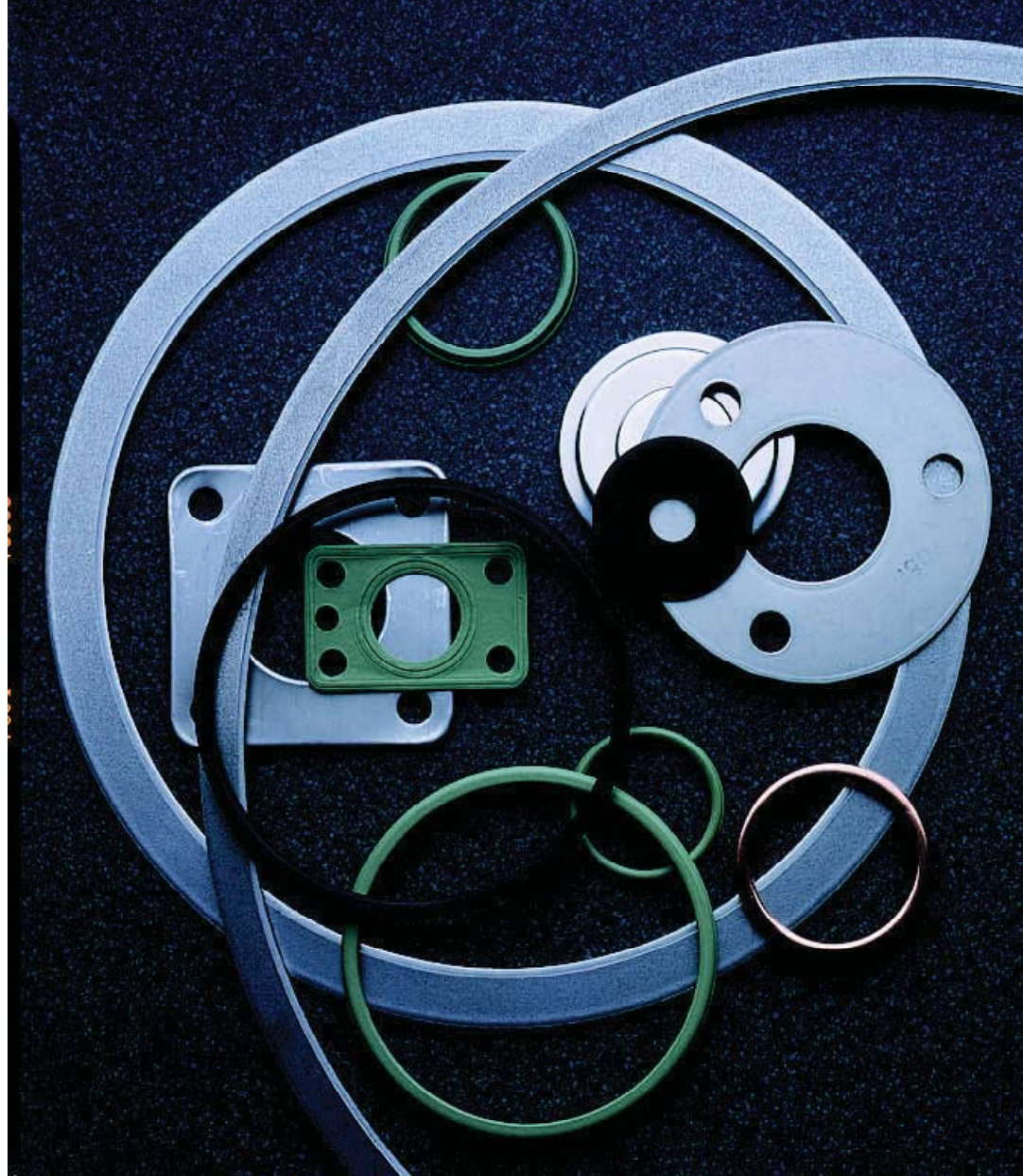
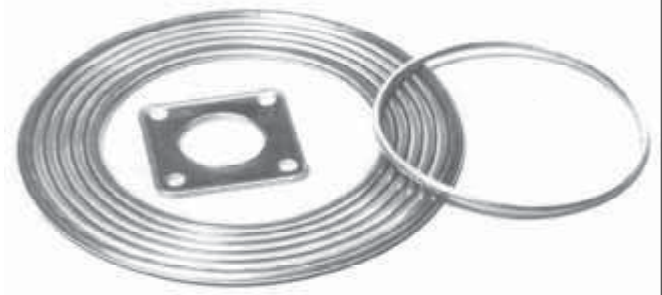


**Catalog 5135 USA**





# PARKER METAL GASKETS & SEALS



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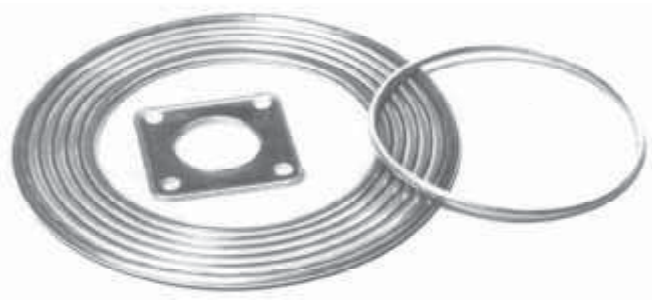
## Need Assistance?

If you need assistance or information in ordering any Parker metal gasket, contact:

**PARKER HANNIFIN CORP.**  
**O-SEAL DIVISION**  
**7664 PANASONIC WAY**  
**SAN DIEGO, CA 92173**  
**TELEPHONE: 619-661-7000**  
**or FAX: 619-671-3202**



## Metal-Jacketed Gaskets



**Why Suggested** - Parker Metal-Jacketed Gaskets are a practical answer to the problem of circular or non-circular sealing problems. This family of gaskets offers good compressibility and excellent compensation for flange irregularities and misalignment when high pressures up to 2500 psi (or higher, depending on joint design) must be contained. By selecting the proper style, almost any size or configuration can be produced.

**Where Recommended** - Parker Metal-Jacketed Gaskets are ideally suited for smooth surface applications such as heat exchangers, valve bonnets, gas mains, vacuum lines, cast iron flanges, autoclaves, boilers and glass-lined equipment. Recommended for use on circular and non-circular applications requiring minimum of 20 to 30 percent compressibility to compensate for flange misalignment, warping, etc.

Parker Metal-Jacketed Gaskets are designed for use in assemblies where the elasticity of bolts or flange design can compensate for joint relaxation. For joints requiring close maintenance of the compressed thickness or joints which mechanically limit compression (such as metal-to-metal), use of Parker metal jacketed geometry is normally not recommended.

**How They Work** - Parker Metal-Jacketed Gaskets are fabricated with a soft, conformable filler, partially or wholly encased in a metal jacket. The primary sealing interface is the inner metal lap where the gasket is thickest when under compression. This area flows into the flange surfaces to create the joint seal; therefore, the entire inner lap must be under compression. The outer lap, if any, when under compression between the flange faces provides a secondary sealing line.

**Available Metal-Jacketed Styles** - Parker Metal-Jacketed Gaskets are produced in a wide range of cross-sections, each designed to provide optimum sealing in a particular application. These styles are shown at the bottom of this page.

**Metal Materials Available** - Standard metals used in the construction of Parker Metal-Jacketed Gaskets and their temperature limits are listed below:

MATERIAL	MAX. TEMP.(°F)
<b>Common Brasses</b>	<b>500°</b>
<b>Copper</b>	<b>600°</b>
<b>Aluminum</b>	<b>800°</b>
<b>Stainless Steel, Type 304</b>	<b>1000°</b>
<b>Stainless Steel, Type 316</b>	<b>1000°</b>
<b>Soft Iron, Low Carbon Steel</b>	<b>1000°</b>
<b>Titanium</b>	<b>1000°</b>
<b>Stainless Steel, Type 50</b>	<b>1150°</b>
<b>Stainless Steel, Type 410</b>	<b>1200°</b>
<b>Silver</b>	<b>1200°</b>
<b>Nickel</b>	<b>1400°</b>
<b>Stainless Steel, Type 430</b>	<b>1400°</b>
<b>Monel</b>	<b>1500°</b>
<b>Stainless Steel, Type 309 SCb</b>	<b>1600°</b>
<b>Stainless Steel, Type 321</b>	<b>1600°</b>
<b>Stainless Steel, Type 347</b>	<b>1600°</b>
<b>Inconel</b>	<b>2000°</b>
<b>Hastelloy</b>	<b>2000°</b>

**Filler Materials Available** - Currently available filler materials for metal-jacketed gaskets are:

**PARMITE** - For service to 900°F and in noncritical service to 1200°F.

**PTFE** - For service to 500°F where extremely corrosive conditions exist.

**GRAFOIL** - For service in extreme temperature conditions.

**METAL MESH** - For service in extreme temperature conditions.

## ***Metal-Jacketed Gaskets***

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### **STYLE P-920 (Single Jacketed)**

The Style P-920 Gasket is recommended for relatively narrow applications. Constructed by encasing the soft filler material on one face and both edges, this style is well suited for narrow-faced closures because the width/diameter limitations do not apply.

Circular and non-circular shapes can be supplied in this style and at a lower cost than "french" type gaskets. NOTE: Specification MS35769 (AN-900) is available in most sizes. For gasket widths over 1/4", Parker Style P-923 Double-Jacketed Gaskets are suggested. Standard thickness available is 3/32".

### **STYLE P-920 BOILER GASKETS**

Parker Style P-920 Gaskets are available in standard hand-hole and tube cap sizes. The light gauge metal jacket, together with the soft filler, provides a rugged yet resilient construction ideally suited for general service in applications not subject to wide fluctuation in operating temperature and pressure.

### **STYLE P-923 (Double Jacketed)**

This gasket is constructed of a soft filler material completely enclosed by a metal shell and top washer. The enclosed edges and added protection of the top washer make the Style P-923 gasket more suitable than french type gaskets for some non-circular applications. The additional thickness of the outer lap joint is helpful in preventing excessive distortion of lightweight flanges.

A gasket width of at least 1/4" is required for P-923 construction. For widths less than 1/4", Styles P-920 and P-930 are recommended.

Parker Style P-923 Gaskets are available in both circular and non-circular configurations.

### **STYLE P-924 (Overlapped Jacket)**

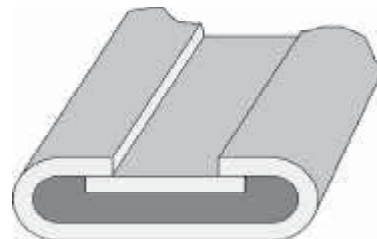
This style is recommended when a completely enclosed gasket is required in widths less than those available in the P-923 style. Style P-924 is constructed by enclosing the Parmite filler with a single metal shell overlapping one face. This style is also available with a filler material of meshed metal wire which supplies more resilience than Parmite. Limited to circular sizes in excess of 1" inside diameter.

### **STYLE P-930 (French Type)**

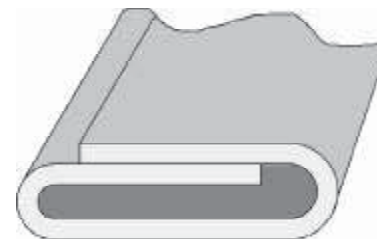
The Parker Style P-930 Gasket is ideal for narrow circular applications such as valve bonnets, sight glasses and vacuum seals requiring a positive unbroken metal gasket line across the full width of the flange face. Style P-930 Gaskets are made by folding a metal jacket over the inner edge and both faces of a soft filler leaving the outer edge exposed. Maximum width is limited by metal, gasket diameter and gasket thickness.



**STYLE P-920 (Single Jacketed)**  
**STYLE P-920 BOILER GASKETS**



**STYLE P-923 (Double Jacketed)**



**STYLE P-924 (Overlapped Jacket)**



**STYLE P-930 (French Type)**

### STYLE P-931 & P-932 (French Type)

These are modifications of the basic Style P-930. The two-piece construction of the P-931 and the three-piece construction of the P-932 are recommended for wide or irregular shapes such as cylinder heads and odd-shaped valve bonnets not requiring protection of the filler material or additional flange support at the outer edge.

### STYLE P-933 (French Type)

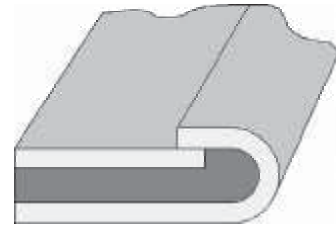
Parker Style P-933 Gaskets are designed expressly for use with glass-lined equipment or lightly bolted flanges. Style P-933 construction consists of a thick woven Parmite filler with a one-piece metal jacket covering the inner edge and equal portions of both contact faces. Style P-933 is also available with an envelope of pure PTFE, either split or welded.

For glass-lined equipment, the jacket material should be of a soft material such as lead, aluminum, silver or copper. In dimensioning Style P-933 Gaskets for glass-lined flanges, it is important that the metal jacket be fully in contact with the flat portion of the flange faces. The Inside Diameter of the gasket must be located outside of the radiused area of the flange bore. This will assure a positive seal between the flange jacket and the glass-lined parts, and will protect the soft gasket filler.

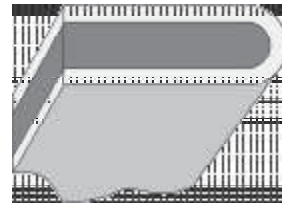
For metal flanges, soft iron or steel, monel, nickel and stainless steel are popular jacket choices.

### STYLE P-934 (Inside-Open Type)

This style is the reverse of the French Type gasket and may be required for applications where the outer edge of the gasket is exposed to fluid pressure or where a non-metallic gasket must be used but mechanical reinforcement is desirable around the outer edge of the gasket.



**STYLE P-931 (French Type)**  
**STYLE P-932 Not Shown**



**STYLE P-933 (French Type)**



**STYLE P-934 (Inside-Open Type)**

## Corrugated Gaskets

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**Why Suggested** - Parker Corrugated Gaskets are available in non-standard sizes or irregular shapes. By proper material selection, this type of gasket can be used at almost any temperature in low pressure applications.

**Where Recommended** - Parker Corrugated Gaskets are recommended for use in valve bonnet joints, fuel and combustion line connections for aircraft gas turbines, steam chests, high-temperature exhaust ducts and glass-lined equipment. This type of gasket is best suited for smooth-faced, complex circular or non-circular shapes at low pressure to 500 psi. The pressure range may be extended to 1000 psi and used on rougher flange finishes with proper joint sealing compound.

Parker Corrugated Gaskets are also available with Parmite cord cemented into the corrugations for use in lightweight cast iron or large, rough or warped flanges for service to 600 psi. For severely warped or badly pitted flanges a Parmite cloth jacket is available.

**How They Work** - Parker Corrugated Gaskets require relatively light bolt force to flow the gasket metal at the points of contact with the flange faces. The corrugations afford some degree of resilience, depending upon their pitch, depth and the type of thickness of the metal. Corrugated gaskets also supply a labyrinth effect for secondary sealing and act as support for sealant compound, Parmite jackets and/or cord inserts.

**What Constructions Are Available** - Parker Corrugated Gaskets are made of thin metal, corrugated or embossed with rings concentric with the gasket's inside diameter. Corrugation pitch for the P-900 style can range from .045" to .250" with the overall gasket thickness varying between 40% and 50% of the corrugation pitch. Temperature limits are determined by metal specified.

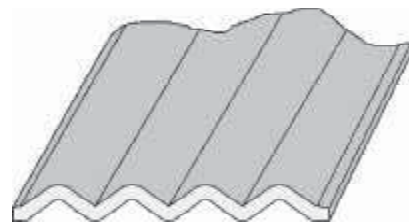
Standard metals used to fabricate these gaskets are soft steel, copper, monel, and type 304 stainless steel. Other available materials include stainless types 405, 410, 302, 316, 321, 347 and Hastelloy

### STYLE P-900

This is a plain, all-metal corrugated gasket for use in low pressure applications to 500 psi, requiring a thin line contact type gasket because of space or weight limitations. For such applications, metal thicknesses are between 0.010" to 0.031" depending on metal and corrugation pitch.

Thicknesses less than .010" are likely to rupture during manufacture. Although a minimum of two corrugations is desirable on each gasket face, many applications exist that use only a single one.

A slight "flat" inside the inner corrugation and outside the outer corrugation will stiffen the gasket and is desirable.



**STYLE P-900**

**Why Suggested** - Parker Flat Metal Gaskets are relatively inexpensive to produce and deliver good sealing performance in a variety of applications over a wide temperature range. The machined styles, with reduced surface may be the only answer to high-pressure, high-temperature situations or corrosive applications in flanges where available bolting forces are too light to accommodate the style P-940 type gasket.

**Where Recommended** - Parker Flat Metal Gaskets are recommended for use in valve bonnets, ammonia fittings, heat exchangers, hydraulic presses and tongue and groove flange joints. Solid metal gaskets like Style P-940 give good service when compressibility is not required to compensate for flange surface finish, warped faces or misalignment and where there is sufficient clamping force available to flow the gasket metal selected.

Machined styles, with profiled cross-sections, are used where the available bolt force is not adequate to properly seal a flat gasket.

**What Constructions Are Available** - Parker Flat Metal Gaskets are made of flat metal, relatively thin in relation to gasket width. They can be used as cut from sheet stock, or with the gasket surface area reduced by machining to improve sealability. Flat metal gaskets are available in any metal in thicknesses and hardness suitable for its intended service which can be machined, or otherwise fabricated to the desired shape.

### STYLE P-940

Parker Style P-940 is a plain solid metal gasket which can be supplied in any desired configuration. Where bolting force is sufficient, this style is efficient and economical, particularly on flanges with a circular lay surface finish. The P-940 has great mechanical strength, excellent heat transfer properties and good resistance to high temperatures, pressures and chemical attack. Unless the gasket is finished machined, the width should be at least 150% of the metal thickness.

There are no limitations on flat metal gasket dimensions, however available sheet stock may require welding to obtain gaskets beyond a certain size.



**STYLE P-940**

### STYLE P-941

Parker Style P-941 Profile Gaskets combine the desirable qualities of solid metal gaskets with the advantages of reduced area of contact (less bolting force required) provided by the "V" shaped ribbed surface. This style is recommended when a solid metal gasket (generally 3/64" or thicker) is required because of pressure (radial strength), temperature, when sealing highly corrosive media or where available bolt force is not sufficient to effect a sealing line.

Style P-941 is also recommended in screwed (attrition) closures where the relatively small contact area keeps friction down to a level low enough to seal the joint.



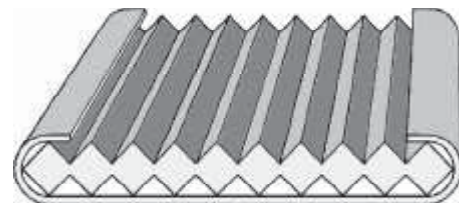
**STYLE P-941**

### STYLE P-943 & P-944

These are essentially Style P-941 gaskets covered with a metal outer jacket employing the principle of reduced contact area with the characteristics of an all-metal gasket. The smooth surface prevents scoring of the flange faces.

Style P-943 gaskets use a French type jacket for narrow gaskets while the Style P-944 gasket employs a single jacket for wider gaskets.

NOTE: These gaskets should NOT be ordered without prior consultation with Parker O-Seal Division Technical services personnel.



**STYLE P-944**  
**STYLE P-943 Not Shown**

## Parker Resilient Metal Seals

**Why Suggested** - Parker S-Shape and Omega Metal Seals are high performance, resilient metal seals intended for separable joint type applications requiring resistance to temperature and pressure extremes, resistance to corrosive fluids, zero leakage and exceptionally long life.

The Parker S-Shape Metal Seal features low seating load, high resilience. They are self energizing and pressure assisted. Parker S-Shape Metal Seals are reusable and require a very simple cavity design,

**How They Work** - The high strength base metal "spring" is coated with a softer sealing material. When compressed between flat surfaces, the spring seal forces the soft coating material into the mating surface roughness, blocking all potential leak paths. Once initiated, the intimate contact is maintained by the seal's resilience, overcoming the effects of temperature, pressure, flange separation and reduction of bolt torque.



OMEGA SEAL



S-SHAPE SEAL

**Cavity Requirements** - The cavity for a Parker S-Shape Metal Seal must provide controlled squeeze, seal location, adequate sealing surface and structural support.

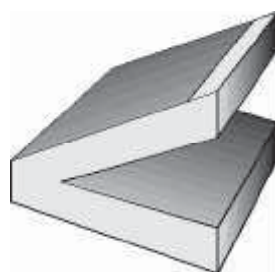
**Where Recommended** - Parker S-Shape Metal Seals are recommended for use in applications beyond the limits of elastomeric O-ring seals. Typical applications for the Parker S-Seal include jet engine fuel and exhaust seals, nuclear couplings, cryogenics, bakeable vacuum hardware, steam systems, turbine engines, cylinder heads and plastics processing equipment.

For complete information on available sizes, metals, coatings and dimensional requirements for S-Seal glands, contact the Parker O-Seal Division Technical Services Department at 310 204-3000 or FAX your requests to 310 841-4249.

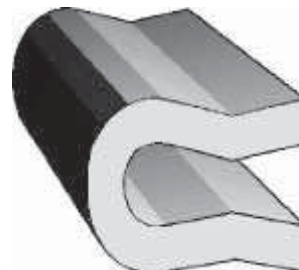
**Other Parker Resilient Metal Seals** - The Parker O-Seal Division also produces two additional types of resilient metal seals for use in super-critical sealing of nuclear, aerospace and aircraft engine applications.

Both the Parker Mark I and Mark II Metal Seals are available in a wide range of base metals and surface coatings from PTFE to gold plating.

For "zero leakage" applications, the Parker Mark I is recommended and is available in either internal or external pressure versions, depending upon customer requirements.



MARK I  
V-SEAL



MARK II  
V-SEAL

**For more information on Parker Mark I and Mark II Resilient Metal Seals, refer to Parker Resilient Metal Seal Brochure OSD 6900.**

**Call 1-800-C-PARKER and ask for your copy.**





# Corrosion Resistance of Gasket Metals

Materials known to be satisfactory have been given an S rating. Those whose resistance is only fair, but not so low as to be dangerous have been given an F rating. A U rating denotes that a material is totally unsatisfactory. A dash indicates that data are not available, or that use of a material is dependent on specific service conditions and should not be selected unless carefully investigated.

	Copper	Aluminum	Monel	Nickel	Iron & Steel	304 Stainless	316 Stainless	347 Stainless		Copper	Aluminum	Monel	Nickel	Iron & Steel	304 Stainless	316 Stainless	347 Stainless
Acetic Acid, crude pure	F	F	F	F	U	-	F	-	Chloroacetic acid	U	U	-	G	U	U	U	U
Acetic anhydride	U	S	S	-	-	F	F	F	Chlorosulphonic acid	-	-	F	-	-	F	-	-
Acetone	S	S	S	S	S	S	S	S	Chromic acid	U	U	F	-	-	S	-	-
Acetylene	-	S	S	-	S	S	S	-	Citric acid	S	S	S	-	U	S	S	-
Air	S	S	S	-	S	S	S	-	Coke-oven gas	S	-	S	-	S	-	S	-
Aluminum chloride	F	U	S	-	F	U	U	F	Copper chloride	-	U	F	-	F	U	U	-
Aluminum fluoride	-	U	-	-	-	-	-	-	Copper sulphate	-	U	S	-	U	S	S	-
Aluminum sulphate	F	-	F	-	U	F	F	F	Corn oil	-	S	S	-	S	S	S	-
Alum	F	-	F	-	U	S	F	F	Cotton seed oil	-	S	S	-	S	S	S	-
Ammonia gas, cold	-	S	S	-	S	S	S	-	Creosote, coal tar	S	S	S	-	S	S	S	-
Ammonia gas, hot	U	-	-	-	-	-	-	-	wood	S	S	S	-	S	S	S	-
Ammonium chloride	U	U	F	F	-	F	F	-	Cresols	S	S	F	-	F	-	S	-
Ammonium hydroxide	U	F	-	-	S	S	S	S	Dowtherm,								
Ammonium nitrate	U	F	-	-	S	S	S	S	A	U	S	-	-	S	-	-	-
Ammonium phosphate, monobasic	F	U	-	-	U	S	S	-	E	S	U	-	-	S	-	-	-
Ammonium phosphate, dibasic	F	F	S	-	F	S	S	-	Ethers	S	S	S	-	S	-	-	-
Ammonium phosphate, tribasic	F	F	S	S	S	S	S	-	Ethyl acetate	S	F	S	-	S	S	S	-
Ammonium sulphate	F	-	S	-	S	S	S	S	Ethyl cellulose	-	-	S	S	-	-	-	-
Amyl acetate	F	F	S	-	-	S	S	S	Ethyl chloride	S	-	S	S	S	S	S	-
Amyl alcohol	S	-	S	-	-	-	-	-	Ethylene glycol	S	S	S	-	S	S	S	S
Aniline, oils	U	U	S	-	S	S	S	S	Ferric chloride	U	U	U	UU	U	U	U	U
Aniline dyes	-	-	S	-	-	S	-	-	Ferric sulphate	U	U	U	U	U	F	S	-
Asphalt	S	-	S	-	S	S	-	-	Formaldehyde	F	F	S	-	F	S	S	-
Barium chloride	-	U	-	S	-	F	S	-	Formic acid	F	U	-	-	U	F	F	-
Barium hydroxide	U	U	-	S	-	S	-	-	Freon	S	S	S	-	-	-	-	-
Barium sulphide	U	-	S	-	-	S	S	S	Fuel oil	S	-	S	-	S	-	-	-
Beer	S	S	S	-	S	S	S	-	Fuel oil, acid	-	-	S	-	-	-	-	-
Beer sugar liquors	S	S	S	-	S	S	S	-	Furfural	S	S	S	-	S	S	S	-
Benzene, benzol	S	S	S	-	S	S	S	-	Gasoline, sour	-	-	S	-	-	-	S	-
Benzine, petroleum ether, naphtha	S	S	S	-	S	S	S	-	refined	S	S	S	-	S	S	S	-
Black sulphate liquor	F	-	S	-	S	S	-	-	Gelatin	-	S	S	-	-	S	S	-
Blast furnace gas	U	-	-	-	S	-	-	S	Glucose	S	S	S	-	S	S	S	-
Borax	F	F	S	S	S	S	S	S	Glue	-	S	S	-	S	S	S	-
Boric acid	F	S	S	S	U	S	S	S	Glycerin, glycerol	F	S	S	-	S	S	S	-
Bromine	U	-	-	-	U	U	U	U	Green sulphate liquor	-	-	S	-	S	-	-	-
Butane	-	S	S	-	S	-	S	-	Hydrobromic acid	-	U	-	-	U	-	-	-
Butyl acetate	S	S	-	-	-	S	S	S	Hydrochloric acid	U	U	-	-	U	U	U	-
Butyl alcohol									less than 150° F	U	U	-	-	U	U	U	-
butanol	S	-	S	-	S	-	-	-	more than 150° F	U	U	-	-	U	U	U	-
Calcium bisulphite	U	-	U	-	U	-	S	S	Hydrocyanic acid	-	-	S	-	-	S	S	-
Calcium chloride	S	-	F	-	S	-	-	-	Hydrofluoric acid	-	U	F	U	U	U	U	U
Calcium hydroxide	-	-	S	S	S	F	F	-	cold, less than 65%	F	U	S	-	F	U	U	U
Calcium hypochloride	-	U	-	-	-	-	-	-	more than 65%	-	-	-	-	-	-	-	-
Caliche liquors	-	-	S	-	S	S	-	-	hot,	U	U	-	U	U	U	U	U
Cane sugar liquors	S	S	S	-	S	S	S	-	less than 65%	F	U	S	-	-	U	U	U
Carbolic acid, phenol	U	S	S	-	-	S	S	-	more than 65%	-	-	-	-	U	U	U	U
Carbon dioxide, dry	S	S	S	-	S	S	S	-	Hydrofluorosilicic acid	-	-	-	-	U	U	U	U
Carbon dioxide, wet	F	F	S	-	F	S	S	-	Hydrogen gas, cold	S	-	S	-	S	S	S	-
Carbon bisulphide	U	S	S	-	S	S	S	-	hot	U	-	S	-	S	S	S	S
Carbon monoxide, hot	U	-	-	-	S	S	S	S	Hydrogen peroxide	U	S	F	F	U	S	S	-
Carbon tetrachloride	-	-	S	-	-	-	-	-	Hydrogen sulphide,								
Castor oil	-	S	S	-	S	S	-	-	dry, cold	U	S	S	S	S	S	S	S
China wood oil									dry, hot	U	S	U	U	U	-	-	S
tung oil	-	S	S	-	S	S	-	-	wet, cold	U	S	S	S	-	S	S	S
Chlorine, dry	S	S	S	-	S	S	S	-	wet, hot	U	S	U	U	U	-	-	S
Chlorine, wet	U	U	U	-	U	U	-	-	Kerosene	S	-	S	-	S	S	S	-
Chlorinated solvents, dry	S	S	S	-	S	S	-	-	Lacquers	-	S	S	-	-	S	S	-
wet	U	U	S	-	U	-	-	-	Lacquer solvents	-	S	S	-	-	S	S	-
Lactic acid, cold	-	-	S	S	U	-	F	F	Lactic acid, cold	-	-	S	S	U	-	F	F
Lactic acid, hot	-	U	-	-	U	-	-	-	hot	-	U	-	-	U	-	-	-

# Corrosion Resistance of Gasket Metals

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	Copper	Aluminum	Monel	Nickel	Iron & Steel	304 Stainless	316 Stainless	347 Stainless		Copper	Aluminum	Monel	Nickel	Iron & Steel	304 Stainless	316 Stainless	347 Stainless
Linseed Oil	S	S	S	-	S	S	S	-	Sodium cyanide	U	U	F	-	S	-	S	-
Lubricating oils, sour	-	-	S	-	-	-	-	S	Sodium hydroxide	U	U	S	S	S	F	F	-
refined	S	S	S	-	S	S	-	S	Sodium hypochlorite	-	U	-	-	U	U	U	-
Magnesium chloride	F	U	F	F	F	F	F	-	Sodium metaphosphate	-	S	S	S	-	S	S	-
Magnesium hydroxide	U	U	S	S	S	S	S	-	Sodium nitrate	F	S	S	S	S	F	S	-
Magnesium sulphate	S	-	S	-	S	S	S	-	Sodium perborate	-	S	S	S	-	S	S	-
Mercuric chloride	U	U	U	U	-	U	U	U	Sodium peroxide	-	S	S	S	-	S	S	-
Mercury	U	U	S	-	S	S	S	-	Sodium phosphate, monobasic	-	S	S	S	-	-	S	-
Methyl alcohol, methanol	S	S	S	-	S	S	S	-	Sodium phosphate, dibasic	S	S	S	S	-	-	S	-
Methyl chloride	S	-	S	-	S	-	-	-	Sodium phosphate, tribasic	U	U	S	S	S	-	S	-
Milk	-	S	S	S	S	-	S	-	Sodium silicate	-	U	S	S	S	-	S	-
Mineral oils	S	S	S	-	S	S	S	-	Sodium sulphate	S	-	S	S	S	S	S	S
Natural gas	-	S	S	-	S	S	S	-	Sodium sulphide	U	U	F	F	S	S	S	S
Nickel chloride	U	U	-	-	-	F	F	-	Sodium thiosulphate "hypo"	U	U	-	-	-	S	S	-
Nickel sulphate	U	U	-	-	-	S	S	-	Soybean oil	-	-	-	-	-	S	S	-
Nitric acid, crude	U	-	U	U	U	-	-	-	Stannic chloride	U	U	U	U	-	-	-	-
diluted	U	U	U	U	U	S	S	-	Steam,								
concentrated	U	S	U	U	U	F	F	-	less than 500°F	S	S	S	S	S	S	S	S
Nitrobenzene	F	-	-	-	S	-	S	-	less than 1000°F	-	-	-	-	S	S	S	S
Oleic acid	U	S	S	S	-	S	S	-	more than 1000°F	U	U	U	U	U	S	S	S
Oleum spirits	S	-	S	-	S	-	-	-	Stearic acid	-	-	S	S	-	S	S	-
Oxalic acid	-	S	S	-	-	-	-	-	Sulphur	U	S	U	U	S	F	F	-
Oxygen, cold	S	S	S	-	S	S	S	-	Sulphur chloride	U	-	-	-	-	-	-	-
less than 500°F	S	S	S	-	S	S	S	-	Sulphur dioxide, dry	S	S	S	S	S	S	S	-
more than 500°F	U	-	S	-	S	S	S	S	Sulphur trioxide, dry	S	S	S	-	S	S	-	-
more than 1000°F	U	U	U	S	U	U	U	S	Sulphuric acid, less than 10%								
Ozone	-	-	-	-	-	-	-	-	cold	-	-	-	-	U	F	F	-
Palmitic acid	S	S	S	-	S	S	S	-	hot	U	-	-	U	U	U	F	-
Petroleum oils, less than 500°F	-	S	-	-	S	S	S	-	10% to 75%								
more than 500°F	U	S	U	U	S	S	S	-	cold	U	-	-	-	U	U	F	-
more than 1000°F	U	U	U	U	U	-	-	S	hot	U	-	-	U	U	U	U	-
Phosphoric acid, crude	U	U	U	U	-	-	-	-	75% to 95%								
pure									cold	U	-	-	-	-	S	S	-
less than 45%	F	-	F	-	U	S	S	-	hot	U	U	-	U	F	U	U	-
more than 45%									fuming	U	-	U	U	-	F	-	-
cold	F	U	F	0	U	S	S	-	Sulphurous acid	-	-	U	U	S	U	-	-
hot	-	U	-	-	U	U	-	-	Tannic acid	-	U	S	S	-	F	F	-
Picric acid, molten	U	F	U	U	S	S	S	-	Tar	-	S	-	-	S	S	-	-
water solution	U	U	-	U	-	S	S	-	Tartaric acid	-	S	-	-	U	-	S	-
Potassium chloride	S	-	S	S	S	S	S	-	Toluene	-	S	S	-	S	-	-	-
Potassium cyanide	U	U	S	-	S	S	S	-	Trichloroethylene	-	-	S	-	-	-	-	-
Potassium hydroxide	U	U	S	S	-	F	F	-	Turpentine	-	S	S	-	-	S	S	-
Potassium sulphate	S	S	S	S	S	F	F	-	Vinegar	-	-	S	-	-	F	S	-
Producer gas	-	S	S	-	S	-	-	-	Water, acid mine, with oxidizing salts	-	-	U	U	U	S	S	-
Propane	-	-	S	-	S	S	S	-	no oxidizing salts	-	S	S	-	-	-	U	-
Sewage	-	F	S	-	F	F	F	-	Water, fresh, tap	S	S	S	-	-	S	S	-
Soap solutions	-	-	S	-	S	S	-	-	distilled, lab grade	U	S	-	S	U	S	S	-
Soda ash, sodium carbonate	-	U	S	0	S	S	S	-	return condensate	S	S	S	-	S	S	S	-
Sodium bicarbonate, baking soda	-	U	S	S	-	S	S	-	Water, seawater	-	U	S	-	-	F	F	-
Sodium bisulphate	F	-	S	S	U	-	-	-	Whiskey and wines	S	-	S	-	U	F	S	-
Sodium chloride	F	U	S	S	S	F	S	-	Zinc chloride	U	U	S	-	-	U	U	-
									Zinc sulphate	U	-	S	-	-	S	S	-

## Bolting Data For Standard Flanges

Nominal Pipe Size (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)
1/4	3-3/8	4	1/2	2-1/4	3-3/8	4	1/2	2-1/4	3-3/8	4	1/2	2-1/4	3-3/8	4	1/2	2-1/4
1/2	3-1/2	4	1/2	2-3/8	3-3/4	4	1/2	2-5/8	3-3/4	4	1/2	2-5/8	3-3/4	4	1/2	2-5/8
3/4	3-7/8	4	1/2	2-3/4	4-5/8	4	5/8	3-1/4	4-5/8	4	5/8	3-1/4	4-5/8	4	5/8	3-1/4
1	4-1/4	4	1/2	3-1/8	4-7/8	4	5/8	3-1/2	4-7/8	4	5/8	3-1/2	4-7/8	4	5/8	3-1/2
1-1/4	4-5/8	4	1/2	3-1/2	5-1/4	4	5/8	3-7/8	5-1/4	4	5/8	3-7/8	5-1/4	4	5/8	3-7/8
1-1/2	5	4	1/2	3-7/8	6-1/8	4	3/4	4-1/2	6-1/8	4	3/4	4-1/2	6-1/8	4	3/4	4-1/2
2	6	4	5/8	4-3/4	6-1/2	8	5/8	5	6-1/2	8	5/8	5	6-1/2	8	5/8	5
2-1/2	7	4	5/8	5-1/2	7-1/2	8	3/4	5-7/8	7-1/2	8	3/4	5-7/8	7-1/2	8	3/4	5-7/8
3	7-1/2	4	5/8	6	8-1/4	8	3/4	6-5/8	8-1/4	8	3/4	6-5/8	8-1/4	8	3/4	6-5/8
3-1/2	8-1/2	8	5/8	7	9	8	3/4	7-1/4	9	8	7/8	7-1/4	9	8	7/8	7-1/4
4	9	8	5/8	7-1/2	10	8	3/4	7-7/8	10	8	7/8	7-7/8	10-3/4	8	7/8	8-1/2
5	10	8	3/4	8-1/2	11	8	3/4	9-1/4	11	8	7/8	9-1/4	13	8	1	10-1/2
6	11	8	3/4	9-1/2	12-1/2	12	3/4	10-5/8	12-1/2	12	7/8	10-5/8	14	12	1	11-1/2
8	13-1/2	8	3/4	11-3/4	15	12	7/8	13	15	12	1	13	16-1/2	12	1-1/8	13-3/4
10	16	12	7/8	14-1/4	17-1/2	16	1	15-1/4	17-1/2	16	1-1/8	15-1/4	20	16	1-1/4	17
12	19	12	7/8	17	20-1/2	16	1-1/8	17-3/4	20-1/2	16	1-1/4	17-3/4	22	20	1-1/4	19-1/4
14	21	12	1	18-3/4	23	20	1-1/8	20-1/4	23	20	1-1/4	20-1/4	23-1/4	20	1-3/8	20-3/4
16	23-1/2	16	1	21-1/4	25-1/2	20	1-1/4	22-1/2	25-1/2	20	1-3/8	22-1/2	27	20	1-1/2	23-3/4
18	25	16	1-1/8	22-3/4	28	24	1-1/4	24-3/4	28	24	1-3/8	23-3/4	29-1/4	20	1-5/8	25-3/4
20	27-1/2	20	1-1/8	25	30-1/2	24	1-1/4	27	30-1/2	24	1-1/2	27	32	24	1-5/8	28-1/2
24	32	20	1-1/4	29-1/2	36	24	1-1/2	32	36	24	1-3/4	32	37	24	1-7/8	33

Nominal Pipe Size (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)	DIA of Flange (inches)	Number of Bolts	DIA of Bolts (inches)	Bolt Circle (inches)
1/2	4-3/4	4	3/4	3-1/4	4-3/4	4	3/4	3-1/4	5-1/4	4	3/4	3-1/2
3/4	5-1/8	4	3/4	3-1/2	5-1/8	4	3/4	3-1/2	5-1/2	4	3/4	3-3/4
1	5-7/8	4	7/8	4	5-7/8	4	7/8	4	6-1/4	4	7/8	4-1/4
1-1/4	6-1/4	4	7/8	4-3/8	6-1/4	4	7/8	4-3/8	7-1/4	4	1	5-1/8
1-1/2	7	4	1	4-7/8	7	4	1	4-7/8	8	4	1-1/8	5-3/4
2	8-1/2	8	7/8	6-1/2	8-1/2	8	7/8	6-1/2	9-1/4	8	1	6-3/4
2-1/2	9-5/8	8	1	7-1/2	9-5/8	8	1	7-1/2	10-1/2	8	1-1/8	7-3/4
3	9-1/2	8	7/8	7-1/2	10-1/2	8	1-1/8	8	12	8	1-1/4	9
4	11-1/2	8	1-1/8	9-1/4	12-1/4	8	1-1/4	9-1/2	14	8	1-1/2	12-3/4
5	13-3/4	8	1-1/4	11	14-3/4	8	1-1/2	11-1/2	16-1/2	8	1-3/4	12-3/4
6	15	12	1-1/8	12-1/2	15-1/2	12	1-3/8	12-1/2	19	8	2	14-1/2
8	18-1/2	12	1-3/8	15-1/2	19	12	1-5/8	15-1/2	21-3/4	12	2	17-1/4
10	21-1/2	16	1-3/8	18-1/2	23	12	1-7/8	19	26-1/2	12	2-1/2	21-1/4
12	24	20	1-3/8	21	26-1/2	16	2	22-1/2	30	12	2-3/4	24-3/8
14	25-1/4	20	1-1/2	22	29-1/2	16	2-1/4	25	---	---	---	---
16	27-3/4	20	1-5/8	24-1/4	32-1/2	16	2-1/2	27-3/4	---	---	---	---
18	31	20	1-7/8	27	36	16	2-3/4	30-1/2	---	---	---	---
20	33-3/4	20	2	29-1/2	38-3/4	16	3	32-3/4	---	---	---	---
24	41	20	2-1/2	35-1/2	46	16	3-1/2	39	---	---	---	---