AS&P
American Seal & Packing

Gaskets & Gasketing

We have prepared this braided compression packing catalog as a guide to selecting the right material for the job. Because every application is different, and the variations in those applications are far ranging, we must advise this is to be only used as a guide.

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Sealing...why we need gaskets.

IF it was possible to manufacture flanges to be perfectly smooth and polished, and **IF** it were possible to maintain these surfaces in permanent contact, then we simply wouldn't need gaskets. Unfortunately this is an impossiblity which results from several factors:

- The size of the vessel and/or flanges.
- Difficulty in maintaining these surfaces while handling and installing.
- Corrosion or errosion of the surface over time.

To overcome these factors we use gaskets, which fill these surface imperfections and allow for reliable fluid sealing. In order to get the optimum sealing results from your gasket, these four factors must be considered:

- **Seating Stress:** You first must provide an adequate sealing pressure in order to seat the gasket so it can fill the imperfections of the flange without destroying the gasket or causing it to extrude. To this end the American Society of Mechanical Engineers, or ASME, has set a minimal initial seating stress guideline in their Pressure Vessel and Boiler Code.
- **Sealing Force:** You must ensure that the residual stress on the gasket after seating is adequate enough to make sure the gasket does not separate from the flange.
- **Material Selection:** You must make sure that the material you are using is rated for both the pressure it will be opperating under and the fluids that are being contained by the seal.
- **Surface Finish:** There is a recommended surface finish for every style of gasket and every application. The leading cause of gasket leakage is the incorrect matching of a surface finish to an incompatible gasket material.

Material Selection

Its very difficult to choose the right gasket for the job these days, there are just so many styles. There are many different packings with similar properties and prices. And with the ban on asbestos-based materials, there are many more styles being made to replace them.

The four basic things you have to keep in mind when selecting a material are as follows:

- Operating Pressure
- Bolt Load
- Resistance to chemical attack (Corrosion)
- Operating temperature

The corrosion resistance can vary based on a couple different factors:

- The concentration of the corrosive agent: Higher concentrations does not always mean the fluid will be more corrosive.
- The temperature of the corrosive agent: Higher temperatures tend to speed the effects of corrosion.
- Dew Point: When the fluid moves through the dew point when in the presence of sulfer and water can result in the formation of highly corrosive condensates. The formation of sulfer and water are commonly found in gases resulting from combustion.

In critical applications it is common practice to test materials in a lab to determine their chemical resistance to corrosive media under service conditions.

In order to design a gasket, an evaluation is required, starting with the type of flange, bolt load, setting stress, etc. Attention to detail is key in this process and every step must be followed in order to get maximum use out of your material. Gasket selection can be simplified by using the Pressure x Temperaure (P x T) Factor. Generally Speaking, a P x T number under 350,000 can be sealed with a compressed non-asbestos gasket material. Metallic Gaskets are generally recommended for applications over 350,000.

P x T or Service Factor

The Pressure x Temperature Factor or Service Factor is an ideal starting point in gasket material selection. It is obtained be multiplying the pressure(psi) by the temperature(°F) and then comparing the result to the table below*. If the P x T exceeds 500,000 then a metallic gasket is required.

P x T Maximum	Temperature F Maximum	Gasket Material
15,000	225	Rubber
30,000	200	Vegetable Fiber
75,000	450	PTFE
350,000	750-850 (as rated)	Compressed Non-Asbestos
500,000	750-850 (as rated)	Compressed with wire mesh

These values are not absolute due to the fact that when you increase the operating temperature, the maximum operating pressure decreases. Also products specifications do vary my manufacturer.

In each case, things like gasket material, flange design, bolt torque, size of bolts, number of bolts, sealing surface area, gasket shape and other unique factors of each application must be carefully evaluated.

***IMPORTANT NOTE:** All recommendations and values used are generic and can vary on a case-to-case basis. This is only intended as a general guide.

Compressed Non-Asbestos Gasket Sheets

Compressed gasket sheets are manufactured by taking a mixture of either mineral or synthetic fibers and a combination of elastomers and vulcanizing it under pressure to create a flat sheet. The resulting sheet is then used to create a low cost, high perfomance gasket. The major characteristics of compressed sheets are:

- High resistance to seating stress.
- Low creep relaxation
- Wide range of operating temperatures and pressures.
- Resistance to a wide range of chemical products.

Fibers

The fibers in compressed sheets help the sheet keep its structure as well as give it high mechanical resistance. Some of the most used fibers include Glass, Aramid, Carbon and Cellulose.

Elastomers

The elastomers used in the vulcanization process determines the chemical resistance of the compressed sheet as well as the flexibility and elastic properties. the most common elastomers used in sheet gaskets include Natural rubber, styrene-butadiene rubber(SBR), Chloroprene, Nitrile rubber, and Hypalon.

Wire Mesh

Wire mesh inserts are used to increase compression resistance and mechanical resistance. The mesh is usually made from carbon steel but can be replaced by stainless steel when needed for corrosive service. The drawback to wire mesh inserts is the reduction of sealability because the sheet to mesh interface creates more leak paths. It also make the gasket harder to cut.

ASP 660 Non-Asbestos Gasketing

Description:

Style ASP 660 is a high quality general service sheet, manufactured with synthetic fibers and an NBR binder. Recommended for use in sealing against oils, solvents, fuels, non-aggressive solutions, and service conditions up to 750°F. Available in thicknesses from 1/64” through 1/4”.

- Aramid Fibers with NBR binder
- Excellent general service sheet
- Available in 59" x 63" & 59" x 126" sheets
- Available in thicknesses of 1/64", 1/32", 1/16", 3/32", 1/8", 3/16" and 1/4"

Physical Properties:

Color:	Green
Density(lbs/cubic ft):	109 lbs/ft^3
Maximum Service Temperature:	750°F(398°C)
Recommended Maximum Continuous Temperature:	460°F(237°C)
Maximum Service Pressure:	1380 psi
Compressability(after 1hour at 210°F)-ASTM F36A:	7-17%
Recovery-ASTM F36A:	45% min.
Creep Relaxation-ASTM F38B:	25% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil #3):	12% max
Weight Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	15% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	12% max

ASP 880 nbr

Description:

ASP 880 is a premium grade compressed sheet, manufactured with synthetic fibers and NBR as a binder. This material is recommended for use in sealing against oils, solvents, fuels, mild acids and alkalis. ASP 880 is capable of service temperatures up to 750°F.

Physical Properties:

Color:	Blue
Density(lbs/cubic ft):	108 lbs/ft^3
Maximum Service Temperature:	750°F(398°C)
Recommended Maximum Continuous Temperature:	475°F(246°C)
Maximum Service Pressure:	1400 psi
Compressability(after 1hour at 210°F)-ASTM F36A:	7-15%
Recovery-ASTM F36A:	45% min.
Creep Relaxation-ASTM F38B:	20% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil #3):	12% max
Weight Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	15% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	12% max

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ASP 680 Aramid and NBR

Description:

ASP 680 is a premium quality general service gasket material, made with synthetic fibers and an NBR binder. This style is recommended for use in sealing against oils, solvents, fuels, non-aggresive solutions, and service temperatures up to 750°F. Available in thicknesses from 1/64" through 1/4".

Physical Properties:

Color:	Off-White
Density(lbs/cubic ft):	109 lbs/ft^3
Maximum Service Temperature:	750°F(398°C)
Recommended Maximum Continuous Temperature:	460°F(237°C)
Maximum Service Pressure:	1380 psi
Compressability(after 1hour at 210°F)-ASTM F36A:	7-17%
Recovery-ASTM F36A:	45% min.
Creep Relaxation-ASTM F38B:	25% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil #3):	12% max
Weight Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	15% max
Thickness Increase(max%)-ASTM F146-(ASTM Oil Fuel B):	15% max

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ASP-300 Neo

Description:

This gasketing material is uniquely suited for both high and low temperatures. ASP-300 utilizes a unique blend of aramid fibers and bound with neoprene to make this material very temperature resistant as well as chemical resistant. ASP-300 has been widely recommended for use in applications thatuse refridgerants like Freon®.

Physical Properties:

Density(lbs/cubic ft):	102 lbs/ft^3
Maximum Temperature:	700°F(371°C)
Recommended Max. Continuous Temp:	518°F(270°C)
Maximum Service Pressure:	1480 psi
Compressibility (after 1 hour at 210°F) - ASTM F36A:	7-17%
Recovery - ASTM F36A:	50% Min.
Creep Relaxation - ASTM F38B:	18% Max
Thickness Increase (man%) - ASTM F146(ASTM Oil#3):	8% Max
Weight Increase (max%) - ASTM F14 6 (ASTM Oil Fuel B):	15% Max
Thickness Increase (max%) - ASTM F146 (ASTM Oil Fuel B):	8% Max

BA-F

Description:

Made with a combination of synthetic fibers, graphite, and NBR, BA-F exhibits very good thermal properties as well as a chemical resistance to steam, oil,gases, fuels,alkaline media and weak acid.

Properties (typical for thickness of 2mm):

Density (lbs/cubic ft)	105 lbs/ft3
Compressibility (ASTM F 36A):	7-17%
Recovery (ASTM F 36A):	60% min
Creap Relaxation (ASTM F38B)	19% max
Thickness increase (max%) ASTM F 146 (ASTM oil#3)	8% max
Weight Increase (max %) ASTM F146 (ASTM Oil Fuel B)	15 % max

Max. operating conditions:

Peak temperature:	800°F(426°C)
Continuous temperature:	540°F (282°C)
Pressure:	1500psi

ASP-C6 Carbon & NBR

Description:

Style C6 is a high quality gasket sheet comprised of carbon fiber and NBR. Style C6 is good for service conditions up to 850°F and has been fire tested, making it ideal for sealing against steam and aggresive media asscosiated with the chemical and petrochemical industries.

- **Carbon Fiber with NBR binder**
- **Fire Tested and Approved**
- **Available in 59" x 63" & 59" x 126" sheets**
- **Available in thickness of 1/64", 1/32", 1/16", 3/32" 1/8"**

Physical Properties:

Density (lbs/cubic ft):	105 lbs/ft^3
Maximum Service Temperature:	850°F (454°C)
Recommended Maximum Continuous Temperature:	575°F (300°C)
Maximum Service Pressure:	1550 psi
Compressibility (after 1 hour at 210°F)-ASTM F36A:	7-15%
Recovery-ASTM F36A:	55% min.
Creep Relaxation-ASTM F38B:	20% max.
Thickness Increase (max%)-ASTM F146 (ASTM Oil #3):	10% max.
Weight Increase (max%)-ASTM F146 (ASTM Oil Fuel B):	15% max.
Thickness Increase (max%)-ASTM F146 (ASTM Oil Fuel B):	10% max.

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GLD Gasket Material

GLD is the next generation of gasket material designed for maximum performance, safety and minimal environmental impact. Made in a water-based process, this patented material is completely nitrosamine free, making it safe for those who fabricate and install gaskets cut from GLD. Once in service, that same composition translates into a highly compressible, and high temperature seal. The sealabilty of GLD actually gets better as temperature increases.

Color	Silver-Black
Density (lbs/cubic ft)	70 lbs/ft3
Maximum Service Temperature*	850°F / 454°C
Maximum Service Pressure*	1800 psi
Compressibility (after 1 hour at 210° F) - ASTM F36/J	35-45%
Recovery ASTM F36/J	9% min
Creep Relaxation 7250 psi / 572°F	14% max
Thickness Increase (max%) ASTM F146 (ASTM Oil Fuel B)	8% max
Weight Increase (max%) ASTM F146 (ASTM Oil Fuel B, 5hrs, 70°F)	35% max
Thickness Increase (max%) ASTM F146 (ASTM Oil Fuel B)	3% max

ASTM F104 Line Call out
F727150A9E41M9

* **Physical properties and values shown are typical. Specifc application data should be evaluated for suitability, through independent study. For specific application recommendations consult AS&P. Failure to select proper sealing products could result in property damage and/or serious personal injury. Specifications are subject to change without notice.**

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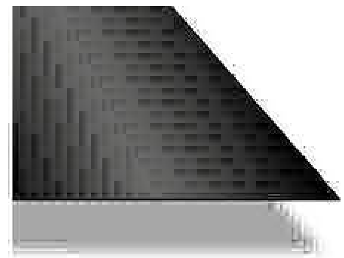
Flexible Graphite

Flexible graphite is made by immersing natural flake graphite in a bath of chromic acid, then concentrated sulfuric or nucleic acid, which forces the crystal lattice planes apart, thus expanding the graphite. It is an ideal material for gasketing and sealing applications and can also be used in many other applications including heat dissipation, lubrication, stress sensing, vibration damping, and other thermal or electronic or electrochemical applications.

Plain Flexible Graphite

Density:	70Lb/ft^3
Max Temp:	900°F
Max Pressure:	1500psi
Compressability@5000psi:	49%
Recovery Minimum(%):	15%
Creep Relaxation ASTM F38B (max %):	4%
Gas Permeability - Nitrogen DIN3535/6:	2800
Pressure x Temperature (P x T):	700,000
Ash Content - Din 51903:	<1%
Chloride and Fluoride Content:	<50ppm

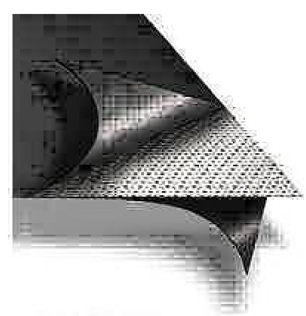


Flexible Graphite w/ SS Foil Insert

Density:	70Lb/ft^3
Max Temp:	900°F
Max Pressure:	2000psi
Compressability@5000psi:	35%
Recovery Minimum(%):	17%
Creep Relaxation ASTM F38B (max %):	4%
Gas Permeability - Nitrogen DIN3535/6:	2800
Pressure x Temperature (P x T):	700,000
Ash Content - Din 51903:	<1%
Chloride and Fluoride Content:	<50ppm

Flexible Graphite w/ SS Tang Insert

Density:	70Lb/ft^3
Max Temp:	900°F
Max Pressure:	2000psi
Compressability@5000psi:	35%
Recovery Minimum(%):	17%
Creep Relaxation ASTM F38B (max %):	4%
Gas Permeability - Nitrogen DIN3535/6:	2800
Pressure x Temperature (P x T):	700,000
Ash Content - Din 51903:	<1%
Chloride and Fluoride Content:	<50ppm



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MICA GASKET MATERIAL

Mica gasket material is exceptional in it resistance to high heat. At temperatures over 900 F the ideal sealing material Grafoil or flexible graphite cannot be used. Flexible graphite or Grafoil will coke at those elevated temperatures when oxygen is present, where mica gasket material will not (900 - 1850 F).

Mica gasket material is an excellent alternative in these high temperature (to 1800 F) applications. Some of the basics on Mica are shown below. As a gasket material Mica can be very effective in sealing those high temp critical applications with out failing due to the presence of oxygen.

Mica is a mineral, which offers a wide range of exceptional properties. You may find that some of the properties of mica could improve the different products in your range.

Mica which comes in the form of flakes is completely harmless and presents very high thermal and mechanical performances, allowing it to successfully replace asbestos gasket material in many applications.

American Seal & Packing offers a wide range of gasket materials, each corresponding to specific requirements and designed for a well-defined application. American Seal & Packing can assist you in determining which mica gasket material (or other material) corresponds best to your application.

AMERI-MICA® ASP-710M "High Temp"'

HI-temp Gaskets

GENERAL DESCRIPTION: **Ameri-mica®** "Hi-Temp" is a material containing high percentage of phlogopite mica paper impregnated with a silicone binder. Mica, an aluminosilicate of mineral origin, has a lamellar and nonfibrous structure representing a satisfactory alternative to asbestos. This material gives "High Temp"' its thermal characteristics -weight loss at 800°C (1472 °F) less than 5 % - and its chemical resistance to solvents, acids, bases and mineral oils.

Ameri-mica® Hi-Temp ensures the sealing in applications wheretemperatures up to 1000°C (1832°F) can be reached. Gaskets made of Hi-temp are used in automobile exhaust manifolds, gas turbines, gas and oil burners, heat exchangers, and in other flange connections. It is also used as filler for spiral wound gaskets and as a material for camprofile seals.

SIZE SHEETS:

ASP-710M Sheets of 1000 x 1200 and 2400 mm (39.37" x 47.24" and 94.49") or strips. Thickness: 0,1 - 3 m (0.004" -0.125")

Other dimensions on request.

STORAGE: 6 years at 20°C

CHARACTERISTICS:

Mica content % >90	Binder content % <10
Weight loss % <5	Compressibility % 15-35
Elastic recovery % 30-45	Creep relaxation 7252 psi - 572°F 5.8 DIN 52913

Temperature range

Continuous Service	1832°F	Intermttent Service 2012°F
Maximum Pressure:	72.5°F	

Data are average results of laboratory costs conducted under standard procedures and are subjects to variation. These do not constitute a warranty or representation for which we assume legal responsibility/

Styles of PTFE

Molded and Sintered PTFE: This type of PTFE was the first to be introduced to the market. This style is made from virgin or reprocessed PTFE resin, without fillers, which is then molded, compressed and sintered. As with any other type of plastic, PTFE has a high creep factor when compressed. The creep factor is detrimental and can lead to having to re-tighten the bolts to maintain seating pressure and prevent leakage. The higher the temperature in the application it is used for, the more the creep factor will increase. Even with these drawbacks, PTFE is affordable, easily available and highly chemical resistant.

Skived PTFE: This style is similar to molded and sintered PTFE as it is also make of virgin or reprocessed PTFE without fillers. Instead of molding an individual sheet, the sheets are taken from a billet of PTFE with a process called skiving. The skiving process was developed to overcome manufacturing deficiencies of the molding process. Skived PTFE shares the same creep characteristics as molded and sintered PTFE.

Molded or Skived Filled PTFE: In order to correct the creep characteristics of molded and skived PTFE, manufacturers started adding mineral fillers or fibers in order to reduce creep factor. This indeed reduced the creep characteristics but not by a significant amount.

Restructured Filled PTFE: Because the addition of fillers in the molding process was not enough to significantly reduce creep, a new manufacturing process was developed to produce filled PTFE sheets. In this new HS10 process the material is laminated before being sintered, which yeilds a significantly reduced creep. The different fillers used in this process are as follow:

- Barium Sulfate : Added for use in strong caustic service. Also FDA compliant.
- Mineral Silica: Used for strong acidic service.
- Hollow Glass Microshperes: Used to increase compressibility.
- Synthetic Silica: Used as subsitute for glass microspheres.

Expanded PTFE: This style of PTFE is made by heating and stretching PTFE before sintering it. Like all PTFE it has strong chemical resistance, but unlike molded or skived PTFE, this material has a high compressibility and is good for use in flanges made from fragile materials.

PTFE Gaskets

Polytetrafluorethylene or PTFE is a polymer with an exceptional chemical resistance and is the most widely used plastic for industrial sealing. The only substances that attack PTFE are liquid alkaline metals and free fluorine.

PTFE Gasket products are manufactured by taking either pure PTFE or PTFE with other materials mixed in and sintering or extruding it. Sintering is a process where powdered material is held in a mold and then heated to a temperature below the melting point. There are different styles of PTFE for different application needs and several different styles can be used in the same application. Additionally, PTFE has good electrical insulation, anti-stick, impact resistance and low friction properties.

PTFE was first developed by Dupont who still holds the most recognized brand name "Teflon" by DuPont Co. TEFLON® is a registered trademark of E.I. du Pont de Nemours & Co.

Styles of PTFE Sheets

Virgin - 100% PTFE material sheets

Mechanical Grade - Contains a small percentage of recycled PTFE.

Filled PTFE - PTFE can be filled with a wide range of materials to help over come "cold Flow issues associated with PTFE. The most common filler materials are:

Silica	Micro Glass Spheres	Barium Sulfate
Brass / Bronze	Carbon Filled PTFE	Graphite Filled

The percentage of filler varies according to the requirments of the application. Each filler has there advantages. Conductivity is a major factor in deciding what material and how much of it is added..

Ameri-lon 9504 is a true re-structured PTFE gasket sheet with excellent physical properties to be used in the most demanding applications. Its unique construction which includes premium ptfe resin and glass microspheres limits the cold flow problems associated with skived PTFE sheets. Ameri-lon 9504 is more compressible than other styles of Ameri-lon and is effective in applications where bolt load is limited by equipment design.

Ameri-lon 9504 is suitable for a variety of services including aggressive chemicals such as acids and caustics, hydrocarbon derivatives, solvents, water, steam, hydrogen-peroxide, refrigerants, and more. The high compressibility of this style makes it particularly suitable for use with stress sensitive joints.

Color	Medium Blue
Specific Gravity (g/cm3)	.97 g/cm^3
Maximum Service Temperature*	500°F / 260°C
Mimimum Service Temperature*	-350°F / -210°C
Maximum Service Pressure*	790 psi
Compressibility (after 1 hour at 210° F) - ASTM F36A	50%
Recovery ASTM F36A	23% minimum
Creep Relaxation ASTM F38B	40% max
P x T pressure times temperature 1/16" sheet thickness	350,000 psi / 12,000 bar
P x T pressure times temperature 1/8" sheet thickness	250,000 psi / 8,600 bar
Sealability ASTM F37A (ml/hr)	0.15 ml/hr
Sealability DIN 3535 (cm3/min)	< 0.019
Tensile Strength	2000 psi / 13.7 MPa

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Ameri-lon, A Superior Gasket Material

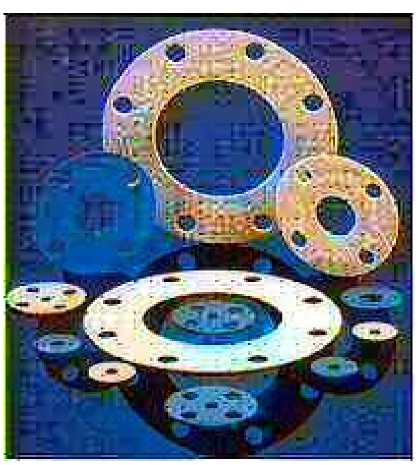
Ameri-lon 9504	Ameri-lon 9510	Ameri-lon 9500
Ameri-lon 9504 is a true re-structured PTFE gasket sheet with excellent physical properties to be used in the most demanding applications. Its unique construction limits the cold flow problems associated with skived PTFE sheets. It is very effective in applications where available bolt load is low due to is glass sphere content. Color: Blue	**Ameri-lon 9510** is a true re-structured PTFE gasket sheet with excellent physical properties to be used in the most demanding applications. Its specific construction of virgin PTFE and Barium Sulfate fillers, limits both creep and cold flow in service and at temperature. Color: Off White	***Ameri-lon*** 9500 is a premium re-structured PTFE gasket sheet with excellent physical properties that can be used in most strong acids, except for Hydrofluoric acid. ***9500*** is made of 100% PTFE and silica fillers. Color: Sand

Ameri-lon PTFE sheets are available in 24" X 24", 36" X 36", 48" X 48" and 60" X 60" sizes in thick nesses from 0.010" to ¼".

Ameri-lon a new family of products using a new hybrid material, Ameri-lon is the result of years of experience in producing PTFE materials. It is designed for a wide range of demanding industrial requirements including gasket and bearing applications. Ameri-lon is filled PTFE, uniquely combining the properties of PTFE and Fller materials. The Filler enhances the physical properties of the PTFE and results in a superior gasket material. Ameri-lon shows less cold flow and greater sealing ability than other filled Teflon® materials (PTFE) or Fluorocarbons. It maintains the chemical attack resistance and the temperature range of other Teflon ® based sheets.

Ameri-lon is available in a wide range of products including gaskets, sheet, molded tube and rod as well as finished and machined items

Ameri-lon can be considered as an equivalent to the Garlock Gylon Product range. The interchange for the Gylon products is as follows:



Ameri-lon 9504 = Gylon 3504

Ameri-lon 9510 = Gylon 3510

Ameri-lon 9500 = Gylon 3500

Ameri-lon = Gylon 3450/3545

Amerilon = Gylon Chemrex 3570

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Expanded PTFE Gasket Sheet

Expanded PTFE gasket sheet is made from 100% expanded PTFE by means of a proprietary manufacturing process that produces a highly fibrillated structure with equal tensile strength in all directions. The characteristics of Expanded PTFE sheet are significantly different from conventional PTFE. This expanded sheet is much more flexible than regular PTFE sheet and thus conforms easily to irregular and rough surfaces. In addition, the expanded sheet is easier to compress and minimizes creep and cold flow.

Sheet Dimensions	
Sheet size	60"60" (1524mm x 1524 mm)
Thickness	1/16"(1.5mm), 1/8"(3.0mm)
Thickness Tolerance	3/16"(4.5mm), ¼" (6.omm)

Service Limits	
Pressure Limits:	Full Vacuum to 3000 pal
Temperature Limits:	-450F to +600F
pH Range:	pH 0-14 except molten alkali metals and elemental flourine
FDA/USDA	Meets requirements

Physical Properties	
Specific Gravity	0.85
% Compressibility (ASTM F-36)	68%
% recovery (ASTM F-36)	12%
Sealability(m/hr leakage) (ASTM – F-37B)	0.00 (Fuel A) 0.02 (Nitrogen)
% creep relaxation relaxation (ASTM F-38)	32% 212F 16% 73F

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Types of Elastomers

Natural Rubber(NR):

Natural rubber possesses many excellent physical properties including high resilience and strength and good abrasion resistance. Natural rubber has its downsides like, having poor resistance to hydrocarbon oil and not suitable in UV, oxygen, and ozone environments. Its poor weathering resistance can be modified by special additive.

Styrene-Butadiene(SBR):

SBR is a copolymer of styrene and butadiene. The most common use of SBR is in tires where it is blended with natural rubber and butadiene rubber. In its normal state SBR is weak and unusable, however, when you combine it with Carbon black it is strong and abrasion resistant. SBR shares the same weaknesses as natural rubber.

Chloroprene(CR):

Chloroprene rubber is more widely known as Neoprene (trademark of Du Pont). Chloroprene is a great multi-purposed elastomer that boasts a balanced combination of properties. CR is resistant to sunlight, ozone, and weathering. Unlike NR or SBR, it is also resistant to oils and many chemicals. CR is also very tough and is resistant to fire.

Nitrile(NBR):

Nitrile Rubber, aslo knows as NBR or Buna-N, is one of the more common materials used in gaskets and o-rings. This stems from the fact that NBR is very petroleum resistant and is less expensive than other similar materials. Nitrile is a copolymer of acrylonitrile(ACN) and butadiene. By changing the content of ACN, you can change the properties of Nitrile. Lower ACN content gives better low temperature properties but poorer fuels and polar lubricants. Higher ACN content gives poorer low temperature properties but improved fuels and polar lubricants resistance.

Fluorelastomer(CFM, FVSI, FPM):

It is also known as Viton (trademark of Du Pont). It offers excellent resistance to strong acids, oils, gasoline, chlorate solvents, and aliphatic and aromatic hydrocarbons. NOT recommended for aaminos, esters, ketones and steam.

Types of Elastomers Pt.2

Silicone(SI):

Silicone rubber has an uncanny resistance to the aging process and is unaffected by sunlight or ozone. For this reason silicone is quite often used in hot air applications. The drawback to this is that silicone has very little mechanical resistance and is not meant for dynamic applications.

Ethylene-Propilene(EPDM):

EPDM is a Copolymer of ethylene and propylene. EPDM typically has excellent resistance to ozone, sunlight, and weathering, and is very flexible at low temperatures. EPDM also is very chemical resistant and can resist many dilute acids and alkalis as well as polar solvents. To top it all off EPDM even has good electrical insulation properties.

Hypalon®:

Hypalon is similar to Neoprene rubber and exhibits excellent resistances to ozone, sunlight, chemical products and a good resistance to oils.

Cellulose Fiber Sheet:

Cellulose fiber sheets are manufactured from cellulose with glue and glycerin binders. These sheets are often used in sealing oil products, gases and diverse solvents.

Cork:

Cork grain and rubber are bound to produce a material with the compressability of cork and the properties of rubber. Used in applications where seating force is limited (ie. when the flanges are made from a fragile material like sheet metal and ceramic). This material is recommended for uses involving water, lubricant oils, and other oil derivative products at pressures up to 50 psi (3.5 bar). The drawbacks to using cork gaskets are their low resistance to aging as well as low resistances to inorganic acids, alkali or oxidant solutions.

AS&P
American Seal & Packing
1537 E. McFadden Ave. Santa Ana, CA. 92705
Phone: 714-361-1435 Fax: 714-593-9701
E-Mail: sales@aspseal.com

Aflas Gasketing

Aflas sheet gasket material is an elastomeric based flouorubber, a copolymer of tetrafluroethlene and propylene. This elastomer offers excellent chemical resistance qualities, with serviceability in the temperatures up to 550 degrees F depending on environment. Services where Aflas sheet might be applicable include inorganic acids, alkalis, high temperature steam, polar solvents, organic bases, hydrocarbon oils, amines and amine corrosion inhibitor systems, and hydrogen sulfide bearing fluids. Consult American Seal & Packing for your specific application.

Available in 1/32", 1/16", 1/8", 3/16" and 1/4"

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Buna Gasket Material

Nitrile (Buna-N)

Trade Names:
Chemigum Hycar (Zeo (Goodyear)n Chemical) Ny Syn (Copolymer) Paracril (Uniroyal) Krynac (Polysar) Perbunan (Mobay)

The most widely used O-Ring elastomer. Excellent resistance to petroleum products. Excellent compression set, tear and abrasion resistance. Does not have good resistance to ozone, sunlight, or weather, unless specifically compounded. Should not be stored in direct sunlight or near motors or other electrical equipment which may generate ozone. Temperature range: -40° to +250°F.

STYLE 0726T -
Buna-N 70 Durometer for Transformer Gaskets and Strip Especially selected for the fabrication of gaskets and strip for transformers. High resistance to transformer oils. Durometer 70±5.

- Tensile strength: 1500 PSI
- Elongation: 250%
- Temperature range: -30°F to 250°F

STYLE 0726H -
Buna-N 90 Durometer Good resistance to many oils and chemicals.
Durometer 90±5:

- Tensile strength: 1500 PSI.
- Elongation: 100%.
- Temperature range: -30°Fto250°F

STYLE 0726W -
Buna-N White 50-65 Durometer
Manufactured from FDA approved ingredients. Good resistance to oily and greasy food products. Good resistance to abrasion. Non-toxic and non-marking.
Durometer 55+10/-S.

- Tensile strength: 1000 PSI
- Elongation: 400%
- Temperature range: -20° F to 200° F

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EPDM Gasket Material

Description: Ethylene Propylene Diene Monomer (EPDM):
EPDM is a black plate finish sheet with superior resistance to weathering, ozone and UV exposure. EPDM also provides excellent chemical resistance*, and good electrical properties. EPDM resists animal and vegetable oils, steam, water and oxygenated solvents. This material meets ASTM D-2000-2BA specifications.

High grade material including Mil-specification is available. EPDM is also available in a white FDA approved sheet.

Typical EPDM Specifications:
Excellent resistance to UV rays and ozone. Good resistance to Anti-freeze, Synthetic Detergents, Acetone, Boric acid, Ethanol, Formaldehyde, Mercury, Potassium Sulfate, Silver Nitrate, Steam (up to 212 Fahrenheit), Saccharin. For EPDM's gasket materials compatibility with your specific medium please contact American Seal & Packing.

Chemical Resistance
- **Compound:** **EPDM**
- **Color:** **Black**
- **Weight:** **1/16" =.625 lbs per square foot.**
- **Durometer:** **45-55 or 55-65**
- **Temperature Range:** **-40 F to 212 F**
- **Minimum Tensile:** **800 PSI**
- **Finish:** **Smooth**
- **Minimum Elongation:** **300%**
- **Gauges:** **1/16", 1/8" ,3/32", 1/4" , 3/8" , 1/2"**
- **Widths:** **36" and 48"**
- **PSA:** **Can be added**
- **Roll Length:** **25' to 150' (Short lengths may be available)**

Flexibility: This medium durometer (45-55) sheet rubber offers moderate pliability and elasticity. The harder durometer variant (55-65) offers higher abrasion resistant durability, but less pliability and flexibility.

Applications: Provides outstanding resistance to weathering, ozone and UV exposure. Gasket, bumper and general exterior applications.

Custom Cuts: In addition to hand fabrication, this product can be fabricated using laser, die, and water-jet cut. Please submit your drawings for a price quote.

Available in 1/32", 1/16", 1/8", 3/16" and 1/4"

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Neoprene

Neoprene gasket material comes in four primary forms; closed cell (wet suit material), open cell, diaphragm, and homogeneous. Each of these three types have styles, colors and density variations that make them unique gasket materials.

Neoprene Gasket Material - Homogeneous

Style 0725 - 60 Duro Neoprene blend provides moderate resistance to oil and ozone. For use in bumpers, pads, and sealing in general gasket and flange applications.

Minimum tensile strength - 800 PSI. Durometer 60±5. Temperature range: -20°F to +170° F. Black color.

Style 0725S - 40 Duro Neoprene blend provides moderate resistance to oil and ozone. For use in bumpers, pads, and sealing in general gasket and flange applications.

Style 0725H - 70 Duro Neoprene blend provides moderate resistance to oil and ozone. For use in bumpers, pads, and sealing in general gasket and flange applications.

Style 0734 - 70 Duro Cloth Finish - Good resistance to Sunlight, and outdoor weathering. Performs well in contact with many oils and chemicals. Cloth Finish. Durometer 70 +/-5.
Tensile strength 1000 PSI. Elongation 200%.
Temperature Range -30° F to +200° F

Neoprene Gasket Material - Sponge

STYLE R-451 / R431 Black Closed Cell Sponge

Black neoprene closed cell (expanded) sponge gasket sheet. Tiny individual sealed cells contain inert nitrogen gas to resist moisture, dirt and air even at cut edges. It is this unique structure that makes the closed cell sheet an insulator, sound and vibration damper and shock absorber. Compression deflection 5-13 PSI. Density 15-30 lbs/cubic foot. Water absorption 5% maximum. Temperature range -30°F to +150°F (continuous) (to 200°F intermittent). Tensile strength 150 PSI. Elongation 350%.
Neoprene Gasket Material - Diaphragm

STYLE 0741 Neoprene Duck Inserted Diaphragm Gasket Material

Oil-resistant neoprene diaphragm material designed transmit pulsations between gases, air, and fluids. Reinforced with cotton duck to provide structural Strength. Durometer 70±5. Tensile strength 1500 PSI. Elongation 300%. Temperature range -40°F to 220°F Smooth finish.

Gasket Materials

Viton® (FKM): Viton® (FKM) fluoroelastomer is the most specified fluoroelastomer, well known for its excellent (400°F/200°C) heat resistance. Viton® (FKM) offers excellent resistance to aggressive fuels and chemicals. This flouroelastomer is very versital and can be altered through its Fluorine content to cater to many industry needs.

Aflas®: Aflas® material is an elastomeric based flouorubber, a copolymer of tetrafluroethlene and propylene. This elastomer offers excellent chemical resistance qualities, with serviceability in the temperatures up to 550 degrees F depending on environment.

Buna-N: Nitrile butadiene rubber (NBR) is a family of unsaturated copolymers of 2-propenenitrile and various butadiene monomers (1,2-butadiene and 1,3-butadiene). Although its physical and chemical properties vary depending on the polymer's composition of nitrile

PTFE: Polytetrafluoroethylene (PTFE) is a synthetic fluoropolymer of tetrafluoroethylene that has numerous applications. The best known brand name of PTFE is *Teflon® by DuPont Co. PTFE is a fluorocarbon solid, as it is a high-molecular-weight compound consisting wholly of carbon and fluorine.

Neoprene: Neoprene or polychloroprene is a family of synthetic rubbers that are produced by polymerization of chloroprene. Neoprene exhibits good chemical stability, and maintains flexibility over a wide temperature range.

EPDM: EPDM rubber (ethylene propylene diene monomer) is an elastomer which is characterized by a wide range of applications. EPDM exhibits satisfactory compatibility with fireproof hydraulic fluids, ketones, hot and cold water, and alkalis, and unsatisfactory compatibility with most oils, gasoline, kerosene, aromatic and aliphatic hydrocarbons, halogenated solvents and concentrated acids

Silicone: Silicone rubber is an elastomer composed of silicone—itself a polymer—containing silicon together with carbon, hydrogen, and oxygen. Silicone rubber is generally non-reactive, stable, and resistant to extreme environments.

We Also Stock:

Flexible Graphite, Non-Asbestos, SBR, Mica, and Ameri-Lon.

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Silicone Gasketing

Silicone sheet gasket material is a very versatile material ideal for a wide range of applications. Silicone rubber gasket material offers temperature resistance, weather (UV and ozone) resistance, and fire resistance . Silicone gasket material has very good compression set resistance allowing it to maintain a proper seal over many years.

Silicone gaskets offer exceptional high and low temperature capability while maintaining excellent flexibility. Normally manufactured by molding or die cutting of sheet stock. Silicone rubber offers the advantages of lower molding pressures compared to organic rubber, as well as low toxicity and low odor.

Silicone gasket material is not recommended for dynamic applications due to it's poor tear strength and tensile. It does not do well with oils. It does however do well in most gasketing (static) applications and seals at lower bolt loads than most rubber materials due to it's low durometer.

The temperature range on most silicone gasket materials is -80o F to +450o F

Consult American Seal & Packing for your specific application.

Available in 1/32", 1/16", 1/8", 3/16" and 1/4"

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Viton Gasket Material (FKM)

Gasketing perfect for gasket cutting, flat seals, door seals, Industrial applications. Standards are in stock or custom manufactured to your specifications. Viton is a high tech. elastomer designed for extreme heat, oil and chemical resistance. Viton resists aliphalactic aromatic and halogenated hydrocarbons, concentrated acids, alkalis, animal and vegetable oils.

Restrictions: Viton is not generally resistant to ketones, low molecular weight esters (such as ethyl acetate), or nitro containing compounds. products are not usually serviceable below - 15 degrees F.

Specifications: Temperature Limit: 350 F (constant) 400 F (intermittent) Pressure Limit: 800 lbs. @ 400 F Durometer Hardness: 72 Shore A, Tensile Strength: 1285 psi,

Elongation: 286%

Specific Gravity: 1.88, Finish: Matte, Press Cured

Relative chemical compatibility and mechanical properties for Viton® fluoroelastomers

	Viton® general use types					Viton® specialty types		
Chemical environment	A	B	F	GBL-S	GF-S	GLT-S	GFLT-S	ETP-S
Automotive and aviation fuels	1	1	1	1	1	1	1	1
Automotive fuels oxygenated with MEOH, ETOH, MTBE, etc.	4	2	1	2	1	4	1	1
Engine lubricating oil, SE and SF	2	1	1	1	1	1	1	1
Engine lubricating oil, SG and SH	3	2	2	1	1	2	1	1
Aliphatic hydrocarbon process fluids, chemicals	1	1	1	1	1	1	1	1
Aromatic hydrocarbon process fluids, chemicals	2	2	1	1	1	2	1	1
Aqueous fluids, steam mineral acids	3	2	2	1	1	1	1	1
Strong base, high pH, caustic, aminos	4	4	4	2	2	2	2	1
Low molecular weight carbonyls 100% concentration (MTBB, MBK, MIBK, etc.)	4	4	4	4	4	4	4	1
Compression set and low-temperature performance								
Resistance to compression set	1	2	2	2	2	2	2	2
Low-temperature flexibility	2	2	3	2	3	1	1	2

Key: 1 = Excellent 2 = Fair to Good 3 = Poor 4 = Not Recommended

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There are different types of Viton. A good example of the differences can be viewed by examining the following chart:

While there are substitues that will often perform, specifying the most recognized name in FKM material is an inexpensive form of insurance. Insurance that you will get what you pay for. Not all FKM's are equivalent.

Specify the Grade you need:

Specifications that are insufficient, inaccurate or that allow substitutions open the door to quality and performance problems. When you specify DuPont Performance Elastomers' Viton®, the most specified fluoroelastomer worldwide, you can enhance your products' performance by ordering the specific type of Viton® that has been tailored for your application needs.

Viton® was introduced in 1958 and scientists and engineers have relied on DuPont and now DuPont Performance Elastomers Viton® for its superior performance and unique properties ever since. However, DuPont Performance Elastomers is not the only company that manufactures FKM products. Many people in the industry incorrectly refer to any and all FKM elastomers as Viton®. As a result, you could end up with sealing products that are not the type of Viton® you need, let alone made of 100% virgin DuPont Performance Elastomers Viton®. Products not made from DuPont Performance Elastomers Viton® may fall short of the expected performance levels afforded by the stringent quality standards DuPont Performance Elastomers has set for Viton®, which is manufactured at ISO 9002 registered facilities worldwide.

Q. What is FKM?

A. FKM is the ASTM designation for the fluoroelastomer category. It is not a mark of quality. Not all FKMs are equivalent, and some may fall short on desired performance.

Q. What does the "Made With Genuine Viton®" seal mean?

A. It means the part has been manufactured and distributed in accordance with DuPont Performance Elastomers' guidelines. Only parts made with 100% virgin Viton® as the sole elastomeric component are labeled with this seal.

To ensure that you always receive the highest quality FKM products available, insist on 100% virgin DuPont Performance Elastomers Viton® and look for the "Made With Genuine Viton®" seal.

Testing by ASTM Standards

These standards ensure product consistancy and uniformity as well as the ability to compare products from different manufacturures. Here are some of the standards used to measure the physical characteristics of a material.

Compressability and Recovery(ASTM F36A)

The compressibility is the thickness reduction when the material is compressed by a load of 5000 psi (34.5 MPa). This value is expressed as a percentage of the original thickness. The recovery is the increase in thickness anfter the load removal.

Sealability(ASTM F37)

This standard helps determine a material's sealing ability under controlled conditions using Isooctane at a pressure of 14.7 psi (0.101 MPa) and a seating stress from 125 psi (0.86 MPa) to 4000 psi (27.58 MPa).

Torque Retention(ASTM F38)

This test indicates how well the material can retain the bolt load over time. This value is expressed as a percentage of the initial load. A good sheet will keep a high residual load, however, an unstable sheet will continuously lose bolt load pressure and as a result will lose sealability. The test parameters are initial load 3045 psi (21 MPa), temperature 212°F (100°C) for 22 hours. It is important to note that an increase in thickness or service temperature decreases the torque retention.

Fluid Immersion(ASTM F146)

This standard is used to determine changes in a material when in contact with fluids in controlled conditions of pemperature and pressure. The most common fluids used in this test are ASTM No. 3 petroleum oil and ASTM Fuel B (70% Isooctane and 30% Toluene. After the immersion the material is then tested for compressability, recovery, inrease in thickness, tensile strength and increase in volume. The results are then compared to the statistics before immersion.

Tensile Strength(ASTM F152)

Used as a quality controle parameter in sheet manufacturing.

Ignition Loss(ASTM F495)

Indicates material loss of mass with temperature.

Designing a Gasket

Operational Conditions

Before designing a gasket it is important to confirm the operating conditions. First you must compare the service temperature and pressure with the maximum values recommended for the intended material. Then you calculate the service factor be multiplying the design pressure (psi) by the temperature (°F). The result is then compared with the maximum values indicated by the manufacturer.

Chemical Resistance

Before choosing a material it is improtant to note the type of fluid that is going to be sealed and the material's resistance to this fluid.

ASME Flange Gasket Dimensions

The ASME B16.21 Non-Metallic Gaskets for Pipe Flanges standard shows gasket dimensions for use in several ASME standard flanges, including the commonly used B16.5 flanges. The gaskets can be either full face(FF) or raised face(RF). Style RF comes highly recommended due to the fact that it is economical and allows more seating stress to be applied with the same bolt load.

Gaskets for Heat Exchangers

It is common for sheet gaskets to be used in shell and tube heat exchangers. Because the flange width of the tongue and groove flange facings, it is important to control the seating pressure to prevent crushing of the gasket.

Non Standard Flanges

Sheet gasketing is frequently used in heat exchangers, reactors and other equipment. When designing a gasket for a non standard flange, it is important to verify the conditions that it will be used in.

Designing a Gasket (continued)

Large Diameter Gaskets

A gasket can be mafufactured in separate pieces then spliced together. This process is used when the gasket is too large for the sheet its being manufactured from or when maufacturing the gasket in parts is more economical. For this, two kinds of splicing are used: dovetail and bevelled.

-Dove-tail Gaskets

The dovetail splice is widely used in most industrial applications. This method can be used to make gaskets of almost any size or thickness. The male and female ends are designed to have as little a gap between them as possible.

-Bevelled Splice

When there is not an adequate seating stress for the use of dove tailed gaskets, bevelled and glued splices can be used. This style is difficult to manufacture and can only be used for gaskets with a minimum of 1//8 in. (3.2 mm) thickness.

Gasket Thickness

The ASME recommends three thicknesses for industrial applications: 1/32 in (0.8 mm), 1/16 in (1.6 mm) and 1/8 in (3.2 mm). To determine the gasket thickness required, its important to know the roughness of the flange sealing service. It is widely noted that a gasket should be as thin as possible while still being able to flow into the imperfections of the flange surface. A good rule of thumb is that a gasket should be about four times the thickness of the groove depth of the sealing surface. Using a thickness greater than 1/8" is only recommended when absolutely necessary. Thicknesses up to 1/4 in (6.4 mm) can however be used when dealing with very worn out, twisted or large flanges.

Bolt Load

It is important to be sure that the bolt load does not exert an excessive seating stress, otherwise the gasket can be damaged or crushed. It is important to note that as the thickness of the material increases the maximum bolt load is reduced.

Surface Finish

For every style of gasket there is a recommended flange suraface finish. While the proper finish is not mandatory, it is based in successful practical applications.

In aplications using non-metal gaskets (ie. PTFE, rubber, sheet packing) the surface must be serrated. When using metal gaskets however, a smoother suraface is required.

The reason for this difference is that non-metal gaskets need the surface to have grip on the material to prevent extrusion or blow out. Metal gaskets require high pressure loads to ensure proper sealing, so the smoother the surface, the less likely a metal gasket will leak.

Spiral wound gaskets require a rough surface to make sure they do not slide while under stress. They tend to buckle inward which is critical in applications involving Flexible Graphite filled gaskets.

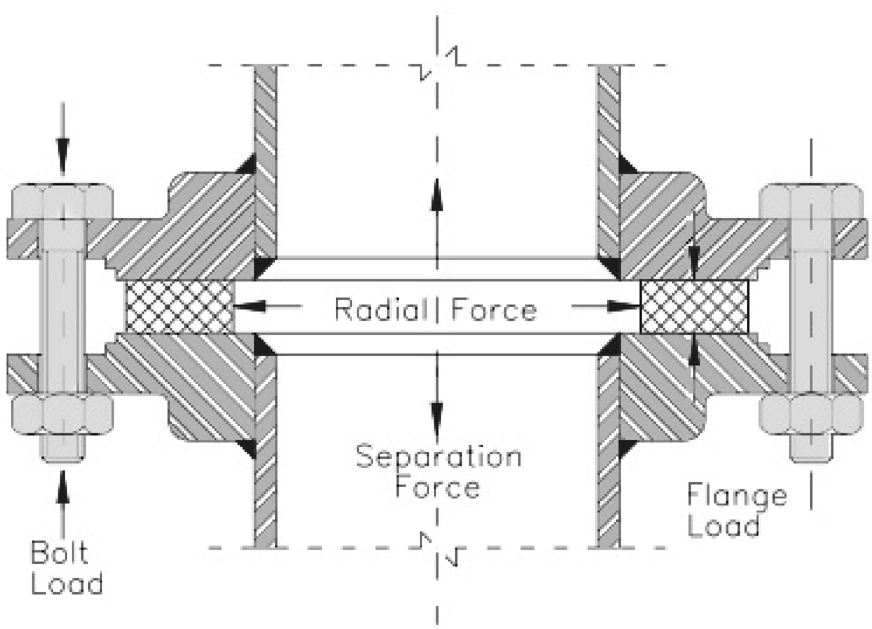
The style of gasket will determine the finish of the sealing surface to be used, there is no "optimum finish" that fits all styles of gaskets. The material must always be softer than the the surface finish to prevent damage to the surface.

So just to re-cap. Non-metal gaskets need a rougher (32rms) or serrated finish. Metal gaskets need a smooth finish. Spiral wound gaskets need a rough surface. There is no "universal surface."

So long as you follow these guidelines, you are sure to get the most out of your gasketing material and ensure that they will work at maximum efficiency.

The Forces in a Flanged Joint

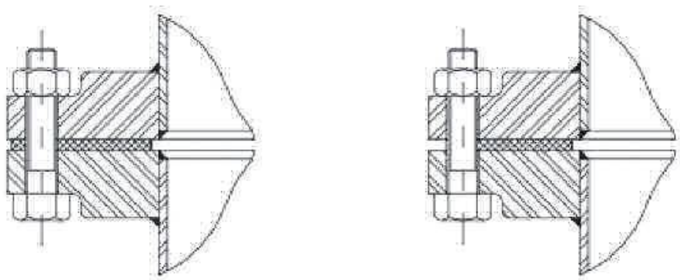
- **Radial Force:** Comes from the internal pressure; it tends to blow out the gasket.
- **Seperation Force:** Also originates from internal pressure and can cause the flanges from separating.
- **Bolt Load:** The total load exerted by the bolts.
- **Flange Load:** This is the force that compresses the flanges to the gasket. The initial stress put on the flanges not only must allow the material to flow, but must also:
  - Compensate for the seperation force.
  - Be enough to maintain sealing pressure on the gasket and prevent leakage.



Styles of Non-confined Flanges

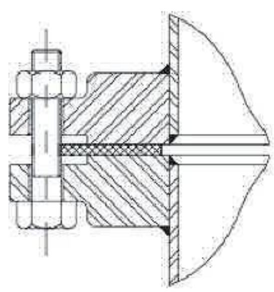
Flat Face:

Surfaces in both flanges are flat. A flat face flange can be a style RF with the external diameter touching the bolts. Or FF with the gasket covering the entire flange surface. Flat face flanges are usually used when the flange is made from a fragile material.



Raised Face:

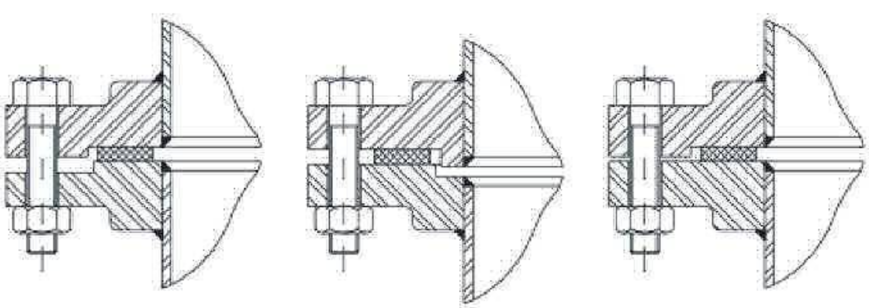
In a raised face flange the contact surfaces are raised approximately 1/16". Normally the bolts are covered up by the gasket. This style allows for the removal and installation of gaskets without having to separate the flanges.



Male and Female:

A **semi-confined** Gasket

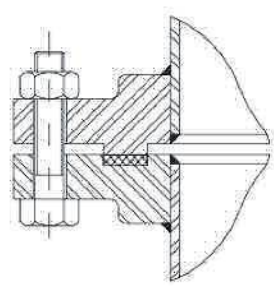
The depth of the female face is equal or less than the male to prevent the faces from making contact during the seating of the gasket. The external diameter of the female face is 1/16" bigger than the male. The flanges must be separated in order to remove gasket.



Styles of Confined Flanges

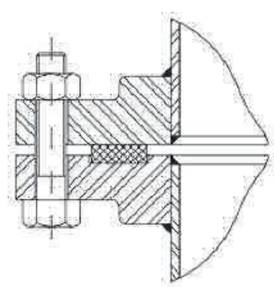
Tongue & Groove:

This style of flange features a groove that is a little wider than the tongue above it. The gasket used in this flange is usually the same width of the tongue so that it can fit in the groove on the bottom. Separation of the flanges is required for installation and removal. this flange exerts a lot of seating pressure and is not recommended for non-metallic gaskets.



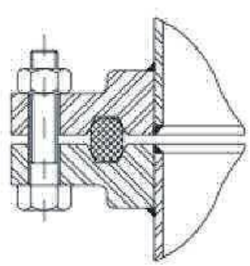
Flat Face and Groove:

Similar to a tongue and groove flange with the exception that it does not feature a tongue, but instead has a flat face. This flange is used in applications that require precision when setting the gasket. When seated the flanges will touch one another. Only very durable gaskets are recommended for this style of flange.



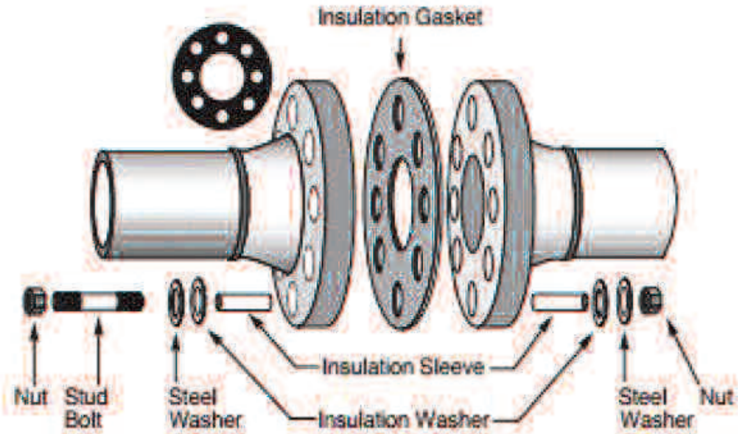
Ring-Joint:

This style is also known as an API Ring. Both faces have grooves that feature 23° angled walls. The gaskets used in this flange are primarily solid metal but can be used with other hard materials like PTFE. The gasket is usually has a round or octagonal profile. The otcagonal ring are the more efficient of the two.



Insulation Sets

ASP 7700-R	TYPE 'R' - Raised Face
ASP 7700-F	TYPE 'F' - Full Face
ASP 7700-RJ	TYPE 'RJ' - R.T.J

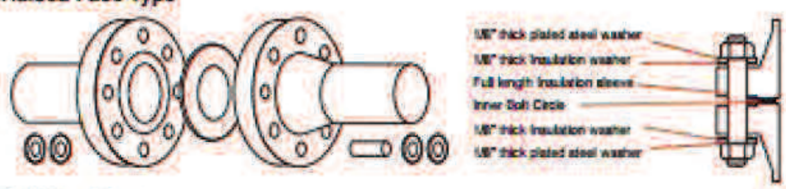


[Characteristic]

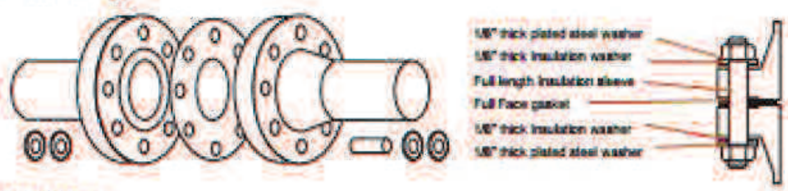
Insulation sets are used for pipeline flange corrosion protection and for complete electrical insulation protection where a seal is required between dissimilar flange materials.
There are three standard styles available to suit raised face, full face and ring grooved flanges.

[Standard Styles of Insulation Sets]

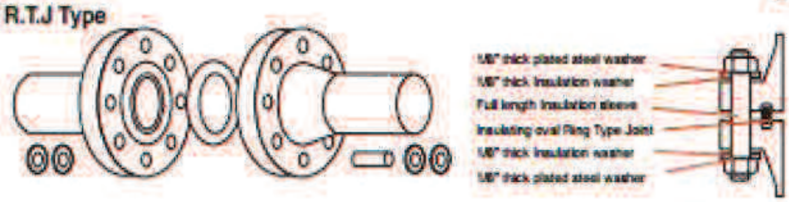
Raised Face Type



Full Face Type

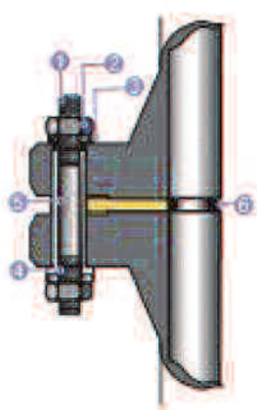


R.T.J Type



[Insulation Set Material]

Items	Materials	Max.Temp. (℃)	Thickness
Insulation Gasket	PTFE Solid	260	3.0T~3.2T
	Rubber	150	
	Neoprene Faced Reinforced Phenolic	130	
	Glass Reinforced Epoxy with Viton Seals	180	
Insulation Sleeve	Phenolic Glass	130	0.8T~1.0T
	Epoxy Glass	180	
	PTFE	260	
Insulation Washer	Glass Reinforced Epoxy	180	3.0T
	Glass Reinforced Phenolic	130	
Steel Washer	Carbon Steel	N/A	3.0T~4.0T
	Stainless Steel	N/A	
Nut	A194 Gr.2H (ASTM)	N/A	N/A
Bolt	A193 Gr.B7 (ASTM)	N/A	N/A



❶ Nut
❷ Stud Bolt
❸ Insulation Washer
❹ Steel Washer
❺ Insulation Sleeve
❻ Insulation Gasket

A Lesson in Leakage

In industry there is no such thing as "zero leakage", so in order to figure out whether or not a gasket is leaking, it is impotant to know how you are measuring the leak and by what standard you are basing your measurements. In some applications the maximum leak allowance can be one drop per second. In other applications the leak allowance can be judged by the absence of soap bubbles when the equipment is functioning. More intense applications can even call for mass spectrometers or other leak detection tools.

In order to establish a standard for maximum Leak allowance, one should consider the following variables.

- What fluid will be sealed.
- Impact on the immediate environment, if the fluid escapes into the atmosphere.
- Danger of fire or explosion.
- Other unique factors based on the application the gasket is used for.

For industrial applications "zero leakage" is defined as Helium leakage between 10^{-4} and 10^{-8} cm^3/sec. or less. In order to control fugitive emissions the Environmental Protection Agency or EPA, established a limit of 500 ppm (parts per million) as a maximum leak allowance for flanges. More recently this value has been considered to be too high and is currently being moved to be revised to 100 ppm instead of 500 ppm.

The leakage rate is not always relevant in all applications but in critical situations must be firmly established.

Materials for Metallic Gaskets

Corrosion

When specifying the material for a metalic gasket it is important to analyze the metal or alloy properties and its reactions under stress and temperature. Special attention must be given to:

- **Stress Corrosion:** stainless steel 18-8 can exhibit stress corrosion when around certain fluids.
- **Intergranular Corrosion:** some chemical products can penetrate carbides where the crystalline grain formations in metal meet when in temperatures between 790°F (420°C) and 1490°F (810°C). This occurance is called Intergranular Corrosion.
- **Fluid Compatibility:** The material used must be resistant to the fluid you are sealing and cannot contaminate said fluid.

The following are the most common alloys used in manufacturing metallic gaskets, their characteristics, temperature limits and approximate Brinell harness (HB).

Carbon Steel

Commonly used in jacketed gaskets and ring joints. Carbon Steel has a low corrosion resistance and should not be used in water, diluted acids or saline solutions. Carbon Steel can however be used in alkalis and concentrated acids. Temperature limits: 900°F (500°C). Hardness: 90 to 120 HB.

Stainless Steel AISI 304

An alloy that contains 18% Cr (Chromium) and 8% Ni (Nickle) and is one of the most common in the maufacturing of metallic gaskets because of its excellent resistance to corrosion, its low cost and is readily available. Its maximum operating temperature is 1400°F (760°C). Because of stress and intergranular corrosion, the continuous service temperature is limited to 790°F (420°C). Hardness: 160 HB.

Materials for Metallic Gaskets (continued)

Stainless Steel AISI 304L

It has the same corrosion resistance as AISI 304. Its Carbon content is limited to 0.03%, has less Intergranual Carbon precipitation and therefore less Intergranual Corrosion. Its operational limit for continuous service is 1400°F (760°C). AISI 304L is susceptible to Stress Corrosion. Hardness: 160 HB.

Stainless Steel AISI 316

This alloy contains 18% Ni (Nickle), 13% Cr (Chromium), 2% Mo (Molybdenum) and offers excellent resistance to corrosion. It can have carbonate precipitation at temperatures between 860°F (460°C) and 1650°F (900°C), under severe corrosion conditions. Max continuous service temperature is 1400°F (760°C). Hardness: 160 HB

Stainless Steel AISI 316L

Has the same chemical composition as the AISI 316 but has a carbon content limited to 0.03% , inhibiting Intergranual Carbon precipitation, and by extension limiting Intergranular Corrosion. Maximum Service Temperature is 1400°F (760°C). Hardness: 160 HB.

Stainless Steel AISI 321

This alloy contains 18% Cr and 10% Ni stabalized with Ti (Titanium), which reduces Intergranular Carbon precipitation. Can be used in temperatures up to 1500°F (815°C). Hardness: 160 HB.

Stainless Steel AISI 347

An alloy similar to AISI 304 but is stabilized with Nb (Niobium) and Ta (Tantalum) to reduce carbonate precipitation. This alloy is also susceptible to Stress Corrosion. Has good performance in high temperature corrosive service. Maximum temperature: 1550°F (815°C). Hardness: 160 HB.

Materials for Metallic Gaskets (continued)

Monel

An alloy with 67% Ni and 30% Cu (Copper) that offers great resistance to most acids and alkalis with the exception of extremely oxidant acids. This metal is subject to stress corrosion and therefore it should not be used in applications involving fluorine-silicon acid and Mercury. When used in conjunction with PTFE, it is used frequently in Spiral Wound gaskets for highly corrosive service. Maximum operating temperature: 1500°F (815°C). Hardness: 95 HB

Nickle 200

An alloy with 99% Ni and offers great resistance to caustic applications although it does not have the same kind of chemical resistance as Monel. It is also used in Spiral Wound and jacketed gaskets for special applications. Maximum operating temperature: 1400°F (760°C). Hardness: 110 HB.

Copper

This material is often used in small dimension gaskets, where the seating pressure is limited. Maximum operating temperature: 500°F (260°C). Hardness: 80HB

Aluminum

Because it has great corrosion resistance and is easy to handle, aluminum is frequently used to make gaskets. Maximum service temperature: 860°F (460°C). Hardness: 35 HB.

Inconel

This alloy contains 70% Ni, 15% Cr and 7% Fe (Iron). Inconel has excellent corrosion resistance from cryogenic to high temperature. Temperature limit: 2000°F (1100°C) Hardness: 150 HB.

Titanium

This metal has excellent corrosion resistance in high temperatures, oxidant service, Nitric acid and caustic solutions. Temperature limit: 2000°F (1100°C). Hardness: 215 HB.

Jacketed Gaskets

A jacketed gasket is make from a soft pliable core inside a metallic jacket as seen in the diagram below.

Metallic Jacket

Almost any metal or alloy that can be found in sheet form can be used as a metallic jacket. As with any material you must consider the fluid you are sealing in order to choose the right material. The metallic jacket is typically 0.016 in. (0.4 mm) to 0.024 in. (0.6 mm) thick.

Filler

Filler material typically used in jacketed gaskets include Flexible Graphite, ceramic, mica-graphite, PTFE and other metals.

Design

Below are some recommendations for determining the dimensions of a jacketed gasket.

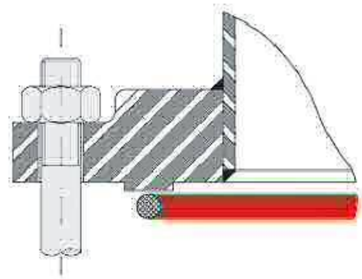
- **Gaskets confined by the inside and outside diameters:**
- Gasket inside diameter = Groove inside diameter plus 1/16 in (1.6 mm)
- Gasket outside diameter = Groove outside diameter less 1/16 in (1.6 mm)

- **Gaskets confined by outside diameter:**
- Gasket inside diameter = Flange inside diameter plus a min. of 1/8 in. (3.2mm)
- Gasket outside diameter = Groove outside diameter less 1/16 in. (1.6mm)

- **Non confined gaskets:**
- Gasket inside diameter = Flange inside diameter plus 1/8 in. (3.2mm)
- Gasket outside diameter = Bolt circle diameter less bolt diameter.

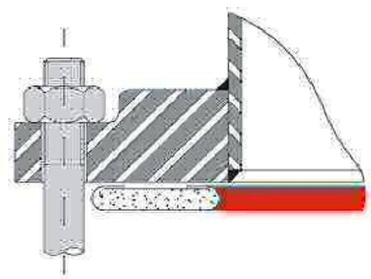
Styles of Jacketed Gaskets

Round Single Jacket Gasket



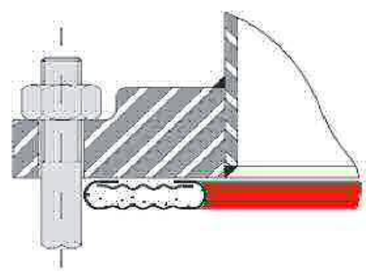
This style can be manufactured in either circular or oval cross sections. It is used in applications that have restrictions in seating stress and width. The maximum gasket width 1/4 in. (6.4mm) and the standard thickness is 3/32 in. (2.4mm).

Flat Double Jacket Gasket



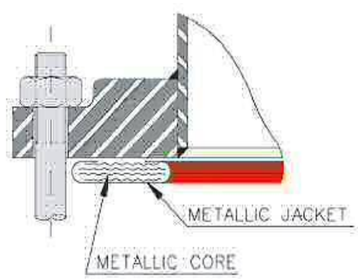
This style is typically used as pipe flange gaskets and in Heat Exchangers. The standard thickness is 1/8 in. (3.2mm). This style is aslo used in large size reactors in chemical plants. Another use for this style is in flanges in the large, low pressure ducting in Blast Furnaces. To compensate for irregularities in these flanges, these gaskets have a thickness from 5/32 in. (4mm) to 1/4 in. (6mm).

Corrugated Double Jacket Gasket



This style is similar to the flat double jacket gasket with the exception that its jacket is corrugated. These corrugations serve as a kind of maze, increasing its sealability.

Double Jacket Gasket w/ Metallic Filler



This style is similar to the flat double jacket except is has a grooved metallic core. This style is used in applications where non-metallic materials cannot be used. Its temperature limits and chemical resistance is determined by the type of metal used.

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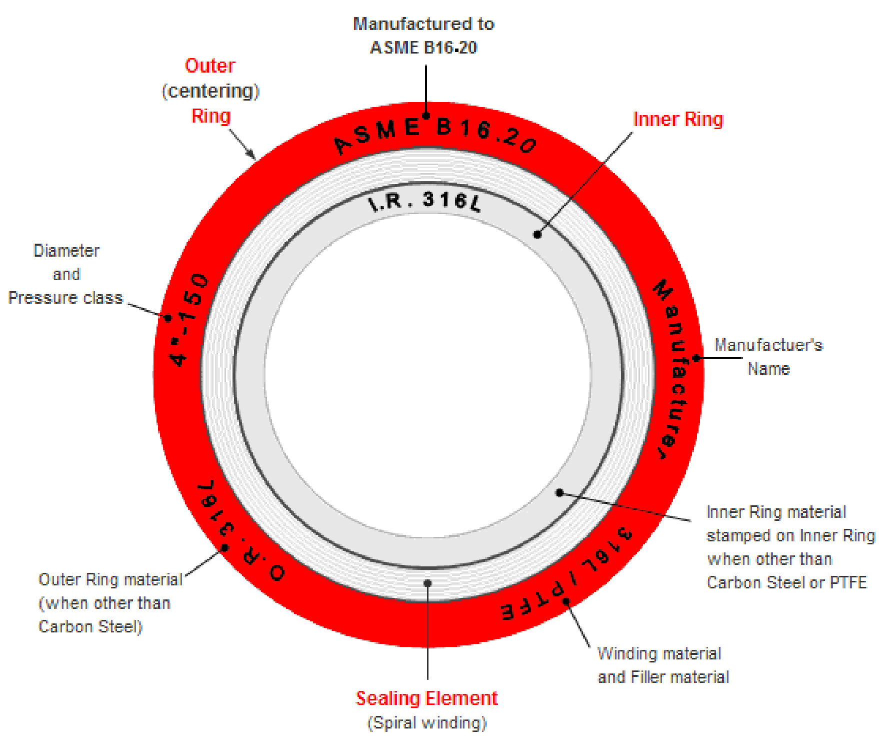
Spiral Wound Gaskets

Spiral Wound gaskets made with a preformed metallic strip and a soft filler material wound together under pressure. The filler flows into the flange imperfections when the gasket is seated and the metallic strip holds the filler, giving it mechanical resistance and durability. The "V" shape of the filler material acts as a *Chevron Ring* that is capable of reacting to changes in pressure and temperature.

Spiral wound gaskets are manufactured in many different material combinations as well as a wide range of dimensions and shapes. These gaskets are widely used and cover a large array of applications. Spiral wound gaskets designed for ASME B16.5 flanges are produced in high volumes and are competitively priced.



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