.61	1.02	1.78	.08
5-869	6.609	.045	.139	.004	5-869	167.87	1.14	3.53	.10
5-871	6.850	.045	.275	.006	5-871	173.99	1.14	6.99	.15
5-434	7.108	.045	.275	.006	5-434	180.54	1.14	6.99	.15
5-696	7.110	.045	.103	.003	5-696	180.59	1.14	2.62	.08
5-691	7.139	.045	.072	.003	5-691	181.33	1.14	1.83	.08
5-873	7.230	.045	.070	.003	5-873	183.64	1.14	1.78	.08
5-975	7.425	.045	.260	.006	5-975	188.60	1.14	6.60	.15
5-875	7.580	.050	.210	.005	5-875	192.53	1.27	5.33	.13
5-438	7.613	.050	.070	.003	5-438	193.37	1.27	1.78	.08
5-439	7.640	.050	.125	.004	5-439	194.06	1.27	3.18	.10
5-876	7.674	.050	.210	.005	5-876	194.92	1.27	5.33	.13
5-877	7.802	.050	.104	.003	5-877	198.17	1.27	2.64	.08
5-442	8.015	.050	.187	.005	5-442	203.58	1.27	4.75	.13
5-445	8.277	.050	.275	.006	5-445	210.24	1.27	6.99	.15
5-880	8.350	.050	.275	.006	5-880	212.09	1.27	6.99	.15
5-575	8.875	.055	.070	.003	5-575	225.42	1.40	1.78	.08
5-450	9.071	.055	.062	.003	5-450	230.40	1.40	1.57	.08
5-882	9.162	.055	.210	.005	5-882	232.72	1.40	5.33	.13
5-635	9.370	.055	.103	.003	5-635	238.00	1.40	2.62	.08

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table *- continued*

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-454	9.565	.055	.103	.003	5-454	242.95	1.40	2.62	.08
5-883	9.820	.060	.103	.003	5-883	249.43	1.52	2.62	.08
5-884	9.984	.060	.070	.003	5-884	253.59	1.52	1.78	.08
5-885	10.171	.060	.139	.004	5-885	258.34	1.52	3.53	.10
5-886	10.178	.060	.112	.004	5-886	258.52	1.52	2.84	.10
5-457	10.232	.060	.139	.004	5-457	259.89	1.52	3.53	.10
5-458	10.340	.060	.139	.004	5-458	262.64	1.52	3.53	.10
5-887	10.343	.060	.275	.006	5-887	262.71	1.52	6.99	.15
5-165	10.359	.060	.139	.004	5-165	263.12	1.52	3.53	.10
5-889	10.372	.060	.104	.003	5-889	263.45	1.52	2.64	.08
5-976	10.425	.060	.260	.006	5-976	264.80	1.52	6.60	.15
5-463	10.504	.060	.125	.004	5-463	266.80	1.52	3.18	.10
5-890	10.606	.060	.103	.003	5-890	269.39	1.52	2.62	.08
5-623	10.630	.060	.139	.004	5-623	270.00	1.52	3.53	.10
5-464	10.656	.060	.070	.003	5-464	270.66	1.52	1.78	.08
5-656	10.702	.060	.070	.003	5-656	271.83	1.52	1.78	.08
5-891	10.734	.060	.139	.004	5-891	272.64	1.52	3.53	.10
5-466	10.749	.060	.210	.005	5-466	273.03	1.52	5.33	.10
5-469	10.883	.060	.103	.003	5-469	276.43	1.52	2.62	.08
5-471	10.995	.060	.149	.004	5-471	279.27	1.52	3.78	.10
5-894	10.996	.060	.103	.003	5-894	279.30	1.52	2.62	.10
5-474	11.331	.060	.275	.006	5-474	287.81	1.52	6.99	.15
5-898	11.335	.060	.103	.003	5-898	287.91	1.52	2.62	.08
5-476	11.562	.070	.275	.006	5-476	293.67	1.78	6.99	.15
5-069	11.750	.070	.139	.004	5-069	298.45	1.78	3.53	.10
5-478	11.860	.070	.139	.004	5-478	301.24	1.78	3.53	.10
5-576	12.000	.070	.159	.005	5-576	304.80	1.78	4.04	.13
5-900	12.000	.070	.187	.005	5-900	304.80	1.78	4.75	.13
5-480	12.017	.070	.285	.006	5-480	305.23	1.78	7.24	.15
5-482	12.109	.070	.139	.004	5-482	307.57	1.78	3.53	.10
5-164	12.160	.070	.210	.005	5-164	308.86	1.78	5.33	.13
5-901	12.234	.070	.139	.004	5-901	310.74	1.78	3.53	.10
5-484	12.250	.070	.150	.005	5-484	311.15	1.78	3.81	.13
5-485	12.260	.070	.139	.004	5-485	311.40	1.78	3.53	.10
5-486	12.299	.070	.137	.004	5-486	312.39	1.78	3.48	.10
5-902	12.360	.070	.210	.005	5-902	313.94	1.78	5.33	.13
5-487	12.380	.070	.139	.004	5-487	314.45	1.78	3.53	.10
5-488	12.463	.070	.103	.003	5-488	316.56	1.78	2.62	.08
5-569	12.475	.070	.139	.004	5-569	316.87	1.78	3.53	.10
5-905	12.623	.070	.140	.004	5-905	320.62	1.78	3.56	.10
5-906	12.705	.070	.070	.003	5-906	322.71	1.78	1.78	.08
5-907	12.725	.070	.275	.006	5-907	323.22	1.78	6.99	.15
5-908	12.840	.070	.139	.004	5-908	326.14	1.78	3.53	.10
5-611	12.900	.070	.159	.005	5-611	327.66	1.78	4.04	.13

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-619	12.915	.070	.139	.004	5-619	328.04	1.78	3.53	.10
5-492	13.248	.070	.139	.004	5-492	336.50	1.78	3.53	.10
5-070	13.270	.070	.139	.004	5-070	337.06	1.78	3.53	.10
5-910	13.375	.070	.210	.005	5-910	339.73	1.78	5.33	.13
5-071	13.410	.070	.139	.004	5-071	340.61	1.78	3.53	.10
5-072	13.460	.070	.210	.005	5-072	341.88	1.78	5.33	.13
5-493	13.490	.070	.139	.004	5-493	342.65	1.78	3.53	.10
5-494	13.541	.070	.210	.005	5-494	343.94	1.78	5.33	.13
5-495	13.601	.070	.139	.004	5-495	345.47	1.78	3.53	.10
5-496	13.616	.070	.141	.004	5-496	345.85	1.78	3.58	.10
5-498	13.650	.070	.139	.004	5-498	346.71	1.78	3.53	.10
5-500	13.718	.070	.275	.006	5-500	348.44	1.78	6.48	.15
5-912	13.734	.070	.139	.004	5-912	348.84	1.78	3.53	.10
5-1097	13.750	.070	.103	.003	5-1097	349.25	1.78	2.62	.08
5-073	13.820	.080	.139	.004	5-073	351.03	2.03	3.53	.10
5-564	14.062	.080	.139	.004	5-564	357.17	2.03	3.53	.10
5-502	14.088	.080	.210	.005	5-502	357.84	2.03	5.33	.13
5-624	14.111	.080	.139	.004	5-624	358.42	2.03	3.53	.10
5-074	14.234	.080	.139	.004	5-074	361.54	2.03	3.53	.10
5-916	14.369	.080	.278	.006	5-916	364.97	2.03	7.06	.15
5-504	14.430	.080	.139	.004	5-504	366.52	2.03	3.53	.10
5-626	14.470	.080	.087	.003	5-626	367.54	2.03	2.21	.08
5-505	14.470	.080	.139	.004	5-505	367.54	2.03	3.53	.10
5-506	14.570	.080	.141	.004	5-506	370.08	2.03	3.58	.10
5-507	14.600	.080	.210	.005	5-507	370.84	2.03	5.33	.13
5-508	14.674	.080	.139	.004	5-508	372.72	2.03	3.53	.10
5-166	14.722	.080	.139	.004	5-166	373.94	2.03	3.53	.10
5-920	14.780	.080	.175	.005	5-920	375.41	2.03	4.45	.13
5-921	14.795	.080	.071	.003	5-921	375.79	2.03	1.80	.08
5-922	14.990	.080	.104	.003	5-922	380.75	2.03	2.64	.08
5-512	15.171	.080	.139	.004	5-512	385.34	2.03	3.53	.10
5-076	15.260	.080	.210	.005	5-076	387.60	2.03	5.33	.13
5-077	15.300	.080	.139	.004	5-077	388.62	2.03	3.53	.10
5-924	15.410	.080	.210	.005	5-924	391.41	2.03	5.33	.13
5-925	15.465	.080	.188	.005	5-925	392.81	2.03	4.78	.13
5-079	15.540	.080	.139	.004	5-097	394.72	2.03	3.53	.10
5-515	15.548	.080	.210	.005	5-515	394.92	2.03	5.33	.13
5-516	15.740	.080	.139	.004	5-516	399.80	2.03	3.53	.10
5-517	15.750	.080	.275	.006	5-517	400.05	2.03	6.99	.15
5-1099	16.014	.080	.102	.003	5-1099	406.76	2.03	2.59	.08
5-518	16.031	.080	.256	.006	5-518	407.19	2.03	6.50	.15
5-571	16.234	.090	.139	.004	5-571	412.34	2.29	3.53	.10
5-930	16.285	.090	.250	.006	5-930	413.64	2.29	6.35	.15
5-520	16.435	.090	.139	.004	5-520	417.45	2.29	3.53	.10
5-522	16.507	.090	.225	.006	5-522	419.28	2.29	5.72	.15

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Table 9-3: Parker Series 5-XXX O-Ring Size Cross Reference Table *- continued*

Std. 5-Size	Inches				Metric 5-Size	Millimeters			
	I.D.	Tol ±	W	Tol ±		I.D.	Tol ±	W	Tol ±
5-080	16.575	.090	.187	.005	5-080	421.01	2.29	4.75	.13
5-524	16.640	.090	.210	.005	5-524	422.66	2.29	5.33	.13
5-622	16.750	.090	.275	.006	5-622	425.45	2.29	6.99	.15
5-525	16.765	.090	.125	.004	5-525	425.83	2.29	3.18	.10
5-081	16.830	.090	.210	.005	5-081	427.48	2.29	5.33	.13
5-935	17.100	.090	.275	.006	5-935	434.34	2.29	6.99	.15
5-526	17.250	.090	.187	.005	5-526	438.15	2.29	4.75	.13
5-082	17.250	.090	.240	.006	5-082	438.15	2.29	6.10	.15
5-528	17.268	.090	.242	.006	5-528	438.61	2.29	6.15	.15
5-936	17.296	.090	.210	.005	5-936	439.32	2.29	5.33	.13
5-937	17.390	.090	.139	.004	5-937	441.71	2.29	3.53	.10
5-529	17.455	.090	.139	.004	5-529	443.36	2.29	3.53	.10
5-1100	17.500	.090	.139	.004	5-1100	444.50	2.29	3.53	.10
5-939	17.870	.090	.210	.005	5-939	453.90	2.29	5.33	.13
5-621	17.875	.090	.187	.005	5-621	454.03	2.29	4.75	.13
5-083	17.910	.090	.139	.004	5-083	454.91	2.29	3.53	.10
5-532	18.000	.090	.103	.003	5-532	457.20	2.29	2.62	.08
5-084	18.062	.090	.281	.006	5-084	458.77	2.29	7.16	.15
5-533	18.169	.090	.096	.003	5-533	461.49	2.29	2.44	.08
5-1102	18.265	.090	.210	.005	5-1102	463.93	2.29	5.33	.13
5-085	18.350	.090	.210	.005	5-085	466.09	2.29	5.33	.13
5-534	18.405	.090	.210	.005	5-534	467.49	2.29	5.33	.13
5-1104	18.500	.090	.188	.005	5-1104	469.90	2.29	4.78	.13
5-1105	18.635	.090	.139	.004	5-1105	473.33	2.29	3.53	.10
5-943	18.870	.100	.275	.006	5-943	479.30	2.54	6.99	.15
5-944	18.880	.100	.139	.004	5-944	479.55	2.54	3.53	.10
5-946	19.310	.100	.140	.004	5-946	490.47	2.54	3.56	.10
5-947	19.380	.100	.139	.004	5-947	492.25	2.54	3.53	.10
5-541	19.500	.100	.250	.006	5-541	495.30	2.54	6.35	.15
5-086	19.580	.100	.210	.005	5-086	497.33	2.54	5.33	.13
5-948	19.725	.100	.210	.005	5-948	501.02	2.54	5.33	.13
5-1022	19.941	.100	.289	.007	5-1022	506.50	2.54	7.34	.18
5-950	19.960	.100	.139	.004	5-950	506.98	2.54	3.53	.10
5-1019	20.180	.100	.125	.004	5-1019	512.57	2.54	3.18	.10
5-1010	20.609	.100	.139	.004	5-1010	523.47	2.54	3.53	.10
5-088	21.180	.100	.147	.004	5-088	537.97	2.54	3.73	.10
5-547	21.564	.100	.139	.004	5-547	547.73	2.54	3.53	.10
5-953	22.360	.100	.132	.004	5-953	567.94	2.54	3.35	.10
5-549	22.500	.100	.250	.006	5-549	571.50	2.54	6.35	.15
5-089	23.406	.120	.281	.006	5-089	594.51	3.05	7.14	.15
5-551	23.540	.120	.139	.004	5-551	597.92	3.05	3.53	.10
5-090	23.576	.120	.139	.004	5-090	598.83	3.05	3.53	.10
5-552	23.612	.120	.275	.006	5-552	599.74	3.05	6.99	.15
5-167	23.780	.120	.375	.007	5-167	604.01	3.05	9.52	.18
5-168	24.875	.120	.250	.006	5-168	631.82	3.05	6.35	.15
5-169	25.153	.120	.214	.005	5-169	638.89	3.05	5.44	.13
5-091	25.474	.120	.139	.004	5-091	647.04	3.05	3.53	.10
5-170	25.500	.120	.275	.006	5-170	647.70	3.05	6.99	.15
5-171	26.125	.120	.275	.006	5-171	663.58	3.05	6.99	.15
5-173	26.188	.120	.210	.005	5-173	665.18	3.05	5.33	.13
5-631	26.408	.120	.139	.004	5-631	670.76	3.05	3.53	.10
5-172	27.485	.120	.275	.006	5-172	698.12	3.05	6.99	.15
5-092	27.625	.120	.275	.006	5-092	701.68	3.05	6.99	.15
5-955	28.801	.140	.275	.006	5-955	731.55	3.56	6.99	.15

(a) The rubber compound must be added when ordering by the 5-size number (i.e., 5-007 N0674-70).
(b) This chart provides dimensions for standard (AN) shrinkage materials ONLY. O-Rings manufactured out of compounds with different shrinkage rates (other than AN) will produce slightly different dimensions and tolerances.

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Zatkoff SEALS & PACKINGS

Table 9-4: Series 5-XXX Locator Table

SIZE	I.D.
5-001	.547
5-002	.416
5-003	.836
5-004	1.070
5-005	.640
5-006	.796
5-008	1.421
5-009	1.553
5-011	1.860
5-015	2.296
5-018	.352
5-021	.603
5-022	.890
5-024	1.515
5-025	1.765
5-027	2.140
5-031	3.640
5-034	1.599
5-035	1.786
5-037	2.036
5-039	2.411
5-042	2.846
5-044	3.036
5-045	3.161
5-049	.871
5-051	.070
5-052	.270
5-056	.301
5-057	.364
5-058	.426
5-060	4.390
5-062	5.604
5-063	5.750
5-064	6.350
5-069	11.750
5-070	13.270
5-071	13.410
5-072	13.460
5-073	13.820
5-074	14.234
5-076	15.260
5-077	15.300
5-079	15.540
5-080	16.575
5-081	16.830
5-082	17.250
5-083	17.910
5-084	18.062
5-085	18.350
5-086	19.580
5-088	21.180
5-089	23.406
5-090	23.576
5-091	25.474
5-092	27.625
5-101	.100
5-102	.116

SIZE	I.D.
5-103	.128
5-105	.154
5-106	.154
5-107	.176
5-108	.176
5-118	.059
5-124	.176
5-125	.180
5-127	.239
5-133	.332
5-134	.410
5-135	.526
5-136	.643
5-137	.775
5-138	.898
5-139	.987
5-140	1.112
5-141	1.226
5-142	1.450
5-143	1.670
5-144	1.891
5-145	2.141
5-148	.154
5-151	.239
5-152	.301
5-156	.575
5-157	1.338
5-158	1.550
5-159	2.683
5-160	.312
5-162	.554
5-164	12.160
5-165	10.359
5-166	14.722
5-167	23.780
5-168	24.875
5-169	25.153
5-170	25.500
5-171	26.125
5-172	27.485
5-173	26.188
5-178	.120
5-179	.239
5-180	.248
5-181	.725
5-187	.070
5-190	.132
5-193	.176
5-194	.228
5-197	.242
5-200	.265
5-202	.278
5-204	.312
5-205	.312
5-206	.326
5-209	.370
5-211	.375

SIZE	I.D.
5-212	.384
5-215	.418
5-218	.425
5-222	.455
5-223	.458
5-225	.469
5-230	.500
5-231	.501
5-236	.562
5-239	.570
5-242	.600
5-243	.604
5-247	.623
5-248	.625
5-250	.627
5-251	.631
5-252	.652
5-254	.660
5-256	.707
5-257	.772
5-263	.750
5-264	.752
5-266	.766
5-273	.879
5-278	.979
5-279	1.004
5-290	1.180
5-291	1.186
5-294	1.213
5-295	1.225
5-296	1.229
5-297	1.230
5-301	1.259
5-309	1.436
5-312	1.454
5-320	1.540
5-321	1.559
5-327	1.640
5-329	1.670
5-330	1.674
5-332	1.687
5-335	1.802
5-337	1.873
5-338	1.925
5-342	1.980
5-343	2.000
5-346	2.046
5-347	2.163
5-348	2.172
5-354	2.471
5-355	2.524
5-358	2.576
5-361	2.671
5-367	2.924
5-368	3.020
5-369	3.037
5-374	3.112

SIZE	I.D.
5-380	3.363
5-381	3.475
5-385	3.603
5-390	3.957
5-394	4.096
5-395	4.117
5-396	4.171
5-401	4.531
5-402	4.750
5-403	4.930
5-1068	5.139
5-407	5.249
5-408	5.265
5-410	5.340
5-412	5.414
5-413	5.475
5-414	5.487
5-416	5.553
5-417	5.616
5-420	5.826
5-421	5.882
5-428	6.361
5-430	6.482
5-434	7.108
5-438	7.613
5-439	7.640
5-442	8.015
5-445	8.277
5-450	9.071
5-454	9.565
5-457	10.232
5-458	10.340
5-463	10.504
5-464	10.656
5-466	10.749
5-469	10.883
5-471	10.995
5-474	11.331
5-476	11.562
5-478	11.860
5-480	12.017
5-482	12.109
5-484	12.250
5-485	12.260
5-486	12.299
5-487	12.380
5-488	12.463
5-492	13.248
5-493	13.490
5-494	13.541
5-495	13.601
5-496	13.616
5-498	13.650
5-500	13.718
5-502	14.088
5-504	14.430
5-505	14.470

SIZE	I.D.
5-506	14.570
5-507	14.600
5-508	14.674
5-512	15.171
5-515	15.548
5-516	15.740
5-517	15.750
5-518	16.031
5-520	16.435
5-522	16.507
5-524	16.640
5-525	16.765
5-526	17.250
5-528	17.268
5-529	17.455
5-532	18.000
5-533	18.169
5-534	18.405
5-541	19.500
5-547	21.564
5-549	22.500
5-551	23.540
5-552	23.612
5-557	3.125
5-559	5.236
5-563	.583
5-564	14.062
5-566	.489
5-567	5.985
5-569	12.475
5-571	16.234
5-573	5.968
5-575	8.875
5-576	12.000
5-578	.102
5-579	.133
5-580	.165
5-581	.192
5-582	.224
5-583	.251
5-584	.283
5-585	.314
5-586	.350
5-587	.350
5-588	.413
5-590	.535
5-591	.594
5-592	.665
5-593	.724
5-594	.720
5-595	.779
5-596	.838
5-597	.905
5-598	.968

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Table 9-4: Series 5-XXX Locator Table *- continued*

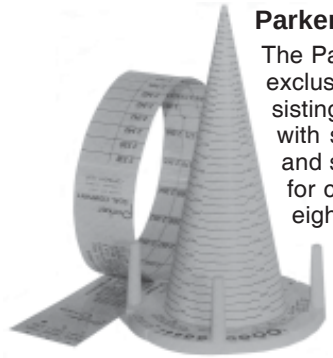
SIZE	I.D.
5-599	1.031
5-600	1.094
5-601	1.153
5-602	1.212
5-603	1.279
5-604	1.342
5-605	1.401
5-606	1.468
5-609	.600
5-611	12.900
5-612	.344
5-613	.437
5-614	.391
5-615	.469
5-616	.516
5-617	.625
5-618	1.016
5-619	12.915
5-621	17.875
5-622	16.750
5-623	10.630
5-624	14.111
5-626	14.470
5-631	26.408
5-632	.110
5-635	9.370
5-638	.233
5-642	2.051
5-643	.650
5-646	.126
5-652	.473
5-655	2.020
5-656	10.702
5-657	1.465
5-664	.320
5-666	6.520
5-669	.146
5-670	1.437
5-671	1.680
5-673	.305
5-675	.508
5-676	.610

SIZE	I.D.
5-677	1.004
5-682	.426
5-683	.122
5-685	.208
5-686	.248
5-687	.287
5-691	7.139
5-696	7.110
5-697	2.878
5-698	.283
5-699	.353
5-700	.354
5-701	1.937
5-702	2.312
5-703	2.563
5-704	2.812
5-705	2.937
5-708	.850
5-709	1.000
5-710	.301
5-712	.313
5-716	.362
5-718	.395
5-726	.484
5-735	.583
5-736	.590
5-743	.660
5-751	.820
5-753	.857
5-761	1.010
5-763	1.080
5-769	1.176
5-780	1.412
5-788	1.591
5-794	1.812
5-795	1.850
5-796	1.913
5-800	2.225
5-805	2.535
5-807	2.782
5-810	3.041
5-811	3.060

SIZE	I.D.
5-813	3.130
5-815	3.156
5-816	3.162
5-819	3.210
5-821	3.300
5-825	3.350
5-828	3.661
5-831	4.020
5-833	4.085
5-836	4.427
5-840	4.630
5-842	4.664
5-843	4.674
5-844	4.682
5-848	4.875
5-850	4.925
5-851	4.984
5-852	5.030
5-853	5.057
5-855	5.444
5-856	5.465
5-858	5.500
5-862	5.789
5-863	5.815
5-869	6.609
5-871	6.850
5-873	7.230
5-875	7.580
5-876	7.674
5-877	7.802
5-880	8.350
5-882	9.162
5-883	9.820
5-884	9.984
5-885	10.171
5-886	10.178
5-887	10.343
5-889	10.372
5-890	10.606
5-891	10.734
5-894	10.996
5-898	11.335

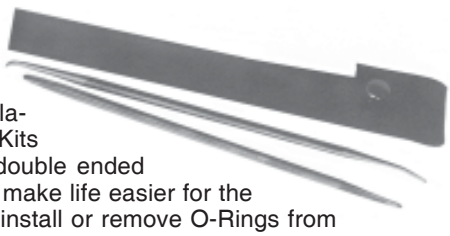
SIZE	I.D.
5-900	12.000
5-901	12.234
5-902	12.360
5-905	12.623
5-906	12.705
5-907	12.725
5-908	12.840
5-910	13.375
5-912	13.734
5-916	14.369
5-920	14.780
5-921	14.795
5-922	14.990
5-924	15.410
5-925	15.465
5-930	16.285
5-935	17.100
5-936	17.296
5-937	17.390
5-939	17.870
5-943	18.870
5-944	18.880
5-946	19.310
5-947	19.380
5-948	19.725
5-950	19.960
5-953	22.360
5-955	28.801
5-964	.744
5-969	5.875
5-975	7.425
5-976	10.425
5-979	3.443
5-980	1.475
5-981	1.850
5-982	2.725
5-983	2.975

SIZE	I.D.
5-984	3.225
5-985	3.600
5-986	3.725
5-987	3.975
5-988	4.100
5-989	4.225
5-1002	.239
5-1004	.290
5-1006	.322
5-1007	.330
5-1010	20.609
5-1011	.447
5-1014	.525
5-1017	.709
5-1018	1.671
5-1019	20.180
5-1022	19.941
5-1023	1.788
5-1028	1.190
5-1030	19.512
5-1041	6.023
5-1042	1.817
5-1043	1.882
5-1044	2.060
5-1046	2.140
5-1047	2.281
5-1052	3.080
5-1053	3.354
5-1054	4.080
5-1056	4.484
5-1097	13.750
5-1099	16.014
5-1100	17.500
5-1102	18.265
5-1104	18.500
5-1105	18.635



Parker O-Ring Sizing Gauges

The Parker Size Gauge for O-Rings is an exclusive Parker Seal Group device consisting of a uniquely marked plastic cone with special cross-section measuring base and separate pi tape. The device is used for checking any sample O-Ring up to eight (8.00") inches in diameter to determine the nearest standard Parker Seal 2-dash size (corresponding to ARP568B standard series O-Rings). NOTE: The device does not measure actual dimensions. Proper identifications and markings appear on the cone and tape, making the device easy to use. Available from your nearest Zatkoff location.



Parker O-Ring Installation & Extraction Tools

Parker O-Ring Installation & Extration Tool Kits contain two unique double ended brass tools that help make life easier for the mechanic who must install or remove O-Rings from hydraulic or pneumatic cylinders or other equipment. Brass tools prevent damage to precision sealing surfaces. Complete with plastic pocket case and instruction sheet. Available from your nearest Zatkoff location.