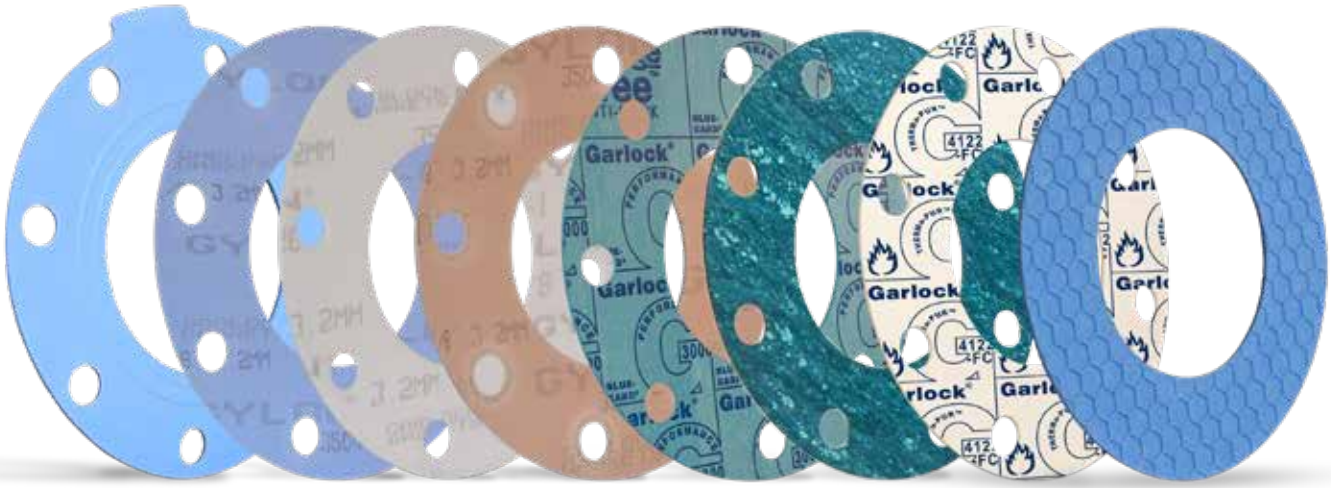
Garlock

Garlock Gasketing Products

Performance with proven reliability



Garlock Gasketing

Today's environmental concerns demand positive seals. Garlock® gaskets provide that assurance, and perform with proven reliability.

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Garlock Gasketing Products

The demands of modern applications make the choice of the right sealing product an important consideration, both in the design of new equipment and in choosing the new products which will replace those no longer suitable.

This catalog provides some typical examples of appropriate applications, but is not intended to be a warranty of performance. All specific uses of sealing products require independent study and specific evaluation for suitability.

Garlock will provide the technical assistance of its applications engineers, who will give you specific recommendations. Please consult us. We are ready to help you make the right choice. Choosing the wrong sealing product can result in property damage and/or serious personal injury. Do not rely on the general criteria, which may not suit your application as well as one that Garlock Engineering can help you choose. Reliability and service to our customers is what the Garlock name means.

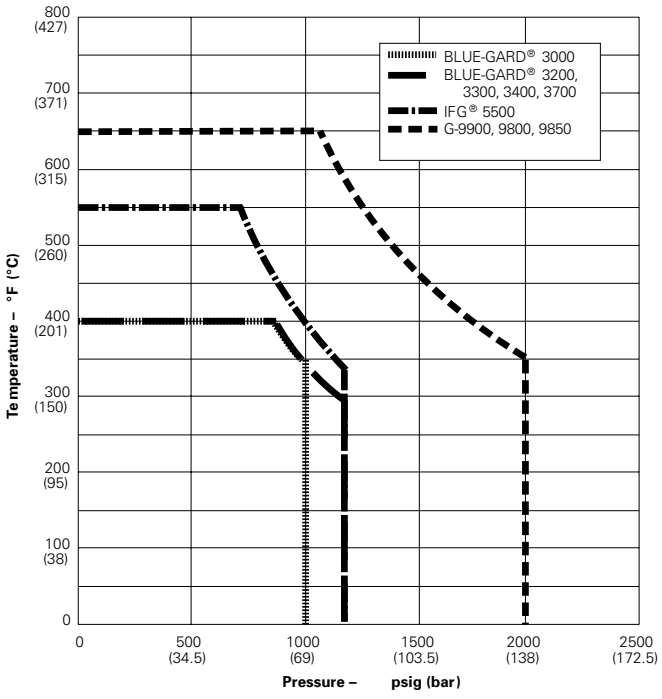
Let us help you choose the right product for your application.

Garlock gasketing products are manufactured in completely modernized facilities. Tight quality controls are used to assure product conformance to specifications and uniformity that results in unvarying performance on the job. Garlock is certified to ISO 9001 standards.

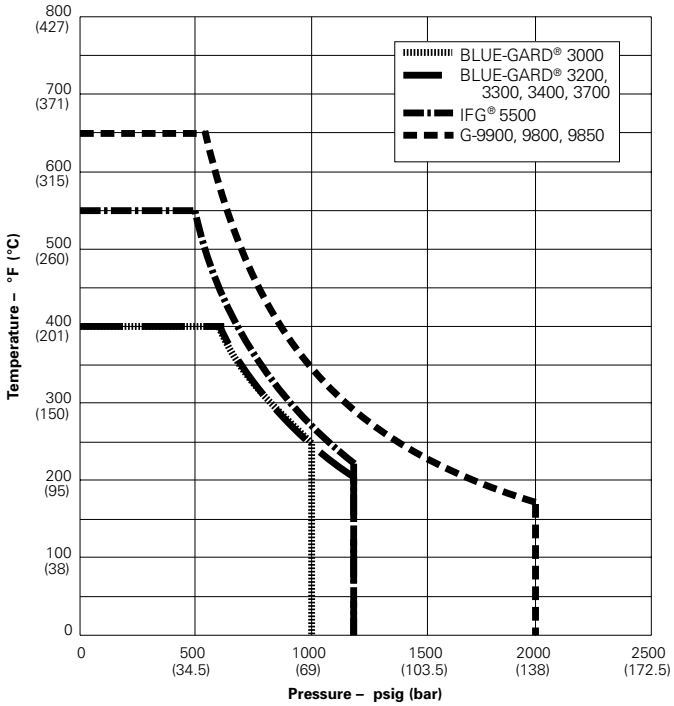
Today's environmental concerns demand positive seals. Garlock gaskets provide that assurance and perform with proven reliability. Whether your industry is chemical processing, hydrocarbon processing, power generation, pulp and paper, microelectronics or transportation, Garlock gasketing products are the logical choice.

Garlock also manufactures a wide range of elastomeric and metallic gaskets. For products not listed in this catalog, contact Garlock Gasket Applications Engineering at 1.800.448.6688.

PxT Graph for 1/32" and 1/16" Compressed Fiber Gasketing[1]



PxT Graph for 1/8" Compressed Fiber Gasketing[1]



NOTES:

1. Based on ASME raised face flanges at the published torque values. When approaching maximum pressure or continuous operating temperature, or 50% of maximum PxT, consult Garlock Applications Engineering.

Gasketing Selection

FACTORS AFFECTING GASKET PERFORMANCE

The main function of a gasket is to create a positive seal between two relatively stationary surfaces. In order to do this the gasket must first initiate a seal, and second, maintain the seal over a desired length of time. Ideally the gasket should also be easily removed and replaced when necessary. The correct gasket for a given service should be able to provide the following::

1. Effectively seal system fluid.
2. Chemically resist the system fluid.
3. Deform / conform to any imperfections that may exist on the sealing surfaces.
4. Withstand system temperatures without serious impairment of performance.
5. Maintain an adequate portion of the applied load.
6. Sufficient strength to resist crushing under the applied load, and maintain integrity during handled and installed.
7. Does not contaminate the system fluid.
8. Does not promote corrosion of the sealing surfaces.
9. Removes easily and cleanly at the time of replacement.

Garlock recommends using these nine (9) factors as a checklist when working through the gasket selection process.

Selecting gasketing materials for particular applications is not an easy task. The variables present in a flanged connection seem endless and yet all of them must be taken into consideration to assure a proper seal. In the past, the acronym "STAMP" (Size, Temperature, Application, Media and Pressure) seemed to give sufficient information to make a gasketing recommendation. Today, items such as: the flange material, the bolt grade, the flange surface finish (and many other variables) also affect how well a gasket will perform. In addition, the definition of what a seal is has changed drastically over the years. Leakage measurements in some applications have gone from drips per minute to parts per million (ppm).

Our catalog is designed to help guide you through the various gasketing products and narrow your choices. All industry standard tests are included in order to allow an end user a means of comparison between different materials. Many of the test procedures require that the tests be conducted on 1/32" (0.8mm) material. Generally, as gaskets become thicker properties such as sealability,load retention (creep relaxation), and blowout resistance can start to degrade. In addition, compressive loads must be increased with thicker materials. Proper bolting sequences are necessary to ensure those compressive loads are uniform. The temperature, pressure and P x T ratings are all based on optimum conditions. When approaching those extremes, it is suggested that you consult with the Garlock Applications Engineering Department or possibly upgrade to a material that has higher ratings.

As industry standards change and new products are introduced, this catalog will be updated. In the meantime, we urge you to take advantage of our experienced personnel for assistance. In-plant training, instructional videos, additional technical information and gasketing recommendations all are available to help in your selection process. Please feel free to contact us should you have any questions or concerns. Garlock is here to help.

Selection thought process:

There is a thought process required when selecting a gasket; it basically involves narrowing the choices as the sealing requirements and service conditions are reviewed. While many understand that service conditions such as temperature, media, and pressure must be considered, few realize how important it is to fully understand the "application", which can be thought of as the mechanical conditions the gasket will see. First and foremost is the compressive load applied to the gasket. With standard flanges, such as 150# raised face (RF), there are dimensional standard so the range of compressive load on the gasket are known. With non-standard flanges, more information is required. While not quite as simple as this, a way to begin this thought process is this: Rubber and some of the softer materials are preferred in light weight and/or full face/flat face flanges; fiber and GYLON® gaskets for 150# RF flanges; FLEXSEAL® spirals or Kammprofile gaskets for high temp/high pressure/ high compressive load situations. Temperature, pressure and media are then considered in order to properly select a material.

Gasketing Selection & TAMPS

TEMPERATURE

In most selection processes, the temperature of the fluid at the gasketed joint should be considered first. This will reduce the number of product candidates quickly, especially as temperatures go from 200°F (95°C) to 1,000°F (540°C). When system operating temperatures approach the published maximum continuous operating temperature limit of a particular gasket material, an upgrade to a superior material is suggested. In some situations cryogenic temperatures must also be considered.

SIZE & APPLICATION

Size and Application tend to overlap. The most important information under application is the type of equipment, flange, heat exchanger, pump, reactor, etc. and what the sealing surfaces are constructed of (i.e. steel, cast iron, bronze, PVC, FRP, etc.). The size pertains more to the dimensional details which include bolting details, (number, size and grade), along with the flange dimensions, thickness, this information is then used to determine the available compressive stress that can be generated on the gasket. The surface area being compressed is calculated from the gasket contact dimensions. The load from the bolts and the contact area of the gasket result in the compressive stress available to seal the gasket. This information has already been calculated and tabulated for standard ASME raised face (RF) flanges and can be found on page 46. The compressive stress available on nonstandard flanges must be calculated on an individual basis. Performing these calculations are necessary in order to properly choose between various types of materials such as elastomeric (rubber) gaskets, compressed fiber, GRAPH-LOCK® and GYLON® styles.

For example, nonmetallic flanges such as FRP, PVC and CPVC are mostly designed for rubber gaskets. These flanges typically use a full face gasket, and the allowable torque is limited so that the flanges do not crack when bolted.

Flat faced flanges made from cast iron, aluminum, bronze, or light weight angle iron or plate will also use a full face gasket to avoid bending forces in the flanges. Therefore, in these flanges the ideal solution is a softer gasket, although fiber gaskets and GRAPH-LOCK® will often work, and may be necessary for certain extreme conditions, such as steam service.

Flanges that create very high compressive loads might require a metallic spiral wound or kammprofile, but many can also be sealed with a fiber or GYLON® gasket. A 150# raised face flange is fine with any of these; a 600# raised face flange is best suited for a metal gasket.

MEDIA

There are thousands of different fluids, and while the chemical resistance guide found on pages 25 through 42 in this catalog cannot cover all of them it does cover a limited number of fluids that make up the vast majority of the media encountered in industry.

NOTE: System clean out and flushes should also be considered. Additional information on products versus fluids is available upon request.

PRESSURE

Next to be considered is the internal pressure of the fluid at the gasketed joint. While maximum pressure limits are listed in this catalog for each style, customers are strongly encouraged to contact the Applications Engineering department if severe and frequent pressure changes are involved, as an alternative product may be more appropriate.

SPECIAL REQUIREMENTS

Beyond the TAMPS, there are other requirements that are IN ADDITION to the information previously listed. Examples are compliance with FDA, fire resistance, electrically insulating properties, cleaned for oxygen service, etc. We have the words IN ADDITION in caps because it is not uncommon to be asked for a "fire resistant" gasket or an FDA gasket, without the necessary TAMP information.

PRESSURE (PSIG OR BAR) X TEMPERATURE (°F OR °C)

We strongly recommend that pressure and temperature be considered simultaneously by using the following procedure:

1. First select the Garlock style(s) being considered for your application/ service,
2. List the maximum pressure, temperature and P x T value for the style(s),
3. Make sure the actual service conditions do not exceed the published ratings in any of the three criteria. If they don't, the style(s) can be used, provided all other requirements are met. If they do exceed any rating, another style or styles should be considered. Rarely can a style be recommended when the service conditions of pressure and temperature are both at the maximum limits for that style.

Example: BLUE-GARD® Compressed Gasketing Style 3000

1. Pressure Limit:	1,000 psig (70 bar)
2. Maximum Temperature Limit:	700°F (370°C);
Ideal Operating Temp.:	400°F (205°C)
3. P x T Limit:	350,000* (12,000)

At 1,000 psig (70 bar), maximum temperature is 350°F (180°C).

IMPORTANT

Maximum pressure and P x T ratings are based on the use of ASME RF flanges at our preferred torque. The ratings were developed using laboratory tests at ideal gasketing conditions. Field conditions will undoubtedly affect the gasket performance.

When approaching maximum pressure, continuous operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Applications Engineering.

We hasten to point out that this method for gasket selection is merely a general guide and should not be the sole means for selecting or rejecting a product.

* P x T based on 1/16" sheet thickness unless otherwise stated.

Bolting and Flange Information

The gasket's function is to seal two different surfaces held together by one of several means, the most common being screw-threaded devices such as bolts. Sometimes the fastener itself must be sealed, as in the case of a thread cap.

The bolt is a spring. It is an elastic member that has been stretched to develop a load. The more spring provided by the bolt, the better the retention of stress on the gasket to maintain a leakproof joint. It must not be over-elongated (over-strained), or the elastic limit of the steel will be exceeded. The bolt then deforms and, with continued loading (stressing), may break.

PROPER TIGHTENING

To avoid such problems with bolt tightening, the use of a torque wrench is recommended. The torque tables on page 46 show the recommended torque values for Garlock compressed fiber, GYLON® and GRAPH-LOCK® gasketing materials in 150# and 300# raised face flanges. The equipment designer may specify the recommended torque to prevent damage to the equipment from over torquing. Garlock's recommended assembly stresses, (page 45), may help the equipment designer determine the maximum allowable torque per bolt. The load will be retained better by using a bolt with a longer grip, thereby ensuring a leakproof joint.

IMPERFECTIONS

There are limits on the degree of flange surface imperfection that can be sealed successfully with a gasket. Large nicks, dents, or gouges must be avoided, since a gasket cannot properly seal against them. The surface finish of a flange is described as follows:

» Roughness: Roughness is read in millionths of an inch (or meter) as the average of the peaks and valleys measured from a midline of the flange surface. This is expressed either as rms (root mean square) or AA (arithmetic average). The difference between these two methods of reading is so small that they may be used interchangeably. Roughness is also expressed as AARH (arithmetic average roughness height).

» Lay: Lay is the direction of the predominant surface-roughness pattern. Example: multidirectional, phonographic spiral serrations, etc.

» Waviness: Waviness is measured in thousandths or fractions of an inch. Basically, it is the departure from overall flatness.

FLANGE FINISH

Typical roughness readings can be from 125 - 500 micro-inches for serrated flanges and 125 - 250 micro-inches for non-serrated flanges. Fine finishes, such as polished surfaces, should be avoided. Adequate "bite" in the surface is required to develop enough friction to prevent the gasket from being blown out or from extruding or creeping excessively.

SERRATIONS OR ROUGHNESS

The lay of the finish should follow the midline of the gasket if possible. Take, for example, concentric circles on a round flange, or a phonographic spiral. Every effort should be made to avoid lines across the face, such as linear surface grinding, which at 180° points will cross the seal area at right angles to the gasket, allowing a direct leak path.

Waviness is seldom a problem under normal conditions. There are two areas that must be watched, however, since excessive waviness is very difficult to handle.

The first area is **glass-lined equipment** where the natural flow of the fused glass creates extreme waviness. Often the answer here is to use thick and highly compressible gasketing.

The second area of concern is **warped** flanges. If warpage is caused by heat or internal stresses, re-machining is generally sufficient. However, warpage due to excessive bolt loads or insufficient flange thickness results in what is generally called bowing.

The solution is to redesign for greater flange rigidity. Sometimes backer plates can be added to strengthen the design without having to replace the parts. Another step would be to add more bolts. When this is done, usually smaller bolt diameters are possible, thus adding more bolt stretch and better joint performance.

Style 5500

Compressed Inorganic Fiber Gasketing

BENEFITS

Tighter Seal

» Inorganic fiber gasketing offers excellent thermal stability with minimal weight loss

» Reduced creep relaxation and improved torque retention provide optimal sealability

Temperature resistant

» Non-oxidizing fibers with an ideal operating temperature limit of up to 550˚F (290˚C), and maximum spike of 800˚F (425˚C)

» Style 5500 has passed the Garlock Fire Test and is ABS Fire Safe Type Approved

Media

Style 5500

» Water, aliphatic hydrocarbons, oils, gasoline, saturated steam[4], inert gases, most refrigerants

TYPICAL PHYSICAL PROPERTIES*

		5500[4]
Color		Gray
Binder		Nitrile (NBR)
Temperature[1] ˚ F (˚ C)	Maximum: Minimum: Ideal Operating Limit:	800 (425) -100 (-75) 550 (290)
Pressure[1] psig (bar)		
	Maximum: Minimum: Ideal Operating Limit:	1,200 (83) Full Vacuum 750 (52)
P x T, max. (psig x ˚F) (bar x ˚C)	1/32", 1/16" (0.8mm, 1.6mm) 1/8" (3.2mm)	400,000 (14,000) 275,000 (9,600)
Sealability (ASTM F37B)[2]		
ASTM Fuel A	ml/hr	0.3
Nitrogen	ml/hr	1.0
Creep Relaxation (ASTM F38)	%	25
Compressibility Average (ASTM F36)	%	10
Recovery (ASTM F36)	%	>50
Tensile Strength across grain (ASTM F152)	psi (N/mm^2)	1,500 (10)
Density	lbs/ft^3 (g/cm^3)	100 (1.60)
Gas Permeability (DIN 3535-6)	mg/m-sec	0.005

* Values do not constitute specification limits

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values. When approaching maximum pressure, ideal operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Engineering.

2 ASTM F37B Sealability
ASTM Fuel A (isooctane):
Gasket load = 500 psi (3.5 N/mm^2), Int. pressure = 9.8 psig (0.7 bar)
Nitrogen:
Gasket load = 3,000 psi (20.7 N/mm^2), Int. pressure = 30 psig (2 bar)

3 DIN 3535-6 Gas Permeability, mg/m-sec (1/16" thick)
Nitrogen:
Gasket load = 4,640 psi (32 N/mm^2), Int. pressure = 580 psig (40 bar)

4 Saturated steam service guidelines:
- For steam service above 150 psig contact Applications Engineering.
- For optimal performance, use thinner gaskets when possible.
- Minimum recommended assembly stress = 4,800 psi
- Preferred assembly stress = 6,000 psi to 10,000 psi
- Retorque the bolts/studs prior to pressurizing the assembly.
- If the service is superheated steam or saturated steam above 150 psig contact Applications Engineering.

High Temp Compressed Graphite or Carbon Fiber Gasketing

TYPICAL PHYSICAL PROPERTIES*

		9900[4]	9800[4]	9850[4]
Color		Mahogany	Black	Black
Composition		Graphite with nitrile	Carbon with SBR	Carbon with nitrile
Temperature[1] ˚ F (˚ C)	Maximum: Minimum: Ideal Operating Limit:	1,000 (540) -100 (-75) 650 (340)	900 (480) -100 (-75) 650 (340)	900 (480) -100 (-75) 650 (340)
Pressure[1] psig (bar)				
	Maximum: Minimum: Ideal Operating Limit:	2,000 (138) Full Vacuum 750 (52)	2,000 (138) Full Vacuum 750 (52)	2,000 (138) Full Vacuum 750 (52)
P x T, max. (psig x ˚F) (bar x ˚C)	1/32", 1/16" (0.8mm, 1.6mm) 1/8" (3.2mm)	700,000 (25,000) 350,000 (12,000)	700,000 (25,000) 350,000 (12,000)	700,000 (25,000) 350,000 (12,000)
Sealability (ASTM F37B)[2]				
ASTM Fuel A	ml/hr	0.3	0.3	0.3
Nitrogen	ml/hr	0.6	0.6	0.6
Creep Relaxation (ASTM F38) (1/32")	%	9	15	15
Compressibility Average (ASTM F36)	%	9	8	8
Recovery (ASTM F36)	%	>55	>55	>55
Tensile Strength across grain (ASTM F152)	psi (N/mm^2)	1,800 (12)	1,800 (12)	1,800 (12)
Density	lbs/ft^3 (g/cm^3)	110 (1.76)	105 (1.68)	105 (1.68)
Gas Permeability (DIN 3535-6)	mg/m-sec	0.0014	0.0014	0.0014

This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 1/32" (0.8mm) sheet thickness.

* Values do not constitute specification limits
All styles are furnished with an anti-stick parting agent as standard.

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values. When approaching maximum pressure, ideal operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Engineering.

2 ASTM F37B Sealability
ASTM Fuel A (isooctane):
Gasket load = 500 psi (3.5 N/mm^2), Int. pressure = 9.8 psig (0.7 bar)
Nitrogen:
Gasket load = 3,000 psi (20.7 N/mm^2), Int. pressure = 30 psig (2 bar)

3 DIN 3535-6 Gas Permeability, mg/m-sec (1/16" thick)
Nitrogen:
Gasket load = 4,640 psi (32 N/mm^2), Int. pressure = 580 psig (40 bar)

4 Saturated steam service guidelines:
- For steam service above 150 psig contact Applications Engineering.
- For optimal performance, use thinner gaskets when possible.
- Minimum recommended assembly stress = 4,800 psi.
- Preferred assembly stress = 6,000 psi to 10,000 psi.
- Retorque the bolts/studs prior to pressurizing the assembly.
- If the service is superheated steam or saturated steam above 150 psig contact Applications Engineering.

Style 9900

BENEFITS

Tough & Reliable

» Graphite fiber gasketing withstands extreme temperatures and pressures, as well as many chemicals

» Passed Garlock fire tests and is ABS Fire Safe Type Approved

» See note below for STR 508

Tighter Seal

» Maintains superior seal during thermal cycling, even in saturated steam[4] and hot oils

» Significantly reduces emissions to meet stringent Clean Air Act requirements

Easy to Install

» Graphite fiber sheet is easier to handle and cut than exfoliated graphite sheets or metal-inserted gasket material

NOTES:
Refer to "Military Specifications" section under "Gasketing Terms" for order/inquiry requirements. To ensure receipt of product with the required STR 508 approvals, certification will be required; associated fees based on quantity.

Media

» Saturated steam[4], water, inert gases, aliphatic hydrocarbons, oils, gasoline and most refrigerants

Styles 9800 / 9850

BENEFITS

Heat & Pressure Resistant

» Carbon fiber gasketing excels in harshest conditions - intense heat, high pressure, saturated steam[4] and hot oils (Style 9850)

» Laboratory tested for fire safety

Tighter Seal

» Maintains effective seal during pressure and temperature fluctuations

» Superior torque retention lowers leakage rates and reduces maintenance time

Convenient

» Flexible material is easy to handle and cut

» Sheet sizes to 120" x 120" (3.0m x 3.0m) minimize waste and inventory costs

Media

Style 9800

» Saturated steam[4], water and inert gases

Style 9850

» Saturated steam[4], water, aliphatic hydrocarbons, oils, gasoline and most refrigerants

Various gasket materials including 9900, 9800, 9850 and 5500, have been tested to industry fire test standards.

THERMa-PUR®

4122-FC, THERMa-PUR® Faced CMG, Kammprofile, Spiral Wound

THERMa-PUR® is a proprietary new gasketing material designed for use in high temperature sealing applications and is produced using an environmentally friendly solvent-free process. THERMa-PUR® is yet another innovative Garlock sealing solution that provides more than just temperature resistance.

VALUE & BENEFITS

Extreme Temperature

» Able to withstand high temperatures, whether continuous or in thermal cycling conditions

Oxidation Resistance

» Contains proprietary materials that provide improved weight loss characteristics over other high temperature solutions. (see graph)

Hydrophobic & Electrically Insulating

» Resists water and provides electrical isolation thus reducing the possibility of corrosion between flanges made of dissimilar metals

Easy Release from Flanges

» Does not stick to flanges making removal of gaskets easy and fast

Safer Handling (4122-FC)

» Patented (US 10,894,382) fiber core makes gaskets safer to handle when compared to traditional high temperature gaskets with steel cores

IDEAL FOR

» Marine and Land-based Exhaust Systems
» Biomass Gasification Process
» Oil and Gas Production
» Mineral and Fertilizer Processing
» Incineration Process
» Cogeneration Systems
» Turbochargers Equipment
» Process Drying Equipment

CONFIGURATIONS

» Available in;
  › Sheet
  › Standard FLEXSEAL® Spiral Wound Configurations: RW/RWI/SW/SWI
  › Kammprofile
  › THERMa-PUR® faced corrugated metal gasket (THERPHONIC)

TYPICAL PHYSICAL PROPERTIES (4122-FC)

Temperature Continuous max. ˚ F (˚ C)	+1832 (1000)
Pressure[1] psig (bar) 4122-FC	500 (34.5)
NOTE: Typical Physical Properties for 4122-FC*:	
ASTM Test Method F36	
Compressibility, range, %	35-45
Recovery %	18
ASTM F38	25
Creep Relaxation, %	
ASTM F152	1,200 (8.3)
Tensile, w/insert, psi (N/mm^2)	
ASTM F1315	85 (1.36)
Density, $lbs./ft^3$ ($grams/cm^3$)	
ASTM D149	100
Dielectric Properties, volts/mil.	

NOTES:

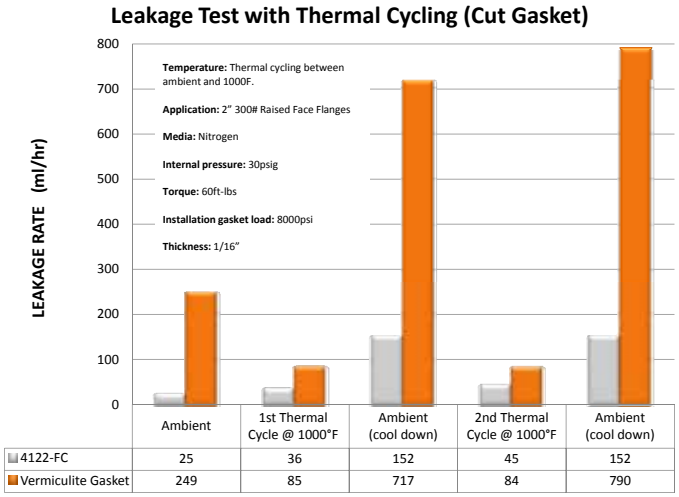
1. Based on ASME raised face flanges at the published preferred torque values. When approaching maximum pressure, ideal operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Engineering.

* This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 1/16" (1.6mm) gasket thickness unless otherwise mentioned. Values do not constitute specification limits.

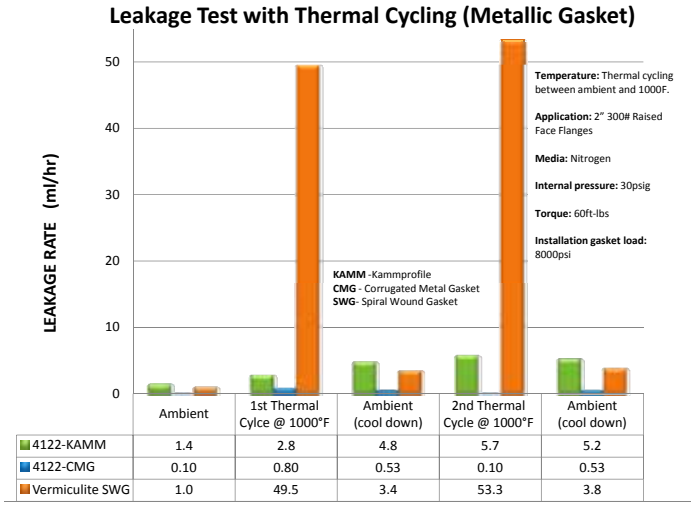
THERMa-PUR®

OUT PERFORMS

THERMa-PUR® out performed vermiculite based gaskets in laboratory testing. THERMa-PUR® showed significantly less leakage even in extreme thermal cycling condition.



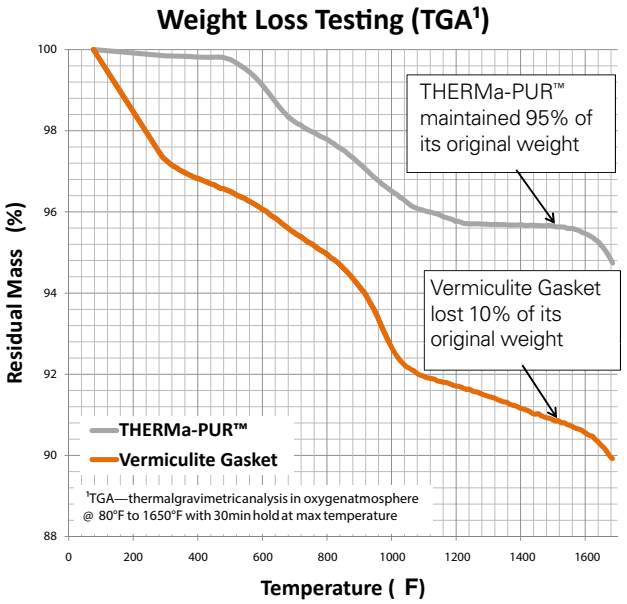
	Ambient	1st Thermal Cycle @ 1000°F	Ambient (cool down)	2nd Thermal Cycle @ 1000°F	Ambient (cool down)
4122-FC	25	36	152	45	152
Vermiculite Gasket	249	85	717	84	790



	Ambient	1st Thermal Cylce @ 1000°F	Ambient (cool down)	2nd Thermal Cycle @ 1000°F	Ambient (cool down)
4122-KAMM	1.4	2.8	4.8	5.7	5.2
4122-CMG	0.10	0.80	0.53	0.10	0.53
Vermiculite SWG	1.0	49.5	3.4	53.3	3.8

LOW WEIGHT LOSS

THERMa-PUR® proprietary formulation resists oxidation and has improved weight loss property by almost 2X when compared to other high temp organic based gaskets such as graphite and vermiculite.



BLUE-GARD® Compressed Fiber Gasketing

TYPICAL PHYSICAL PROPERTIES*

		3000	3200/3400[4/5]	3300[4]	3700[4]	2900/2950
Color		Blue	Off-white/ Grey-black	Black	Light grey	Black/Green
Binder		Nitrile (NBR)	SBR	Neoprene (CR)	EPDM	Nitrile (NBR)
Temperature[1] ˚ F (˚ C)	Maximum:	+700 (+370)	+700 (+370)	+700 (+370)	+700 (+370)	+700 (+370)
	Minimum:	-100 (-75)	-100 (-75)	-100 (-75)	-100 (-75)	-100 (-75)
	Ideal Operating Limit:	+400 (+205)	+400 (+205)	+400 (+205)	+400 (+205)	+400 (+205)
Pressure[1] psig (bar)						
	Maximum:	1,000 (70)	1,200 (83)	1,200 (83)	1,200 (83)	1,000 (70)
	Minimum:	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum
	Ideal Operating Limit:	750 (52)	750 (52)	750 (52)	750 (52)	750 (52)
P x T, max. (psig x ˚F)	1/32", 1/16"	350,000	350,000	350,000	350,000	350,000
(bar x ˚C)	(0.8mm, 1.6mm)	(12,000)	(12,000)	(12,000)	(12,000)	(12,000)
	1/8"	250,000	250,000	250,000	250,000	250,000
	(3.2mm)	(8,600)	(8,600)	(8,600)	(8,600)	(8,600)
Sealability (ASTM F37B)[2]						
ASTM Fuel A	ml/hr	0.2	0.3	0.2	0.3	0.5
Nitrogen	ml/hr	0.6	0.7	1.0	0.7	1.00
Creep Relaxation (ASTM F38)	%	21	18	20	25	25
Compressibility Average (ASTM F36)	%	8	10	10	10	8
Recovery (ASTM F36)	%	50	50	50	40	50
Tensile Strength across grain (ASTM F152)	psi	2,150	2,250	1,800	2,250	1,500
	(N/mm^2)	(15)	(16)	(12)	(16)	(10)
Density	lbs/ft^3 (g/cm^3)	100 (1.60)	100 (1.60)	105 (1.68)	100 (1.60)	105 (1.68)
Gas Permeability (DIN 3535-6)	mg/m-sec	0.005	0.003	0.008	0.004	-

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values. When approaching maximum pressure, ideal operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Engineering.

2 ASTM F37B Sealability
ASTM Fuel A (isooctane):
Gasket load = 500 psi (3.5 N/mm^2), Int. pressure = 9.8 psig (0.7 bar)
Nitrogen:
Gasket load = 3,000 psi (20.7 N/mm^2), Int. pressure = 30 psig (2 bar)

3 DIN 3535-6 Gas Permeability, mg/m-sec (1/16" thick)
Nitrogen:
Gasket load = 4,640 psi (32 N/mm^2), Int. pressure = 580 psig (40 bar)

4 Saturated steam service guidelines:
- For steam service above 150 psig contact Applications Engineering.
- For optimal performance, use thinner gaskets when possible.
- Minimum recommended assembly stress = 4,800 psi.
- Preferred assembly stress = 6,000 psi to 10,000 psi.
- Retorque the bolts/studs prior to pressurizing the assembly.
- If the service is superheated steam or saturated steam above 150 psig contact Applications Engineering

5 Refer to Mill spec section under "Gasketing Terms" for order/inquiry requirements

* This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 1/16" (1.6mm) gasket thickness unless otherwise mentioned. Values do not constitute specification limits.

All styles are furnished with an anti-stick parting agent as standard.

BLUE-GARD® Styles 3000 to 3700

BENEFITS

Excellent Sealability

» Unique blend of aramid fibers, fillers and elastomeric binders provides improved torque retention and drastically lowered emissions levels

Versatile

» Variety of elastomers excel in a wide range of services
» See note below for MIL-DTL-24696

Cost Savings

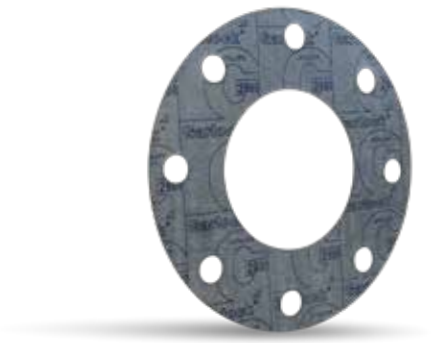
» Cuts operational costs through reduced:
  › Waste
  › Maintenance efforts
  › Stocked inventory
  › Fluid loss
  › Energy consumption

Styles 2900, 2950

BENEFITS

Ideal for utility services

» Excellent sealability
» Improved thermal stability
» Good for general service



MEDIA

3000	Water, aliphatic hydrocarbons, oils & gasoline
3200*, 3400	Water, saturated steam[4], inert gases
3300	Water, saturated steam[4], refrigerants, oils and fuels
3700	Water, saturated steam[4] and mild chemicals
2900, 2950	Water, aliphatic hydrocarbons, oils & gasoline

NOTE:
All styles are furnished with an anti-stick parting agent as standard.

* Refer to "Military Specifications" section under "Gasketing Terms" for order/inquiry requirements. To ensure receipt of product with the required MIL-DTL- 24696 branding, certification will be required; associated fees based on quantity.

MULTI-SWELL™ Style 3760

BENEFITS

Ultra-tight seal in water and oil applications

- Proprietary formulation creates additional gasket load when the gasket comes in contact with oil or water
- Twice as compressible as standard fiber gaskets - conforms to irregular surfaces

Versatile

- Stops leakage in:
  - Gear boxes
  - Compressors
  - Pumps
  - Lube oil systems
  - Access covers

NSF 61 certified MULTI-SWELL™ Style 3760

Up to 120" OD single piece gasket

TYPICAL PHYSICAL PROPERTIES*

		3760
Color		Blue/off-white
Binder		Proprietary
Temperature[1] ˚ F (˚ C)	Minimum: Ideal Operating Limit:	-100 (-75) 400 (205)
Pressure[2]	Max., psig (bar): Minimum"	500 (34.5) Full Vacuum
P xT, max. (psig x ˚F) (bar x ˚C)	1/32", 1/16" (0.8mm, 1.6mm) 1/8" (3.2mm)	150,000 (5,100) 100,000 (3,400)
Sealability (ASTM F37B)[2]		
ASTM Fuel A	ml/hr	0.20
Nitrogen	ml/hr	0.40
Creep Relaxation (ASTM F38)	%	30
Compressibility Average (ASTM F36)	%	15
Recovery (ASTM F36)	%	40
Tensile Strength across grain (ASTM F152)	psi (N/mm^2)	1,000 (6.9)
Density 1/32" (0.8mm) thk	lbs/ft^3 (g/cm^3)	85 (1.36)

* This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 1/16" (1.6mm) gasket thickness unless otherwise mentioned. Values do not constitute specification limits.

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values. When approaching maximum pressure, ideal operating temperature, minimum temperature or 50% of maximum PxT, consult Garlock Engineering.

2 ASTM F37B Sealability
ASTM Fuel A (isooctane):
Gasket load = 500 psi (3.5 N/mm^2), Int. pressure = 9.8 psig (0.7 bar)
Nitrogen:
Gasket load = 3,000 psi (20.7 N/mm^2), Int. pressure = 30 psig (2 bar)

GYLON® Family

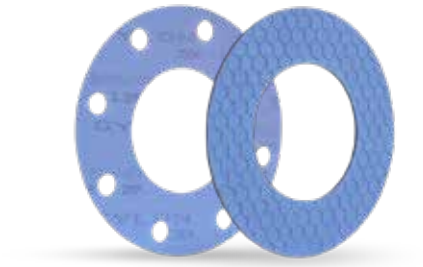
GYLON® STYLE 3500/GYLON EPIX® STYLE 3500 EPX

GYLON® Style 3500/GYLON EPIX® Style 3500 EPX is a high performance, silica filled PTFE sheet material designed for use with strong acids, solvents, hydrocarbons, and other aggressive media.

APPLICATIONS

- Strong Acids
- Solvents
- Hydrocarbons
- Water
- Steam
- Chlorine
- Cryogenics

GYLON® STYLE 3504/GYLON EPIX® STYLE 3504 EPX

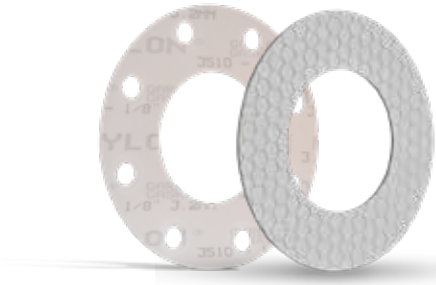


The GYLON® Style 3504/GYLON EPIX® Style 3504 EPX gasket is made of PTFE with aluminosilicate microspheres. It is designed for use in many acids, some caustics, hydrocarbons, refrigerants, and more.

APPLICATIONS

- Moderate acids
- Some caustics
- Hydrocarbons
- Solvents
- Water
- Refrigerants
- Cryogenics

GYLON® STYLE 3510/ GYLON EPIX® STYLE 3510 EPX



GYLON® Style 3510/GYLON EPIX® Style 3510 EPX is a high performance, barium sulfate filled PTFE gasketing material, designed for use in strong caustics and toxic chemicals, where initiating and maintaining an extremely tight seal is critical.

APPLICATIONS

- Strong caustics
- Moderate acids
- Chlorine
- Gases
- Water
- Steam
- Hydrocarbons
- Cryogenics

THERMALLY BONDED GYLON®

BENEFITS

Effective seal

- Patented bonding process produces large one piece gaskets without dovetailed joints for easier installation
- GYLON® material provides the excellent chemical resistance of PTFE without creep relaxation and cold flow problems

Versatile

- Ideal for corrosive applications with extra-large flanges
- Styles 3500, 3502, 3503, 3504, 3505, 3510, 3540, and 3565 can all be thermally bonded using this process

GYLON® Family

GYLON® Gasketing

TYPICAL PHYSICAL PROPERTIES*

GYLON® Styles	3500	3500 EPX	3504	3504 EPX	3510	3510 EPX	3522
Color	Fawn GYLON®	Fawn GYLON®	Blue GYLON®	Blue GYLON®	Off-white GYLON®	Off-white GYLON®	Clear
Composition	PTFE w/ silica	PTFE w/ silica	PTFE with aluminosilicate microspheres	PTFE with aluminosilicate microspheres	PTFE w/ barium sulfate	PTFE w/ barium sulfate	PTFE
Temperature[1] ° F (° C)							
Maximum:	500 (260)	500 (260)	500 (260)	500 (260)	500 (260)	500 (260)	500 (260)
Minimum:	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)
Ideal Operating Limit:	400 (204)	400 (204)	400 (204)	400 (204)	400 (204)	400 (204)	400 (204)
Pressure[1]							
Maximum[1] - psig (bar):	1,200 (83)	1,200 (83)	800 (35)	1,200 (83)	1,200 (83)	1,200 (83)	800 (55)
Minimum:	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum
Ideal Operating Limit - psig (bar):	750 (52)	750 (52)	750 (52)	750 (52)	750 (52)	750 (52)	750 (52)
P x T, max.[1]							
1/32", 1/16"	350,000	350,000	350,000	350,000	350,000	350,000	350,000
(0.8mm, 1.6mm)	(12,000)	(12,000)	(12,000)	(12,000)	(12,000)	(12,000)	(12,000)
psig x °F 1/8"	250,000	-	250,000	-	250,000	-	250,000
(bar x °C) (3.2mm)	(8,600)	-	(8,600)	-	(8,600)	-	(8,600)
Sealability **ASTM Fuel A** ml/hr (ASTM F37B)[3]	0.22	0.20	0.12	0.20	0.04	0.20	0.04
Gas Permeability mg/m-sec (DIN 3535-6)	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bolt Load Retention (DIN 52913) %	46.6[2]	50	48.5[2]	50	41.1[2]	50	40
Compressibility Range (ASTM F36) %	7-12	47	25-45	52	4-10	43	20-25
Recovery (ASTM F36) %	>40	>17	>30	>25	>40	>18	45-50
Tensile Strength psi (ASTM D1708) (N/mm²)	2,000 (14)	2,000 (14)	2,000 (14)	2,000 (14)	2,000 (14)	2,000 (14)	4,500 (31)
Bacterial Growth	Will not support						

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values.

2 DIN 52913 Bolt Load Retention is based 1/16" (1.6mm) for traditional GYLON® style. GYLON EPIX® results based on standard 3/32" (2.4 mm) gasket load = 7250psi (50N/mm²) test temperature: 500°F (260°C) test duration: 16 hours.

3 ASTM F37B Sealability
ASTM Fuel A (isooctane):
Gasket load = 1000 psi (6.9 N/mm²), Int. pressure = 9.8 psig (0.7 bar)
Nitrogen:
Gasket load = 3,000 psi (20.7 N/mm²), Int. pressure = 30 psig (2 bar)

4 DIN 3535-6 Gas Permeability, mg/m-sec (1/16" thick)
Nitrogen:
Gasket load = 4,640 psi (32 N/mm²), Int. pressure = 580 psig (40 bar)

* This is a general guide and should not be the sole means of selecting or rejecting this material. ASTM test results in accordance with ASTM F-104; properties based on 1/16" (1.6mm) gasket thickness unless otherwise mentioned. Values do not constitute specification limits.

TEST DATA

GYLON® Family

GYLON® Style 3545

BENEFITS

Tighter seal

» Higher compressible PTFE outer layers seal under low bolt load - suitable for many flat face and glass-lined flanges*

» Compressible layers conform to surface irregularities, especially on warped, pitted or scratched flanges

» Rigid PTFE core reduces cold flow and creep normally associated with conventional PTFE gaskets

Excellent chemical compatibility

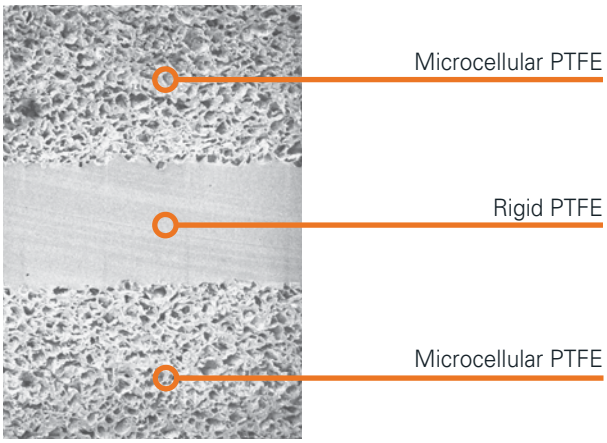
» Pure PTFE withstands a wide range of chemicals

Easy to cut and install

» Soft PTFE can be cut easily from larger sheets, reducing inventory costs and expensive downtime

» Rigid PTFE core facilitates installation, especially on large diameter flanges and hard-to-reach areas

CONFIGURATION



Cross-sectional view under electron microscope. All layers manufactured using proprietary GYLON® process - thermally fused layers, without the use of adhesives.

GYLON® Styles	3540	3545
Color	White GYLON®	White GYLON®
Composition	Microcellular PTFE	Microcellular PTFE w/ rigid core
Temperature[1] ˚ F (˚ C)		
Maximum:	500 (260)	500 (260)
Minimum:	-450 (-268)	-450 (-268)
Ideal Operating Limit:	400 (204)	400 (204)
Pressure[1]		
Maximum[1] - psig (bar):	1,200 (83)	1,200 (83)
Minimum:	Full Vacuum	Full Vacuum
Ideal Operating Limit - psig (bar):	750 (52)	750 (52)
P x T, max.[1]		
1/32", 1/16" (0.8mm, 1.6mm) psig x °F	350,000 (12,000)	350,000 (12,000)
1/8" (3.2mm) (bar x °C)	250,000 (8,600)	250,000 (8,600)
Sealability ASTM Fuel A ml/hr (ASTM F37B)[3]	0.25	0.15
Gas Permeability mg/m-sec (DIN 3535-6)	<0.001	<0.001
Creep Relaxation (ASTM F38) %	10	15
Compressibility Range (ASTM F36) %	70-85	60-70
Recovery (ASTM F36) %	>8	>15

NOTES:

Dramatically reduced leakage of GYLON® 3540 and 3545.
Average of three tests, using 580 psig nitrogen with 4,640 psi gasket load according to DIN 3535-6 requirements. All samples 1/16" (1.6 mm) thick.

See previous page for additional notes.

MEDIA

GYLON® 3540	Strong caustics, strong acids, hydrocarbons and chlorine, cryogenics. Conforms to FDA regulations.
GYLON® 3545	Strong caustics, strong acids, hydrocarbons, chlorine and cryogenics and glass-lined equipment. Conforms to FDA regulations.

High bolt load retention of GYLON® 3540 and 3545, especially at high temperatures, indicates gasket is less likely to incur gross leakage (blowout).

* For flat face flanges, a minimum compressive stress of 1,500 psi (10.3 N/mm²) is recommended on the contacted gasket area for 150 psig (1.0 N/mm²) liquid service. Consult with the flange manufacturer to confirm that adequate compressive stress is available.

GYLON® Style 3540

» Pure microcellular PTFE

» Similar to Style 3545, but without rigid core

» Ideal for wavy, warped, pitted or scratched flanges and for many types of flat face* flanges

STRESS SAVER® Family of Products

STRESS SAVER® gaskets have raised, molded-in sealing rings seal to create 75% less surface area for high performance sealing in non-metallic flanges†

STRESS SAVER® XP

Tighter seal

» Lower seating stress than expanded or specialty PTFE gaskets; ideal for non-metallic flanges

Chemical resistance

» High-performance peroxide cured fluoroelastomer has greater resistance to severe chemicals than standard fluoroelastomers

Outperforms PTFE envelope gaskets

» Won't fail due to filler attack

» Eliminates envelope fold over during installation

» Resistant to hydrochloric acid, hydrogen chloride gas, and low to medium pressure saturated steam

GYLON® 3504 & 3505 STRESS SAVER®

BENEFITS

» Certified to NSF 61 for potable drinking water (Style 3505 only)

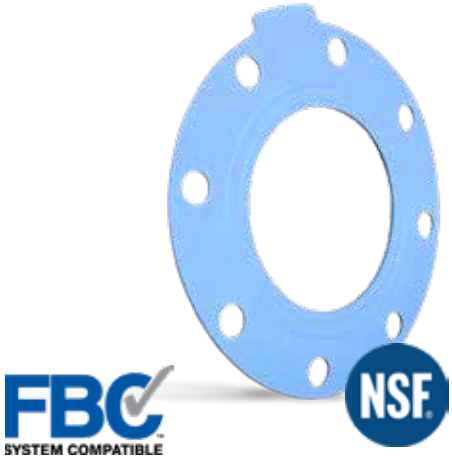
» FBC System Compatible Program approved and recommended for CORZAN® piping systems

Versatility

» Suitable for both metallic and non-metallic piping with either flat or raised face flanges

Chemical resistance

» Ideal for a wide range of caustics and acids, helping to simplify the selection process



MEDIA

Style XP	Steam, most hydrocarbons, gases, solvents, acids and alcohol
Style 3505	Potable water (NSF 61), solvents, hydrocarbons and most chemicals
Style 370	Acids, caustics, gases, water, hydrocarbons

NOTES:

† Flat face flanges strongly recommended.

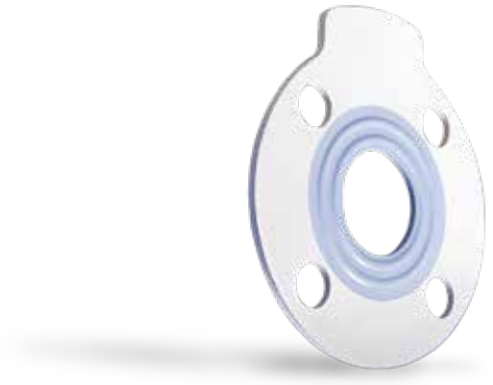
* Tested by BALASZ Labs for trace metal extractables, Anions, Cations and T.O.C.s. Results available on request.

** Consult Garlock Applications Engineering for FDA information.

CORZAN® is a registered trademark of The Lubrizol Corporation

STRESS SAVER® Family of Products

STRESS SAVER® Style 370



Chemical Resistance

» Pure PTFE sealing surface resists many chemicals

High Purity

» Contaminant-free EPDM is ideal for pure service - electronics,* pharmaceutical and food industries**

» Proprietary process bonds PTFE to elastomer, won't delaminate or leach

» Special packaging for high-purity applications

STRESS SAVER® Style 3522

Chemical Resistance

» Widest range of chemical compatibility based on 100% PTFE construction, allowing to simplify inventories and selection process

High Purity

» High purity construction with easy to clean surface, limits contamination or leachable concerns

» Homogeneous Construction – Single piece design to avoid permeation, delamination, or fold over of PTFE envelopes

» FDA, USP Class VI, 3A, and NSF 61 compliant. Suitable for oxygen service

TYPICAL PHYSICAL PROPERTIES

STRESS SAVER®	XP	Style 3504 (Style 3505 - NSF 61)	Style 3522	Style 370
Construction	Peroxide cured fluoroelastomers (70 durometer)	100% GYLON® PTFE with alumino silicate microspheres	100% GYLON® PTFE PTFE	100% Pure PTFE bonded to EPDM (65 duro EPDM)
Color	Black	Blue	Clear	PTFE: Sky blue
Temperature ˚F (˚C)				
Maximum:	400 (204)	500 (+260)	500 (+260)	300 (150)
Minimum:	-15 (-26)	-450 (-268)	-450 (-268)	-40 (-40)
Ideal Operating Limit:	250 (121)	400 (204)	400 (204)	200 (93)
Pressure, psig (bar)				
Maximum:	250 (17)	800 (55)	800 (55)	250 (17)
Minium:	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum
Ideal Operating Limit:	150 (10)	750 (52)	750 (52)	150 (10)
PxT, max				
(psig x °F)	50,000	250,000	250,000	50,000
(bar x °C)	(1717)	(8,600)	(8,600)	(1717)

NOTES:

† Flat face flanges strongly recommended, for styles 370 and XP.

* Tested by BALASZ Labs for trace metal extractables, Anions, Cations and T.O.C.s. Results available on request.

** Consult Garlock Applications Engineering for FDA information.

GRAPH-LOCK® Gasketing

BENEFITS

Excellent Resistance

» Pure exfoliated graphite flake material excels in extreme conditions, withstanding heat, pressure and aggressive chemicals

» Proven fire safe

Reliable seal

» Seals easily under moderate bolt load, offers superior torque retention

» Retains dimensional stability in high temperatures; seals tightly even during pressure fluctuations

Versatility

» Available in two grades - industrial grade is 98% pure; nuclear grade is 99.5% pure

» Available as standard homogeneous sheet or metal-inserted sheet for applications requiring extra strength

Also available:

» Style 3120 - nuclear grade homogeneous sheet

» Style 3122 - high-purity homogeneous sheet

TYPICAL PHYSICAL PROPERTIES*

See note below for MIL-DTL-24696

	3124/3126	3123/3125	3125 SS	3125 TC	HOCHDRUCK® 3128
Description	316SS Wire Inserted	Homogeneous/ Laminated	0.002" 316SS Foil insert	0.004" 316SS Tang Inserted	Reinforced Graphite
Temperature[1] ˚ F (˚ C)					
Max. in atmosphere:	850 (454)	850 (454)	850 (454)	850 (454)	850 (454)
Max. in steam:	1200 (650)	1200 (650)	1200 (650)	1200 (650)	1200 (650)
Minimum:	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)	-450 (-268)
Pressure,[1] **psig (bar)**					
Maximum:	2,000 (140)	2,000 (140)	2,000 (140)	2,000 (140)	2,000 (140)
Minimum:	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum	Full Vacuum
Ideal Operating Limit:	750 (52)	750 (52)	750 (52)	750 (52)	750 (52)
PxT, max[1]					
(psig x °F): 1/32", 1/16"	700,000	700,000	700,000	700,000	700,000
(bar x °C): (0.8mm, 1.6mm)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)
1/8"	350,000	350,000	350,000	350,000	350,000
(3.2mm)	(12,000)	(12,000)	(12,000)	(12,000)	(12,000)
Sealability (ASTM F37B)[2]					
ASTM Fuel A ml/hr	1.5[3]	0.2/0.3	0.25	0.3[3]	0.2
Nitrogen ml/hr	1.5	0.5	0.2	0.3	0.1
Gas Permeability mg/m-sec (DIN 3535 Part-6)	0.04	0.04	0.04	0.04	0.04
Creep Relaxation (ASTM F38) %	20	5/10	12	15	10
Compressibility Range % (ASTM F36)	35	40	35	35	30-40
Recovery (ASTM F36) %	20	>15	>20	>20	20
Tensile Strength[5] psi (ASTM F152) (N/mm²)	2,300 (15.9)	600 (4)	4,500[5] (31)	3,500 (24)	4,500 (31)

NOTES:

1 Based on ASME raised face flanges at the published preferred torque values. When approaching the ideal operating limits, minimum temperature or 50% of the PxT rating consult Garlock Applications Engineering.

2 ASTM F37B Sealability, milliliters/hour (1/32" thick)
ASTM Fuel A (isooctane): Gasket load = 500 psi (3.5 N/mm²), Internal pressure = 9.8 psig (0.7 bar)
Nitrogen: Gasket load = 3,000 psi (20.7 N/mm²), Internal pressure = 30 psig (2 bar)

3 1,000 psi gasket load

4 DIN 3535-6 Gas Permeability, mg/m-sec (1/16" thick)
Nitrogen: Gasket load = 4,640 psi (32 N/mm²), Internal pressure = 580 psig (40 bar)

5 1/32" only (thicker gaskets have lower tensile due to metal construction)

* Values do not constitute specification limits

Refer to "Military Specifications" section under "Gasketing Terms" for order/inquiry requirements. To ensure receipt of product with the required MIL-DTL-24696 branding, certification will be required; associated fees based on quantity.

HOCHDRUCK® Style 3128 Gasketing

High-Performance Reinforced graphite gasket material with improved sealability characteristics

BENEFITS

» Easy and safe to handle without breakage
» Anti-scratch and anti-stick properties built in surface of gasket
» Seals much tighter than standard graphite gaskets
» Available with reduced sulfur (3128RS)
» Dovetails seal tightly

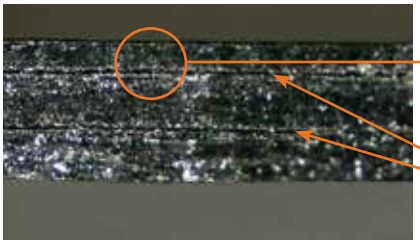
Easy to install

» Can be cut with a utility knife
» Remains flat during installation

EASY TO CUT

EASY TO INSTALL

EASY TO SEAL



Dovetail Installation Instructions

After mating the matching dovetail sections together, wrap a length of either Garlock Smooth Finished or Garlock Diamond Textured Graphite tape (0.015" thick) around dovetail area. Width of graphite tape must be at least 1/2" greater than dovetail area. Wrap tape one full revolution around gasket in dovetail area. Be sure to overlap tape by approximately 1/2" and cut tape. DO NOT attempt to open or move tape at this point - it will damage the tape. With a smooth piece of metal that is greater in area than the dovetail area, softly tap with a hammer and blend the tape into the gasket. Place flanges together and follow normal installation procedures.

Premium Grade (ASTM) Rubber Gasketing

TYPICAL PHYSICAL PROPERTIES*

Material	EPDM	Neoprene	Nitrile
Style	8314	7986	9122
Color	Black	Black	Black
Hardness (ASTM D2240) (Shore A) ± 5	60	60	60
Tensile Strength psi (N/mm²) (ASTM D412)	1,000 (7)	2,000 (14)	2,000 (14)
Elongation, min. % (ASTM D412)	300	350	500
Compression set ASTM Method B (ASTM D395) 25% deflection, maximum %	22 hrs @ 158°F (70°C) 25	70 hrs @ 212°F (100°C) 35	22 hrs @ 212°F (100°C) 20
Volume chg after immersion in ASTM #1 Oil (ASTM D471) 70 hrs @ 212°F (100°C), %	-	-4 to 3	-10 to 5
Volume chg after immersion in ASTM #3 Oil (ASTM D471) 70 hrs @ 212°F (100°C), %	-	50 to 80	0 to 25
Thickness available, inches	1/16, 3/32, 1/8, 3/16, 1/4	1/16, 3/32, 1/8, 3/16, 1/4 & >	1/16, 3/32, 1/8, 3/16, 1/4 & >
Finish available	Satin (cloth)	Satin (cloth)	Satin (cloth)
Meets Specifications	-	MIL-R-3065 MIL-Std. 417 Type S Grade SC620 $A_1E_3E_5$	-
Temperature °F (°C)			
Maximum:	300 (150)	250 (121)	250 (121)
Minimum:	-40 (-40)	-20 (-29)	-20 (-29)
PxT, max[1]			
(psig x °F)	30,000	20,000	20,000
(bar x °C)	(900)	(600)	(600)
Pressure, psig (bar)			
Maximum:	250 (17)	250 (17)	250 (17)
Minimum:	Full Vacuum	Full Vacuum	Full Vacuum
Ideal Operating Limit:	150 (10)	150 (10)	150 (10)

NOTE:

[1] Based on ASME raised face flanges at the published preferred torque values. When approaching the ideal operating limits, minimum temperature or 50% of the PxT rating consult Garlock Applications Engineering.

* Values do not constitute specification limits

Premium Grade (ASTM) Rubber Gasketing

TYPICAL PHYSICAL PROPERTIES*

Material	SBR	Fluoroelastomer (Type A)	EPDM
Style	22	9518	98206
Color	Red	Black	Black
Hardness (ASTM D2240) (Shore A) ± 5	75	75	80
Tensile Strength psi (N/mm²) (ASTM D412)	700 (5)	1,000 (7)	1,500 (10)
Elongation, min. % (ASTM D412)	150	175	185
Compression set ASTM Method B (ASTM D395) 25% deflection, maximum %	22 hrs @ 158°F (70°C) 40	22 hrs @ 347°F (175°C) 50	22 hrs @ 158°F (70°C) 25
Volume chg after immersion in ASTM #1 Oil (ASTM D471) 70 hrs @ 212°F (100°C), %	-	-	-
Volume chg after immersion in ASTM #3 Oil (ASTM D471) 70 hrs @ 212°F (100°C), %	-	-	-
Thickness available, inches	1/16, 3/32, 1/8, 3/16, 1/4 & >	1/16, 1/8, 3/16, 1/4	-
Finish available	Satin (cloth)	Satin (cloth)	Satin (cloth)
Meets Specifications	HHG-156 Type III ASTM-D-1330 Grade I & II	-	NSF-61 D1330 Gr I & II
Temperature °F (°C) Maximum:	200 (93)	400 (204)	275 (135)
Minimum:	-10 (-23)	-15 (-26)	-40 (-40)
PxT, max[1] (psig x °F)	20,000	30,000	30,000
(bar x °C)	(600)	(900)	(900)
Pressure, psig (bar)			
Maximum:	250 (17)	250 (17)	250 (17)
Minimum:	Full Vacuum	Full Vacuum	Full Vacuum
Ideal Operating Limit:	150 (10)	150 (10)	150 (10)

NOTE:
Please consult Garlock Applications Engineering when approaching maximum temperature, pressure, or P x T limits.

* Values do not constitute specification limits

Reinforced Rubber Gasketing & Diaphragms

BENEFITS

Elastic yet strong

» Combines elasticity and extensibility of rubber with strength of fabric insert

» Specially compounded in varying burst strengths for almost any service condition

ASTM D2000 LINE CALLOUTS

Style	ASTM Line Callout*
19	2AA810A13
7992	2BC520A14B14E014E034F17
8798	3BC715A14E014E034

* For rubber compound only, not fabric

Style 8798

BENEFITS

» Premium quality rubber ensures a reliably long life and consistent high-level performance

» Specifically formulated for high flexing properties which results in long cycle life for dynamic applications.

» Fabric reinforcement provides exceptional burst strength to cover a wide variety of diaphragm applications.

» Manufactured in a variety of thicknesses to meet component or specification requirements.

TYPICAL PHYSICAL PROPERTIES*

Style No.	Reinforced Rubber	Diaphragm	
	19††	7992††	8798††
Material	SBR rubber w/ 5.0oz. cotton sheeting w/ 1/32" thickness as fabric insert; 10.8oz. cotton chafer in all others	Neoprene w/ 20oz. hose duck fabric insert	Neoprene w/ 13oz. nylon fabric insert
Rubber hardness (Shore A) ±5	80	50	70
Burst test across 2" (50mm) dia. opening psi (bar)	not recommended for use a diaphragm material	290 (20) 1/8' - 1 ply	1,000 (70) 1/8" - 1 ply
Number of plies	1/32", 1/16", 3/32": 1 ply 1/8": 2 ply; 3/16": 3 ply 1/4": 4 ply	1/16", 3/32", 1/8": 1 ply 3/16": 2 ply 1/4": 3 ply	1/16", 3/32", 1/8": 1 ply 3/16": 2 ply 1/4": 3 ply
Thickness available	1/32", 1/16", 3/32", 1/8", 3/16", 1/4"	1/16", 3/32", 1/8", 3/16", 1/4"	1/16", 3/32", 1/8", 3/16", 1/4"
Finish available	Satin (cloth)	Satin (cloth)	Satin (cloth)
Temperature, max. ˚ F (˚ C)	200 (95)	250 (120)	250 (120)
Internal pressure, max. psig (bar)	250 (17)	NA	NA
Pressure, psig (bar)			
Ideal Operating Limit:	150 (10)	NA	NA

NOTES:

† Special insert completely eliminates web page through insert

†† Fabric or cloth inserted rubber may leak through the fabric when used as a gasket

Other sizes available upon request

* Values do not constitute specification limits

Sheet Sizes and Tolerances

Garlock Compressed Fiber and GYLON® Gasketing

COMPRESSED FIBER GASKETING

	60" x 60"						60" x 120"						60" x 180"						120" x 120"		
	1/64"	1/32"	3/64"	1/16"	3/32"	1/8"	1/64"	1/32"	3/64"	1/16"	3/32"	1/8"	1/64"	1/32"	3/64"	1/16"	3/32"	1/8"	1/32"	1/16"	1/8"
5500/9900	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
3700	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
9800/9850	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BLUE-GARD®	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
MULTI-SWELL™	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Compressed Fiber and GYLON Sheet width and length tolerance is +3/4" / -0

GYLON® GASKETING

	30" x 30"	60" x 60"					70" x 70"		60" x 90"		40" x 40"	
	1/32"	1/16"	3/32"	1/8"	3/16"	1/4"	1/16"	1/8"	1/16"	1/8"	1/16"	1/8"
Style 3500	•	•		•	•	•	•	•	•	•		
Style 3500 EPX			•									
Style 3504	•	•		•	•	•	•	•	•	•		
Style 3504 EPX			•									
Style 3510	•	•		•	•	•	•	•	•	•		
Style 3510 EPX			•									
Style 3530		•		•							•	•
Style 3540		•		•	•	•	•	•				
Style 3545		•		•	•	•	•	•				
Style 3565		•		•	•	•	•	•				

Compressed Fiber and GYLON Sheet width and length tolerance is +3/4" / -0

FLEXIBLE GRAPHITE GASKETING

	39.4" x 39.4"			59.1" x 59.1"		
	.030"	.060"	.120"	.030"	.060"	.120"
Style 3124/3126	•	•	•	•	•	•
Style 3125SS	•	•	•	•	•	•
Style 3125TC	•	•	•		•	•
Style 3128		•	•		•	•
	40" x 40"			**60" x 60"**		
	.030"	.060"	.120"	.030"	.060"	.120"
Style 3123/3125	•	•	•	•	•	•

NOTE:
Tolerance is ±10% of thickness. This supercedes the limits in ASTM F104. Style 3128 also available in .040" & .080" thickness.

TOLERANCES: COMPRESSED FIBER & GYLON® GASKETING

Nominal Thickness		Variation	Tolerance
1/64"	(0.016")*	0.014" - 0.021"	+0.005"/-0.002"
0.020"		0.018" - 0.025"	+0.005"/-0.002"
1/32"	(0.031")	0.026" - 0.036"	±0.005"
3/64"	(0.047")	0.042" - 0.052"	±0.005"
1/16"	(0.062")	0.056" - 0.068"	±0.006"
5/64"	(0.078")	0.071" - 0.085"	±0.007"
3/32"	(0.094")	0.086" - 0.102"	±0.008"
7/64"	(0.109")	0.100" - 0.118"	±0.009"
1/8"	(0.125")	0.115" - 0.135"	±0.010"
9/64"	(0.141")	0.126" - 0.156"	±0.015"
5/32"	(0.156")	0.141" - 0.171"	±0.015"
3/16"	(0.188")	0.173" - 0.203"	±0.015"
7/32"	(0.219")	0.204" - 0.234"	±0.015"
1/4"	(0.25")	0.230" - 0.270"	±0.020"

* Close tolerance sheet available upon request. Tolerance supersede the limits in ASTM F104.

TOLERANCES: RUBBER SHEET

Nominal Thickness		Tolerance
Fractions	Decimals	
under 1/32"	0.031"	±0.010"
1/32" up to 1/16"	0.031" up to 0.062"	±0.012"
1/16" up to 1/8"	0.062" up to 0.125"	±0.016"
1/8" up to 3/16"	0.125" up to 0.187"	±0.020"
3/16" up to 3/8"	0.187" up to 0.375"	±0.031"
3/8" up to 9/16"	0.375" up to 0.562"	±0.047"
9/16" up to 3/4"	0.562" up to 0.750"	±0.063"
3/4" up to 1"	0.750" up to 1.00"	±0.093"
1" and up	1.00" and up	±10%

TOLERANCES: VEGETABLE FIBER

0.006"	±0.0035"	0.062"	±0.008"
0.010"	±0.0035"	0.094"	±0.008"
0.015"	±0.0035"	0.125"	±0.016"
0.021"	±0.005"	0.187"	±0.016"
0.031"	±0.005"	0.250"	±0.016"
0.046"	±0.005"		

Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Abietic Acid	A	A	A	A	A	A	A	A	A	–	–	–
Acetaldehyde	A	A	A	A	A	A	A	C	C	C	C	B
Acetamide	A	A	A	A	A	A	A	A	A	C	A	B
Acetic Acid (Crude, Glacial, Pure)	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	B[1]	B[1]	B[1]	B[1]	B[1]
Acetic Anhydride	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	B[1]	B[1]	B[1]	B[1]	B[1]
Acetone	A	A	A	A	A	A	A	C	C	B	B	A
Acetonitrile	A	A	A	A	A	A	A	C	C	–	B	B
Acetophenone	A	A	A	A	A	A	A	C	C	C	C	B
2-Acetylaminofluorene	A	A	A	A	A	A	A	C	C	C	C	C
Acetylene	A	A	A	A	A	A	A	A	A	B	A	B
Acrolein	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	B[1]	B[1]	C	B[1]	B[1]
Acrylamide	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Acrylic Acid	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	B[1]
Acrylic Anhydride	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	–	–	–	–	–
Acrylonitrile	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Air, 150°F and below	A	A	A	A	A	A	A	A	A	A	A	A
Air, 150°F to 300°F	A	A	A	A	A	A	A	B	B	B	B	B
Allyl Acetate	A	A	A	A	A	A	A	C	C	C	C	B
Allyl Chloride	A	A	A	B	B	A	A	C	C	C	C	B
Allyl Methacrylate	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Aluminum Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Aluminum Fluoride	C	–	A	C	C	A	A	C	C	C	C	C
Aluminum Hydroxide (Solid)	A	A	A	A	A	A	A	A	A	A	A	A
Aluminum Nitrate	A	A	A	A	A	A	–	B	B	B	B	B
Aluminum Sulfate	A	A	A	B	B	A	A	A	A	A	A	A
Alums	A	A	A	B	B	A	A	A	A	A	A	A
4-Aminodiphenyl	A	A	A	A	A	A	A	C	C	C	C	C
Ammonia, Gas, 150°F and below	A	A	A	A	A	A	A	A	A	A	A	A
Ammonia Gas, Above 150°F	A	A	A	A	A	A	A	C	C	C	B	B
Ammonia Liquid, Anhydrous	A	A	A	A	A	A	A	B	B	–	A	A
Ammonium Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Ammonium Hydroxide	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Nitrate	A	A	A	A	A	A	–	B	B	B	B	B
Ammonium Phosphate, Monobasic	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Phosphate, Dibasic	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Phosphate, Tribasic	A	A	A	A	A	A	A	A	A	A	A	A

KEY

A	Suitable - little or no adverse effect
B	Possible minor to moderate adverse effect
C	Not suitable - moderate to severe adverse effect
-	No data or insufficient evidence

Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Ammonium Sulfate	A	A	A	B	B	A	A	A	A	A	A	A
Amyl Acetate	A	A	A	A	A	A	A	C	C	C	C	B
Amyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Aniline, Aniline Oil	A	A	A	A	A	A	A	C	C	C	C	B
Aniline Dyes	A	A	A	A	A	A	A	C	C	B	B	B
o-Anisidine	A	A	A	A	A	A	A	C	C	C	C	C
Aqua Regia	A	A	A	B	B	A	C	C	C	C	C	C
Aroclors	A	A	A	A	A	A	A	C	C	C	C	C
Asphalt	A	A	A	A	A	A	A	A	A	C	B	C
Aviation Gasoline	A	A	A	A	A	A	A	B	B	C	B	C
Barium Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Barium Hydroxide	A	A	A	A	A	A	A	A	A	A	A	A
Barium Sulfide	A	A	A	A	A	A	A	A	A	A	A	A
Baygon	A	A	A	A	A	A	A	C	C	C	–	–
Beer [9]	A	A	A	A	A	A	A	A	A	A	A	A
Benzaldehyde	A	A	A	A	A	A	A	C	C	C	C	B
Benzene, Benzol	A	A	A	A	A	A	A	C	C	C	C	C
Benzidine	A	A	A	A	A	A	A	C	C	C	C	–
Benzoic Acid	A	A	A	A	A	A	A	B	B	B	B	B
Benzonitrile	A	A	A	A	A	A	A	C	C	–	–	C
Benzotrichloride	A	A	A	C	C	A	A	C	C	C	C	C
Benzoyl Chloride	A	A	A	–	–	A	A	C	C	–	C	C
Benzyl Alcohol	A	A	A	A	A	A	A	C	C	–	B	B
Benzyl Chloride	A	A	A	–	–	A	A	C	C	C	C	B
Bio-diesel (B100)	A	A	A	A	A	A	A	A	A	A	-	-
Biphenyl	A	A	A	B	B	A	A	C	C	C	C	C
Bis(2-chloroethyl)ether	A	A	A	–	–	A	A	C	C	C	C	C
Bis(chloromethyl)ether	A	A	A	–	–	A	A	C	C	C	C	B
Bis(2-ethylhexyl)phthalate	A	A	A	A	A	A	A	C	C	C	C	B
Bitumen	A	A	A	A	A	A	A	A	A	C	B	C
Black Sulfate Liquor	C	B	A	C	A	A	A	C	C	C	C	C
Blast Furnace Gas	A	A	A	A	A	A	A	B	B	C	B	C
Bleach (Sodium Hyprochlorite)	A	A	A	B	B	A	–	C	C	–	C	C
Boiler Feed Water	A	A	A	A	A	A	A	A	A	A	A	A
Borax	A	A	A	A	A	A	A	A	A	A	A	A
Brake Fluid (Mineral Oil)	A	A	A	A	A	A	A	A	A	C	-	C

KEY

A	Suitable - little or no adverse effect
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C	Not suitable - moderate to severe adverse effect
-	No data or insufficient evidence

Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Brake Fluid (Glycol Ether)	A	A	A	A	A	A	A	-	-	-	-	A
Boric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Brine (Sodium Chloride)	A	A	A	B	B	A	A	A	A	A	A	A
Bromine	A	A	A	C	C	A	–	C	C	C	C	C
Bromine Trifluoride	C	C	C	C	C	C	C	C	C	C	C	C
Bromoform	A	A	A	A	A	A	A	C	C	C	C	C
Bromomethane	A	A	A	A	A	A	A	C	C	C	C	C
Butadiene	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	–	C
Butane	A	A	A	A	A	A	A	A	A	C	B	C
2-Butanone	A	A	A	A	A	A	A	C	C	C	C	C
Butyl Acetate	A	A	A	A	A	A	A	C	C	C	C	B
Butyl Alcohol, Butanol	A	A	A	A	A	A	A	A	A	A	A	A
n-Butyl Amine	A	A	A	A	A	A	A	B	B	–	C	B
tert-Butyl Amine	A	A	A	A	A	A	A	B	B	–	C	B
Butyl Methacrylate	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Butyric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Calcium Bisulfite	A	A	A	A	A	A	A	B	B	–	B	C
Calcium Chloride <200F	A	A	A	B	B	A	A	A	A	A	A	A
Calcium Chloride >200F	A	A	A	B	B	A	A	A	B	B	B	B
Calcium Cyanamide	A	A	A	A	A	A	A	B	B	B	B	B
Calcium Hydroxide	–	A	A	–	A	A	A	A	A	A	A	A
Calcium Hypochlorite	A	A	A	B	B	A	–	B	C	C	C	C
Calcium Nitrate	A	A	A	–	–	A	C	–	–	–	–	–
Calflo AF	A	A	A	A	A	A	A	A	A	C	–	C
Calflo FG	A	A	A	A	A	A	A	A	A	C	–	C
Calflo HTF	A	A	A	A	A	A	A	A	A	C	–	C
Calflo LT	A	A	A	A	A	A	A	A	A	C	–	C
Cane Sugar Liquors	A	A	A	A	A	A	A	A	A	A	A	A
Caprolactam	A	A	A	A	A	A	A	C	C	C	C	B
Captan	A	A	A	A	A	A	A	C	C	C	C	C
Carbaryl	A	A	A	A	A	A	A	C	C	C	C	C
Carbolic Acid, Phenol	A	A	A	A	A	A	A	C	C	C	C	B
Carbon Dioxide, Dry	A	A	A	A	A	A	A	A	A	A	A	A
Carbon Dioxide, Wet	A	A	A	A	A	A	A	A	A	A	A	A
Carbon Disulfide	A	A	A	A	A	A	A	C	C	C	C	C
Carbon Monoxide	A	A	A	A	A	A	A	B	B	B	B	B

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Carbon Tetrachloride	A	A	A	B	B	A	A	C	C	C	C	C
Carbonic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Carbonyl Sulfide	A	A	A	–	–	A	A	C	C	C	C	C
Castor Oil	A	A	A	A	A	A	A	A	A	C	B	B
Catechol	A	A	A	A	A	A	A	C	C	B	–	–
Caustic Soda	C	B	A[5]	C	A[5]	A[10]	A[5]	C	C	C	C	C
Cetane (Hexadecane)	A	A	A	A	A	A	A	A	A	C	B	C
China Wood Oil	A	A	A	A	A	A	A	A	A	C	B	C
Chloramben	A	A	A	–	–	A	A	C	C	C	C	C
Chlorazotic Acid (Aqua Regia)	A	A	A	B	B	A	C	C	C	C	C	C
Chlordane	A	A	A	–	–	A	A	C	C	C	C	C
Chlorinated Solvents, Dry	A	A	A	A	A	A	A	C	C	C	C	C
Chlorinated Solvents, Wet	A	A	A	C	C	A	A	C	C	C	C	C
Chlorine, Dry	A	A	A	A	A	A	A	–	–	–	–	–
Chlorine, Wet	A	A	A	C	C	A	A	C	C	C	C	C
Chlorine Dioxide	A	A	A	–	–	A	C	C	C	C	C	C
Chlorine Trifluoride	C	C	C	C	C	C	C	C	C	C	C	C
Chloroacetic Acid	A	A	A	C	C	A	A	C	C	B	C	B
2-Chloroacetophenone	A	A	A	B	B	A	A	C	C	C	C	C
Chloroazotic Acid (Aqua Regia)	A	A	A	B	B	A	C	C	C	C	C	C
Chlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
Chlorobenzilate	A	A	A	–	–	A	A	C	C	C	C	C
Chloroethane	A	A	A	A	A	A	A	C	C	C	C	C
Chloroethylene	A	A	A	A	A	A	A	C	C	C	C	C
Chloroform	A	A	A	A	A	A	A	C	C	C	C	C
Chloromethyl Methyl Ether	A	A	A	–	–	A	A	C	C	C	C	C
Chloronitrous Acid (Aqua Regia)	A	A	A	B	B	A	C	C	C	C	C	C
Chloroprene	A	A	A	B	B	A	A	C	C	C	C	C
Chlorosulfonic Acid	A	A	A	–	–	A	–	C	C	C	C	C
Chrome Plating Solutions	–[4]	–[4]	A	–[4]	B	A	A	C	C	C	C	C
Chromic Acid	A	A	A	B	B	A	C	C	C	C	C	C
Chromic Anhydride	A	A	A	B	B	A	C	C	C	C	C	C
Chromium Trioxide	A	A	A	B	B	A	C	C	C	C	C	C
Citric Acid	A	A	A	A	A	A	A	A	A	A	A	A
Coke Oven Gas	A	A	A	A	A	A	A	B	B	C	B	C
Copper Chloride	A	A	A	C	C	A	A	A	A	A	A	A

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Copper Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Corn Oil [9]	A	A	A	A	A	A	A	A	A	C	B	B
Cotton Seed Oil [9]	A	A	A	A	A	A	A	A	A	C	B	B
Creosote	A	A	A	A	A	A	A	B	B	C	B	C
Cresols, Cresylic Acid	A	A	A	A	A	A	A	C	C	C	C	C
Crotonic Acid	A	A	A	–	–	A	A	C	C	C	C	C
Crude Oil	A	A	A	B	B	A	A	A	A	B	B	C
Crude oil, sour	A	A	A	B	B	A	A	B	B	C	B	C
Cumene	A	A	A	A	A	A	A	C	C	C	C	C
Cyclohexane	A	A	A	A	A	A	A	A	A	C	B	C
Cyclohexanone	A	A	A	A	A	A	A	C	C	C	C	B
2,4-D, Salts and Esters	A	A	A	–	–	A	A	C	C	C	C	C
Detergent Solutions	B[12]	B[12]	A	A	A	A	A	B[12]	B[12]	B[12]	B[12]	B[12]
Diazomethane	A	A	A	A	A	A	A	–	–	–	–	–
Dibenzofuran	A	A	A	A	A	A	A	C	C	C	C	C
Dibenzylether	A	A	A	A	A	A	A	C	C	C	C	C
1,2-Dibromo-3-chloropropane	A	A	A	B	B	A	A	C	C	C	C	C
Dibromoethane	A	A	A	A	A	A	A	C	C	C	C	C
Dibutyl Phthalate	A	A	A	A	A	A	A	C	C	C	C	B
Dibutyl Sebacate	A	A	A	A	A	A	A	C	C	C	C	B
o-Dichlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
1,4-Dichlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
3,3-Dichlorobenzidene	A	A	A	–	–	A	A	C	C	C	C	C
Dichloroethane (1,1 or 1,2)	A	A	A	A	A	A	A	C	C	C	C	C
1,1-Dichloroethylene	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Dichloroethyl Ether	A	A	A	–	–	A	A	C	C	C	C	C
Dichloromethane	A	A	A	A	A	A	A	C	C	C	C	C
1,2-Dichloropropane	A	A	A	A	A	A	A	C	C	C	C	C
1,3-Dichloropropene	A	A	A	B	B	A	A	C	C	C	C	C
Dichlorvos	A	A	A	B	B	A	A	C	C	C	C	C
Diesel Oil/Fuel	A	A	A	A	A	A	A	A	A	B	B	C
Diethanolamine	A	A	A	A	A	A	A	B	B	B	B	B
N,N-Diethylaniline	A	A	A	–	–	A	A	C	C	C	C	C
Diethyl Carbonate	A	A	A	–	–	A	A	C	C	–	C	–
Diethyl Sulfate	A	A	A	A	A	A	A	C	C	C	–	C
3,3-Dimethoxybenzidene	A	A	A	A	A	A	A	C	C	C	–	–

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Dimethylamine	A	A	A	A	A	A	A	B	B	B	–	B
Dimethylaminoazobenzene	A	A	A	A	A	A	A	–	–	–	–	–
N,N-Dimethyl Aniline	A	A	A	–	–	A	A	C	C	C	C	C
3,3-Dimethylbenzidine	A	A	A	A	A	A	A	C	C	C	C	C
Dimethyl Carbamoyl Chloride	A	A	A	C	C	A	A	C	C	C	C	C
Dimethyl Ether	A	A	A	A	A	A	A	B	B	C	B	B
Dimethylformamide	A	A	A	–	–	A	A	C	C	C	C	C
Dimethyl Hydrazine, Unsymmetrical	A	A	A	A	A	A	A	C	C	B	B	B
Dimethyl Phthalate	A	A	A	A	A	A	A	C	C	C	C	B
Dimethyl Sulfate	A	A	A	A	A	A	A	C	C	C	–	C
4,6-Dinitro-o-Cresol and Salts	A	A	A	A	A	A	A	C	C	C	C	C
2,4-Dinitrophenol	A	A	A	–	–	A	A	C	C	C	C	C
2,4-Dinitrotoluene	A	A	A	A	A	A	A	C	C	C	C	C
Dioxane	A	A	A	A	A	A	A	C	C	C	C	B
1,2-Diphenylhydrazine	A	A	A	A	A	A	A	C	C	B	–	–
Diphyl DT	A	A	A	A	A	A	A	C	C	C	C	C
Dowfrost	A	A	A	A	A	A	A	B	B	B	–	B
Dowfrost HD	A	A	A	A	A	A	A	B	B	B	–	B
Dowtherm 4000	A	A	A	A	A	A	A	B	B	B	B	B
Dowtherm A	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm E	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm G	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm HT	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm J	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm Q	A	A	A	A	A	A	A	C	C	C	C	C
Dowtherm SR-1	A	A	A	A	A	A	A	A	A	A	A	A
Dynalene EG	A	A	A	A	A	A	A	A	A	A	A	A
Dynalene PG	A	A	A	A	A	A	A	A	A	A	-	A
Dynalene HC Series <200F	B	A	A	A	A	A	A	B	B	B	B	B
Dynalene HC Series >200F	C	B	A	A	A	A	A	C	C	C	C	C
Dynalene MV	A	A	A	A	A	A	A	C	C	C	C	C
DynaleneHF-LO	A	A	A	A	A	A	A	A	A	B	B	C
Dynalene Calcium Chloride <200F	A	A	A	A	A	A	A	A	A	A	A	A
Dynalene Calcium Chloride >200F	A	A	A	A	A	A	A	A	B	B	B	B
Epichlorohydrin	A	A	A	A	A	A	A	C	C	C	C	B
E85 (85% Ethanol, 15% Gas)	A	A	A	A	A	A	A	A	A	A	-	-

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
1,2-Epoxybutane	A	A	A	A	A	A	A	–	–	C	C	C
Ethane	A	A	A	A	A	A	A	A	A	B	B	C
Ethanol, Ethyl Alcohol [9]	A	A	A	A	A	A	A	A	A	A	A	A
Ethers	A	A	A	A	A	A	A	B	B	C	B	B
Ethyl Acetate	A	A	A	A	A	A	A	C	C	C	C	C
Ethyl Acrylate	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	B[1]
Ethyl Alcohol [9]	A	A	A	A	A	A	A	A	A	A	A	A
Ethylbenzene	A	A	A	A	A	A	A	C	C	C	C	C
Ethyl Carbamate	A	A	A	A	A	A	A	C	C	C	B	B
Ethyl Cellulose	A	A	A	A	A	A	A	A	A	A	A	A
Ethyl Chloride	A	A	A	A	A	A	A	C	C	C	C	C
Ethyl Ether	A	A	A	A	A	A	A	B	B	C	B	B
Ethyl Hexoate	A	A	A	A	A	A	A	C	C	–	–	B
Ethylene	A	A	A	A	A	A	A	A	A	B	B	C
Ethylene Bromide	A	A	A	A	A	A	A	C	C	C	C	C
Ethylene Dibromide	A	A	A	A	A	A	A	C	C	C	C	C
Ethylene Dichloride	A	A	A	A	A	A	A	C	C	C	C	C
Ethylene Glycol	A	A	A	A	A	A	A	A	A	A	A	A
Ethyleneimine	–	–	A	–	–	A	A	C	C	C	C	C
Ethylene Oxide	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Ethylene Thiourea	A	A	A	A	A	A	A	–	–	–	C	C
Ethylidine Chloride	A	A	A	A	A	A	A	C	C	C	C	C
Exhaust, engine or combustion	–	–	–	–	–	–	–	B	B	B	B	B
Ferric Chloride	A	A	A	C	C	A	A	A	B	B[3]	B	B
Ferric Phosphate	A	A	A	–	–	A	A	B	B	B	B	B
Ferric Sulfate	A	A	A	B	B	A	A	A	A	A	A	A
Fluorine, Gas	-	-	-	-	-	A[13]	C	C	C	C	C	C
Fluorine, Liquid	-	-	-	C	C	-	C	C	C	C	C	C
Fluorine Dioxide	C	C	C	C	C	C	C	C	C	C	C	C
Formaldehyde	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	B[1]	B[1]	A[1]
Formic Acid	A	A	A	B	B	A	A	C	C	–	B	B
Fuel Oil	A	A	A	A	A	A	A	A	A	B	B	C
Fuel Oil, Acid	A	A	A	A	A	A	A	A	A	B	B	C
Furfural	A	A	A	A	A	A	A	C	C	C	B	B
Gasoline, Refined	A	A	A	A	A	A	A	A	A	C	B	C
Gasoline, Sour	A	A	A	A	A	A	A	A	A	C	B	C

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Gelatin [9]	A	A	A	A	A	A	A	A	A	A	A	A
Glucose	A	A	A	A	A	A	A	A	A	A	A	A
Glue, Protein Base	A	A	A	A	A	A	A	A	A	A	A	A
Glycerine, Glycerol	A	A	A	A	A	A	A	A	A	A	A	A
Glycol	A	A	A	A	A	A	A	A	A	A	A	A
Grain Alcohol [9]	A	A	A	A	A	A	A	A	A	A	A	A
Grease, Petroleum Base	A	A	A	A	A	A	A	A	A	C	–	C
Green Sulfate Liquor	C	B	A	–	A	A	A	C	C	C	C	C
Heptachlor	A	A	A	–	–	A	A	C	C	C	C	C
Heptane	A	A	A	A	A	A	A	A	A	C	B	C
Hexachlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
Hexachlorobutadiene	A	A	A	A	A	A	A	C	C	C	C	C
Hexachlorocyclopentadiene	A	A	A	A	A	A	A	C	C	C	C	C
Hexachloroethane	A	A	A	–	–	A	A	C	C	C	C	C
Hexadecane	A	A	A	A	A	A	A	A	A	C	B	C
Hexamethylene Diisocyanate	A	A	A	A	A	A	A	–	–	C	–	C
Hexamethylphosphoramide	A	A	A	A	A	A	A	–	–	C	–	–
Hexane	A	A	A	A	A	A	A	A	A	C	B	C
Hexone	A	A	A	A	A	A	A	C	C	C	C	B
Hydraulic Oil, Mineral	A	A	A	A	A	A	A	A	A	B	B	C
Hydraulic Oil, Synthetic (Phosphate Esters)	A	A	A	A	A	A	A	C	C	C	C	B
Hydrazine	A	A	A	A	A	A	A	C	C	B	B	B
Hydrobromic Acid	A	A	A	C	C	A	A	C	C	C	C	C
Hydrochloric Acid	A	A	A	C	C	A	A	C	C	C	C	C
Hydrocyanic Acid	A	A	A	A	A	A	A	A	A	B	B	A
Hydrofluoric Acid, Anhydrous	C	C	C	C	C	A	A	C	C	C	C	C
HF Acid, Less than 65%, Above 150°F	C	C	C	C	C	A	A	C	C	C	C	C
HF Acid, 65% to Anhydrous,Above 150°F	C	C	C	C	C	A	A	C	C	C	C	C
HF Acid, Up to Anhydrous,150°F & below	C	C	A	C	C	A	A	C	C	C	C	C
Hydrofluorosilicic Acid	C	C	A	C	C	A	A	C	C	C	C	C
Hydrofluosilicic Acid	C	C	A	C	C	A	A	C	C	C	C	C
Hydrogen	A	A	A	A	A	A	A	A	A	A	A	A
Hydrogen Bromide	A	A	A	–	–	A	A	C	C	C	C	C
Hydrogen Fluoride	C	C	C	C	C	A	A	C	C	C	C	C
Hydrogen Peroxide, 10%	A	A	A	A	A	A	A	B	B	B	B	B
Hydrogen Peroxide, 10-90%	A	A	A	B	B	A	C	B	B	–	C	B

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Hydrogen Sulfide, Dry or Wet	A	A	A	A	A	A	A	B	B	B	B	B
Hydroquinone	A	A	A	A	A	A	A	C	C	B	C	C
Iodine Pentafluoride	–	–	–	–	–	–	C	C	C	C	C	C
Iodomethane	A	A	A	A	A	A	A	C	C	C	B	–
Isobutane	A	A	A	A	A	A	A	A	A	C	B	C
Isooctane	A	A	A	A	A	A	A	A	A	C	B	C
Isophorone	A	A	A	A	A	A	A	C	C	C	C	B
Isopropyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Jet Fuels (JP A, B and JP4 thru JP8)	A	A	A	A	A	A	A	A	A	C	B	C
Jet Fuels, JP9 and JP10	A	A	A	A	A	A	A	C	C	C	C	C
Kerosene	A	A	A	A	A	A	A	A	A	C	B	C
Lacquer Solvents	A	A	A	A	A	A	A	C	C	C	C	C
Lacquers	A	A	A	A	A	A	A	C	C	C	C	C
Lactic Acid, 150°F and below	A	A	A	A	A	A	A	A	A	A	A	A
Lactic Acid, Above 150°F	A	A	A	A	A	A	A	–	–	–	–	–
Lime Saltpeter (Calcium Nitrates)	A	A	A	–	–	A	C	B	B	B	B	B
Lindane	A	A	A	B	B	A	A	C	C	C	C	C
Linseed Oil	A	A	A	A	A	A	A	A	A	B	A	B
Liquified Petroleum Gas (LPG)	A	A	A	A	A	A	A	A	A	B	B	C
Lithium Bromide	A	A	A	A	A	A	A	A	A	–	A	A
Lithium, Elemental	C	C	C	C	C	C	C	C	C	C	C	C
Lubricating Oils, Refined	A	A	A	A	A	A	A	A	A	B	B	C
Lubricating Oils, Mineral or Petroleum Types	A	A	A	A	A	A	A	A	A	B	B	C
Lubricating Oils, Sour	A	A	A	A	A	A	A	B	B	B	B	C
Lye	C	B	A[5]	C	A[5]	A[10]	A[5]	C	C	C	C	C
Magnesium Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Magnesium Hydroxide	A	A	A	A	A	A	A	B	B	B	B	B
Magnesium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Maleic Acid	A	A	A	A	A	A	A	B	B	B	B	A
Maleic Anhydride	A	A	A	A	A	A	A	C	C	–	C	C
Mercuric Chloride	A	A	A	C	C	A	A	A	A	A	B	A
Mercury	A	A	A	A	A	A	A	A	A	A	A	A
Methane	A	A	A	A	A	A	A	A	A	C	B	C
Methanol, Methyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Methoxychlor	A	A	A	A	A	A	A	C	C	C	C	C
Methylacrylic Acid	A	A	A	–	–	A	A	C	C	C	C	C

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Methyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
2-Methylaziridine	–	–	A	–	–	A	A	C	C	C	C	C
Methyl Bromide	A	A	A	A	A	A	A	C	C	C	C	C
Methyl Chloride	A	A	A	B	B	A	A	C	C	C	C	C
Methyl Chloroform	A	A	A	A	A	A	A	C	C	C	C	C
4,4 Methylene Bis(2-chloroaniline)	A	A	A	–	–	A	A	C	C	C	C	C
Methylene Chloride	A	A	A	A	A	A	A	C	C	C	C	C
4,4-Methylene Dianiline	A	A	A	A	A	A	A	C	C	C	C	C
Methylene Diphenyldiisocyanate	A	A	A	–	–	A	A	C	C	C	C	–
Methyl Ethyl Ketone	A	A	A	A	A	A	A	C	C	C	C	C
Methyl Hydrazine	A	A	A	A	A	A	A	C	C	B	B	B
Methyl Iodide	A	A	A	A	A	A	A	C	C	C	B	–
Methyl Isobutyl Ketone (MIBK)	A	A	A	A	A	A	A	C	C	C	C	B
Methyl Isocyanate	A	A	A	A	A	A	A	–	–	C	–	–
Methyl Methacrylate	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
N-Methyl-2-Pyrrolidone	A	A	A	A	A	A	A	C	C	B	–	–
Methyl Tert. Butyl Ether (MTBE)	A	A	A	A	A	A	A	B	B	C	C	C
Milk [9]	A	A	A	A	A	A	A	A	A	A	A	A
Mineral Oils	A	A	A	A	A	A	A	A	A	B	B	C
Mobiltherm 600	A	A	A	A	A	A	A	A	A	C	–	C
Mobiltherm 603	A	A	A	A	A	A	A	A	A	C	–	C
Mobiltherm 605	A	A	A	A	A	A	A	A	A	C	–	C
Mobiltherm Light	A	A	A	A	A	A	A	C	C	C	C	C
Molten Alkali Metals	C	C	C	C	C	C	C	C	C	C	C	C
Monomethylamine	A	A	A	A	A	A	A	C	C	B	A	B
MultiTherm 100	A	A	A	A	A	A	A	A	A	C	B	C
MultiTherm 503	A	A	A	A	A	A	A	A	A	C	–	C
MultiTherm IG-2	A	A	A	A	A	A	A	A	A	C	B	C
MultiTherm PG-1	A	A	A	A	A	A	A	A	A	C	B	C
Muriatic Acid	A	A	A	C	C	A	A	C	C	C	C	C
Naphtha	A	A	A	A	A	A	A	A	A	C	B	C
Naphthalene	A	A	A	A	A	A	A	C	C	C	C	C
Naphthols	A	A	A	–	–	A	A	–	–	–	–	–
Natural Gas	A	A	A	A	A	A	A	A	A	B	B	B
Nickel Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Nickel Sulfate	A	A	A	A	A	A	A	A	A	A	A	A

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Nitric Acid, Less than 30%	A	A	A	A	A	A	C	C	C	C	C	C
Nitric Acid, Above 30%	A	A	A	A	A	A	C	C	C	C	C	C
Nitric Acid, Crude	A	A	A	–	–	A	C	C	C	C	C	C
Nitric Acid, Red Fuming	A	A	A	B	B	A	C	C	C	C	C	C
Nitrobenzene	A	A	A	A	A	A	A	C	C	C	C	C
4-Nitrobiphenyl	A	A	A	A	A	A	A	C	C	C	C	C
2-Nitro-Butanol	A	A	A	–	–	A	–	C	C	–	C	–
Nitrocalcite (Calcium Nitrate)	A	A	A	–	–	A	C	B	B	B	B	B
Nitrogen	A	A	A	A	A	A	A	A	A	A	A	A
Nitrogen Tetroxide	A	A	A	–	–	A	–	C	C	C	C	C
Nitrohydrochloric Acid (Aqua Regia)	A	A	A	B	B	A	C	C	C	C	C	C
Nitromethane	A	A	A	A	A	A	A	C	C	–	C	–
2-Nitro-2-Methyl Propanol	A	A	A	–	–	A	–	C	C	–	C	–
Nitromuriatic Acid (Aqua Regia)	A	A	A	B	B	A	C	C	C	C	C	C
4-Nitrophenol	A	A	A	–	–	A	A	C	C	C	C	C
2-Nitropropane	A	A	A	A	A	A	A	C	C	–	C	C
N-Nitrosodimethylamine	A	A	A	A	A	A	A	B	B	B	–	–
N-Nitroso-N-Methylurea	A	A	A	–	–	A	A	–	–	–	–	–
N-Nitrosomorpholine	A	A	A	A	A	A	A	C	C	–	C	–
Norge Niter (Calcium Nitrate)	A	A	A	–	–	A	C	B	B	B	B	B
Norwegian Saltpeter (Calcium Nitrate)	A	A	A	–	–	A	C	B	B	B	B	B
N-Octadecyl Alcohol	A	A	A	A	A	A	A	A	A	A	–	A
Octane	A	A	A	A	A	A	A	A	A	C	B	C
Oil, Petroleum	A	A	A	A	A	A	A	A	A	B	B	C
Oils, Animal and Vegetable [9]	A	A	A	A	A	A	A	A	A	C	B	B
Oleic Acid	A	A	A	A	A	A	A	B	B	–	C	C
Oleum	A	–	C	C	C	A	–	C	C	C	C	C
Orthodichlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
Oxalic Acid	A	A	A	B	B	A	A	C	C	–	B	B
Oxygen, Gas	See Note 6 - page 42							C	C	C	C	C
Ozone	See Note 6 - page 42						C	C	C	C	C	C
Palmitic Acid	A	A	A	A	A	A	A	A	A	B	B	A
Paraffin	A	A	A	A	A	A	A	A	A	B	B	C
Paratherm HE	A	A	A	A	A	A	A	A	A	C	B	C
Paratherm NF	A	A	A	A	A	A	A	A	A	C	–	C
Parathion	A	A	A	A	A	A	A	C	C	C	C	C

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Paraxylene	A	A	A	A	A	A	A	C	C	C	C	C
Pentachloronitrobenzene	A	A	A	–	–	A	A	C	C	C	C	C
Pentachlorophenol	A	A	A	A	A	A	A	C	C	C	C	C
Pentane	A	A	A	A	A	A	A	A	A	C	B	C
Perchloric Acid	A	A	A	C	C	A	C	C	C	C	C	C
Perchloroethylene	A	A	A	A	A	A	A	C	C	C	C	C
Petroleum Oils, Crude	A	A	A	A	A	A	A	A	A	B	B	C
Petroleum Oils, Refined	A	A	A	A	A	A	A	A	A	B	B	C
Phenol	A	A	A	A	A	A	A	C	C	C	C	B
p-Phenylenediamine	A	A	A	A	A	A	A	C	C	C	–	–
Phosgene	A	A	A	B	B	A	A	C	C	–	–	B
Phosphate Esters	A	A	A	A	A	A	A	C	C	C	C	B
Phosphine	A	A	A	A	A	A	A	–	–	–	–	–
Phosphoric Acid, Crude	C	C	A	C	B	A	A	C	C	C	C	C
Phosphoric Acid, Less than 45%	A	A	A	A	A	A	A	C	C	C	C	C
Phosphoric Acid, Above 45%, to 150°F	B	B	A	B	B	A	A	C	C	C	C	C
Phosphoric Acid, Above 45%, Above 150°F	C	B	A	C	B	A	A	C	C	C	–	–
Phosphorus, Elemental	A	A	A	A	A	A	A	C	C	C	C	C
Phosphorus Pentachloride	A	A	A	B	B	A	A	C	C	C	C	C
Phthalic Acid	A	A	A	A	A	A	A	C	C	–	B	–
Phthalic Anhydride	A	A	A	A	A	A	A	C	C	–	C	B
Picric Acid, Molten	–	–	–	–	–	–	–	–	–	–	–	–
Picric Acid, Water Solution	A	A	A	A	A	A	A	B	B	B	B	B
Pinene	A	A	A	A	A	A	A	A	A	C	B	C
Piperidine	A	A	A	A	A	A	A	C	C	C	C	C
Polyacrylonitrile	A	A	A	A	A	A	A	A	A	A	A	A
Polychlorinated Biphenyls	A	A	A	A	A	A	A	C	C	C	C	C
Potash, Potassium Carbonate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Acetate	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Bichromate	A	A	A	A	A	A	C	A	A	B	B	A
Potassium Chromate, Red	A	A	A	A	A	A	C	A	A	B	B	A
Potassium Cyanide	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Dichromate	A	A	A	A	A	A	C	A	A	B	B	A
Potassium, Elemental	C	C	C	C	C	C	C	C	C	C	C	C
Potassium Hydroxide	C	B	A[5]	C	A[5]	A[10]	A[5]	C	C	C	C	C
Potassium Nitrate	A	A	A	A	A	A	–	B	B	B	B	B

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Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Potassium Permanganate	A	A	A	A	A	A	–	B	B	–	B	B
Potassium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Producer Gas	A	A	A	A	A	A	A	A	A	C	B	C
Propane	A	A	A	A	A	A	A	A	A	C	B	C
1,3-Propane Sultone	A	A	A	–	–	A	A	–	–	–	–	–
Beta-Propiolactone	A	A	A	A	A	A	A	C	C	C	C	B
Propionaldehyde	A	A	A	A	A	A	A	C	C	C	–	–
Propoxur (Baygon)	A	A	A	A	A	A	A	C	C	C	–	–
Propyl Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Propyl Nitrate	A	A	A	A	A	A	A	C	C	C	C	C
Propylene	A	A	A	A	A	A	A	C	C	C	C	C
Propylene Dichloride	A	A	A	A	A	A	A	C	C	C	C	C
Propylene Glycol	A	A	A	A	A	A	A	A	A	A	-	A
Propylene Oxide	A	A	A	A	A	A	A	C	C	C	C	B
1,2-Propylenimine	–	–	A	–	–	A	A	C	C	C	C	C
Prussic Acid, Hydrocyanic Acid	A	A	A	A	A	A	A	A	A	B	B	A
Pyridine	A	A	A	B	B	A	A	C	C	C	C	B
Quinoline	A	A	A	B	B	A	A	C	C	C	C	C
Quinone	A	A	A	A	A	A	–	–	–	–	–	–
Refrigerants	See Specific Ratings Below											
R 10	A	A	A	B	B	A	A	C	C	C	C	C
R 11	A	A	A	A	A	A	A	A	A	C	C	C
R 12	A	A	A	A	A	A	A	A	A	A	A	A
R 13	A	A	A	A	A	A	A	A	A	A	A	A
R 13 B1	A	A	A	A	A	A	A	A	A	A	A	A
R 21	A	A	A	A	A	A	A	C	C	C	A	C
R 22	A	A	A	A	A	A	A	B	B	B	A	A
R 23	A	A	A	A	A	A	A	C	C	A	A	A
R 31	A	A	A	A	A	A	A	C	C	A	A	A
R 32	A	A	A	A	A	A	A	A	A	A	A	A
R 112	A	A	A	A	A	A	A	A	A	C	A	C
R 113	A	A	A	A	A	A	A	A	A	A	A	C
R 114	A	A	A	A	A	A	A	A	A	A	A	A
R 114 B2	A	A	A	A	A	A	A	A	A	C	A	C
R 115	A	A	A	A	A	A	A	A	A	A	A	A
R 123	A	A	A	A	A	A	A	C[2]	C[2]	C	A[2]	C

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R 124	A	A	A	A	A	A	A	C	C	A	A	A
R 125	A	A	A	A	A	A	A	–	–	A	A	A
R 134a	A	A	A	A	A	A	A	B	B	A	A	A
R 141b	A	A	A	A	A	A	A	A	A	–	A	–
R 142b	A	A	A	A	A	A	A	A	A	A	A	A
R 143a	A	A	A	A	A	A	A	–	–	A	A	A
R 152a	A	A	A	A	A	A	A	A	A	A	A	A
R 218	A	A	A	A	A	A	A	A	A	A	A	A
R 290 (Propane)	A	A	A	A	A	A	A	A	A	C	B	C
R 500	A	A	A	A	A	A	A	A	A	–	A	–
R 502	A	A	A	A	A	A	A	A	A	A	A	–
R 503	A	A	A	A	A	A	A	C	C	A	A	A
R 507	A	A	A	A	A	A	A	B	B	–	A	A
R 717 (Ammonia)	A	A	A	A	A	A	A	B	B	–	A	A
R 744 (Carbon Dioxide)	A	A	A	A	A	A	A	A	A	A	A	A
R1234 yf	A	A	A	A	A	A	A	B	B	–	A	B
C316	A	A	A	A	A	A	A	A	A	A	A	A
C318	A	A	A	A	A	A	A	A	A	A	A	A
HP62	A	A	A	A	A	A	A	A	A	–	A	–
HP80	A	A	A	A	A	A	A	–	–	–	A	–
HP81	A	A	A	A	A	A	A	–	–	–	A	–
Refrigerant Oil - Polyalphaolefin (PAO)	A	A	A	A	A	A	A	A	A	-	A	A
Refrigerant Oil - Polyolester (POE)	A	A	A	A	A	A	A	A	A	C	C	B
Refrigerant Oil - Polyalkylene Glycol (PAG)	A	A	A	A	A	A	A	A	A	C	C	A
Refrigerant Oil - Mineral Oil	A	A	A	A	A	A	A	A	A	C	B	C
Salt Water	A	A	A	B	B	A	A	A	A	A	A	A
Saltpeter, Potassium Nitrate	A	A	A	A	A	A	–	B	B	B	B	B
2,4-D Salts and Esters	A	A	A	–	–	A	A	C	C	C	C	C
Sewage	A	A	A	A	A	A	A	A	A	B	B	B
Silver Nitrate	A	A	A	A	A	A	–	B	B	A	A	A
Skydrols	A	A	A	A	A	A	A	C	C	C	C	B
Soap Solutions	A	A	A	A	A	A	A	A	A	A	A	A
Soda Ash, Sodium Carbonate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Bicarbonate, Baking Soda	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Bisulfate (Dry)	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Bisulfite	A	A	A	B	B	A	A	A	A	A	A	A

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Sodium Chlorate	A	A	A	A	A	A	A	C	C	–	C	C
Sodium Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Sodium Cyanide	C	C	A	C	C	A	A	C	C	C	C	C
Sodium, Elemental	C	C	C	C	C	C	C	C	C	C	C	C
Sodium Hydroxide	C	B	A[5]	C	A[5]	A[10]	A[5]	C	C	C	C	C
Sodium Hypochlorite	A	A	A	B	B	A	–	C	C	–	C	C
Sodium Metaborate Peroxyhydrate	A	A	A	B	B	A	C	B	B	B	B	B
Sodium Metaphosphate	B	A	A	B	A	A	A	A	A	A	A	A
Sodium Nitrate	A	A	A	A	A	A	–	B	B	B	B	B
Sodium Perborate	A	A	A	B	B	A	C	B	B	B	B	B
Sodium Peroxide	A	A	A	A	A	A	C	C	C	C	C	C
Sodium Phosphate, Monobasic	A	A	A	A	A	A	A	B	B	B	B	B
Sodium Phosphate, Dibasic	B	B	A	B	A	A	A	B	B	B	B	B
Sodium Phosphate, Tribasic	C	B	A	C	A	A	A	C	C	C	C	C
Sodium Silicate	B	B	A	B	A	A	A	B	B	B	B	B[3]
Sodium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Sulfide	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Superoxide	A	A	A	A	A	A	C	C	C	C	C	C
Sodium Thiosulfate, "Hypo"	A	A	A	A	A	A	A	A	A	A	A	A
Soybean Oil [9]	A	A	A	A	A	A	A	A	A	C	B	B
Stannic Chloride	A	A	A	C	C	A	A	B	B	B	–	B
Steam, Saturated, to 150 psig[11]	A	A	A	A	A	A	A	A[11]	B[8]	B[8]	B[8]	B[8]
Steam, Superheated	–	–	–	–	–	–	–	C	C	C	C	C
Stearic Acid	A	A	A	A	A	A	A	A	A	A	A	A
Stoddard Solvent	A	A	A	A	A	A	A	A	A	C	B	C
Styrene	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Styrene Oxide	A	A	A	A	A	A	A	C	C	C	C	C
Sulfur Chloride	A	A	A	C	C	A	A	C	C	C	C	C
Sulfur Dioxide	A	A	A	A	A	A	A	C	C	C	C	B
Sulfur, Molten	A	A	A	A	A	A	A	C	C	C	B	C
Sulfur Trioxide, Dry	A	A	A	A	A	A	–	C	C	C	C	C
Sulfur Trioxide, Wet	A	A	A	B	B	A	B	C	C	C	C	C
Sulfuric Acid, 10%, 150°F and below	A	A	A	B	B	A	–	C	C	C	C	C
Sulfuric Acid, 10%, Above 150°F	[A]	A	A	C	C	A	–	–	–	C	C	C
Sulfuric Acid, 10-75%, 500°F and below	A	A	A	C	C	A	–	–	–	C	C	C
Sulfuric Acid, 75-98%, 150°F and below	A	A	B	C	C	A	C	C	C	C	C	C

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Sulfuric Acid, 75-98%, 150°F to 500°F	A	B[15]	B	C	C	A	C	C	C	C	C	C
Sulfuric Acid, Fuming	A	–	C	C	C	A	C	C	C	C	C	C
Sulfurous Acid	A	A	A	B	B	A	–	B	B	B	–	–
Syltherm 800	A	A	A	A	A	A	A	B	B	B	B	B
Syltherm XLT	A	A	A	A	A	A	A	B	B	B	B	B
Tannic Acid	A	A	A	–[7]	–[7]	A	A	A	A	A	A	A
Tar	A	A	A	A	A	A	A	A	A	C	B	C
Tartaric Acid	A	A	A	A	A	A	A	A	A	A	A	A
2,3,7,8-TCDB-p-Dioxin	A	A	A	–	–	A	A	C	C	C	C	C
Tertiary Butyl Amine	A	A	A	A	A	A	A	B	B	–	C	B
Tetrabromoethane	A	A	A	A	A	A	A	C	C	C	C	C
Tetrachlorethane	A	A	A	A	A	A	A	C	C	C	C	C
Tetrachloroethylene	A	A	A	A	A	A	A	C	C	C	C	C
Tetrahydrofuran, THF	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 44	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 55	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 59	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 60	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 66	A	A	A	A	A	A	A	C	C	C	C	C
Therminol 75	A	A	A	A	A	A	A	C	C	C	C	C
Therminol D12	A	A	A	A	A	A	A	B	B	C	B	C
Therminol LT	A	A	A	A	A	A	A	C	C	C	C	C
Therminol VP-1	A	A	A	A	A	A	A	C	C	C	C	C
Therminol XP	A	A	A	A	A	A	A	A	A	C	B	C
Thionyl Chloride	A	A	A	C	C	A	A	C	C	C	C	C
Titanium Sulfate	A	A	A	A	A	A	A	C	C	C	C	C
Titanium Tetrachloride	A	A	A	C	C	A	A	B	C	C	C	C
Toluene	A	A	A	A	A	A	A	C	C	C	C	C
2,4-Toluenediamine	A	A	A	A	A	A	A	–	–	C	C	C
2,4-Toluenediisocyanate	A	A	A	–	–	A	A	C	C	C	C	B
Toluene Sulfonic Acid	A	A	A	–	–	A	A	C	C	C	C	C
o-Toluidine	A	A	A	A	A	A	A	C	C	C	C	C
Toxaphine	A	A	A	–	–	A	A	C	C	C	C	C
Transformer Oil (Mineral Type)	A	A	A	A	A	A	A	A	A	C	B	C
Transmission Fluid A	A	A	A	A	A	A	A	A	A	C	B	C
Trichloroacetic Acid	A	A	A	C	C	A	A	C	C	C	C	C

KEY

A	Suitable - little or no adverse effect
B	Possible minor to moderate adverse effect
C	Not suitable - moderate to severe adverse effect
-	No data or insufficient evidence

Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
1,2,4- Trichlorobenzene	A	A	A	A	A	A	A	C	C	C	C	C
1,1,2-Trichloroethane	A	A	A	A	A	A	A	C	C	C	C	C
Trichloroethylene	A	A	A	A	A	A	A	C	C	C	C	C
2,4,5-Trichlorophenol	A	A	A	–	–	A	A	C	C	C	C	C
2,4,6-Trichlorophenol	A	A	A	–	–	A	A	C	C	C	C	C
Tricresylphosphate	A	A	A	A	A	A	A	C	C	C	C	B
Triethanolamine	A	A	A	–	–	A	A	B	B	B	B	B
Triethyl Aluminum	A	A	A	–	–	A	A	C	C	–	C	–
Triethylamine	A	A	A	A	A	A	A	B	B	B	B	A
Trifluralin	A	A	A	A	A	A	A	C	C	C	C	C
2,2,4-Trimethylpentane	A	A	A	A	A	A	A	A	A	C	B	C
Tung Oil	A	A	A	A	A	A	A	A	A	C	B	C
Turpentine	A	A	A	A	A	A	A	A	A	C	C	C
UCON Heat Transfer Fluid 500	A	A	A	A	A	A	A	A	A	B	B	B
UCON Process Fluid WS	A	A	A	A	A	A	A	A	A	B	B	B
Urea, 150°F and below	A	A	A	A	A	A	A	B	B	–	A	A
Urea, above 150°F	A	A	A	A	A	A	A	–	–	–	–	–
Varnish	A	A	A	A	A	A	A	B	B	C	C	C
Vegetable Oil [9]	A	A	A	A	A	A	A	A	A	C	B	B
Vinegar [9]	A	A	A	A	A	A	A	B	B	B	A	A
Vinyl Acetate	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	B[1]	B[1]	C	B[1]	B[1]
Vinyl Bromide	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Vinyl Chloride	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Vinylidene Chloride	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	A[1]	C	C	C	C	C
Vinyl Methacrylate	A	A	A	A	A	A	A	C	C	C	C	C
Water, Acid Mine, with Oxidizing Salt	A	A	A	C	C	A	–	B	B	–	B	–
Water, Acid Mine, No Oxidizing Salts	A	A	A	A	A	A	A	A	A	–	B	A
Water, Distilled	A	A	A	A	A	A	A	A	A	A	A	A
Water, Return Condensate (<225°F)	A	A	A	A	A	A	A	A	A	A	A	A
Water, Seawater	A	A	A	B	B	A	A	A	A	A	A	A
Water, Tap[14]	A	A	A	A	A	A	A	A	A	A	A	A
Whiskey and Wines [9]	A	A	A	A	A	A	A	A	A	A	A	A
Wood Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Xceltherm 550	A	A	A	A	A	A	A	B	B	C	B	C
Xceltherm 600	A	A	A	A	A	A	A	A	A	C	B	C
Xceltherm MK1	A	A	A	A	A	A	A	C	C	C	C	C

KEY

A	Suitable - little or no adverse effect
B	Possible minor to moderate adverse effect
C	Not suitable - moderate to severe adverse effect
-	No data or insufficient evidence

Chemical Resistance Chart

Garlock Compressed Fiber and GYLON® Gasketing

Medium	Garlock Style Number											
	GYLON®							Compressed Fiber Sheet				
	3500 / 3500 EPIX®	3504 / 3504 EPIX® 3565	3510 / 3510 EPIX®	3560	3561	3522 3540 3545	3530	5500 9850 9900	2900 2950 3000	9800 3200 3400	3300	3700
Xceltyherm XT	A	A	A	A	A	A	A	C	C	C	C	C
Xylene	A	A	A	A	A	A	A	C	C	C	C	C
Zinc Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Zinc Sulfate	A	A	A	A	A	A	A	A	A	A	A	A
Wood Alcohol	A	A	A	A	A	A	A	A	A	A	A	A
Xceltherm 550	A	A	A	A	A	A	A	B	B	C	B	C
Xceltherm 600	A	A	A	A	A	A	A	A	A	C	B	C
Xceltherm MK1	A	A	A	A	A	A	A	C	C	C	C	C
Xceltyherm XT	A	A	A	A	A	A	A	C	C	C	C	C
Xylene	A	A	A	A	A	A	A	C	C	C	C	C
Zinc Chloride	A	A	A	B	B	A	A	A	A	A	A	A
Zinc Sulfate	A	A	A	A	A	A	A	A	A	A	A	A

NOTES:

1. Consult the factory regarding your specific applications. See "Monomers" in Gasketing catalog Terms section.
2. There have been conflicting field reports concerning the suitability of NBR and neoprene bound gaskets in 123. End users should take note.
3. Style 9800 is rated "A."
4. Some chromium plating baths contain fluorides that can attack silica and silicate type fillers in some GYLON® styles. If the bath is known to contain little or no fluoride, all GYLON® styles should be suitable for use.
5. These GYLON® styles can be expected to be suitable to 60% concentration at temperatures up to 250°F (121°C).
6. Use GYLON® styles 3502, 3503, 3505, 3562, 3563. These styles are specially processed, cleaned and packaged for oxygen service.
7. This GYLON® contains a stainless steel insert. There is a possibility that this might contribute traces of iron to form iron tannates, resulting in undesirable color in the tannic acid.
8. These styles are not preferred choices for steam service, but are successful when adequately compressed.
9. If a gasketing material that conforms to FDA requirements is desired, contact factory for specific recommendations. GYLON® 3522 is also 3A approved for dairy service.
10. These GYLON® gasket styles can be expected to be suitable to 75% concentration at temperatures up to 400°F (204°C).
11. Minimum recommended assembly stress = 4,800psi. Preferred assembly stress = 6,000-10,000psi. Gasket thickness of 1/16" strongly preferred. For saturated steam above 150psig, consult Garlock Engineering.
12. Some detergent solutions are strongly alkaline and/or may contain bleach. Please contact Applications Engineering.
13. GYLON® 3522 & 3545 is suitable for up to 200°F wet or dry fluorine gas. Above this please consult Applications Engineering.
14. If gaskets certified to NSF/ANSI/CAN 61 are required contact Applications Engineering.
15. GYLON® 3504 is acceptable for use in sulfuric acid (up to 99%) up to 250°F. To optimize the performance of the assembly and minimize media permeation we highly recommend using the recommended installation instructions on page 45 (with emphasis on the re-torque) and a minimum gasket stress of 4,800 psi.

KEY

A	Suitable - little or no adverse effect
B	Possible minor to moderate adverse effect
C	Not suitable - moderate to severe adverse effect
-	No data or insufficient evidence

"M" and "Y" Data

"M" and "Y" date are to be used for flange designs only as specified in the ASME Boiler and Pressure Vessel Code Division 1, Section VIII, Appendix 2. They are not meant to be used as gasket seating stress values in actual service. Our bolt torque tables give that information and should be used as such.

"M" - Maintenance Factor
A factor that provides the additional preload needed in the flange fasteners to maintain the compressive load on a gasket after internal pressure is applied to a joint. The net operating stress on a pressurized gasket should be at least (m) x (design pressure, psig).

"Y" - Minimum Design Seating Stress
The minimum compressive stress in pounds per square inch (or bar-g) on the contact area of the gasket that is required to provide a seal at an internal pressure of 2 psig (0.14 bar-g).

Style	Thickness	M	Y (psi)
3000	1/16" 1/8"	4.2 5.2	3,050 4,400
3123/3125	1/16" 1/8"	2.0 2.0	2,500 2,500
3124/3126 (wire inserted)	1/16" 1/8"	2.0 2.0	2,500 2,500
3125SS	1/16" 1/8"	6.5 11.8*	3,300 5,900
3125TC	1/16" 1/8"	2.6 6.0	2,500 3,000
3128	1/16" 1/8"	3.0 3.6	2,000 3,000
3200/3400	1/16" 1/8"	3.5 6.6	2,100 3,000
3300	1/16" 1/8"	2.1 4.0	3,050 3,500
3500	1/16" 1/8"	5.0 5.0	2,750 3,500
3500 EPIX	3/32"	2.5	2,000
3504	1/16" 1/8" 3/16" 1/4"	3.0 2.5 2.5 2.5	1,650 3,000 3,000 3,000
3504 EPIX	3/32"	2.5	2,000
3510	1/16" 1/8"	2.0 2.0	2,350 2,500
3510 EPIX	3/32"	2.5	2,000
3522	1/16" 1/8"	2.2 2.5	1,000 1,500
3530	1/16" 1/8"	2.8 2.0	1,650 1,650
3535	1/4"	2.0	3,000

Style	Thickness	M	Y (psi)
3540	1/16" 1/8" 3/16" 1/4"	3.0 3.0 2.0 2.0	1,700 2,200 2,200 2,500
3545 (in envelope)	1/16" 1/8" 3/16" 1/4" 1/8"	2.6 2.0 2.0 7.0 2.0	1,500 2,200 2,200 3,700 800
HP 3560	1/16" 1/8"	5.0 5.0	3,500 4,000
HP 3561	1/16" 1/8"	5.0 5.0	3,500 4,000
3565	1/16" 1/8" 3/16" 1/4"	2.8 3.7 5.5 6.0	1,400 2,300 2,800 2,800
3700	1/16" 1/8"	3.5 6.7	2,800 4,200
5500	1/16" 1/8"	6.6 6.6	2,600 3,300
9800	1/16" 1/8"	3.5 8.0	2,350 3,200
9850	1/16" 1/8"	6.5 8.0	2,550 2,800
9900	1/16" 1/8"	4.5 6.0	4,100 4,100
STRESS SAVER® 370	1/8"	2.0	400
STRESS SAVER® XP	1/8"	0.5	100
STRESS SAVER® 3504	1/8"	2.0	400

NOTE:
* These M values, based on ambient temperature leakage with nitrogen, are high. Field experience has shown that lower values would be workable in elevated temperatures. Consult applications engineering.

Gasket Constants

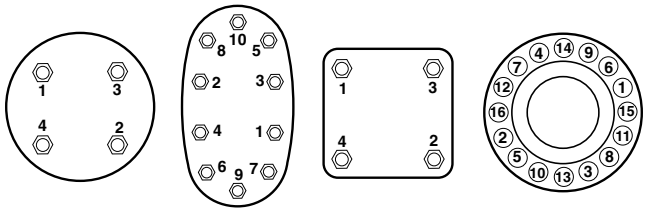
Style	Thickness	Gb (psi)	a	Gs (psi)	S100 (psi)	S1000 (psi)	S3000 (psi)	S5000 (psi)	S10000 (psi)	Tpmin	Tpmax
3000	1/16" 1/8"	2307 2359	0.201 0.216	4.10E-01 2.87E+00	5,819 6,376	9,240 10,481	11,521 13,286	12,780 14,849	14,672 17,229	140 103	54,130 28,050
3123/3125	1/16"	970	0.384	0.05	5,686	13,765	20,989	25,537	33,325	-	-
3125SS	1/16"	816	0.377	0.066	4,631	11,033	16,694	20,240	26,284	-	-
3125TC	1/16"	1400	0.324	0.01	6,225	13,126	18,738	22,110	27,678	-	-
3128	1/16"	787	0.400	0.00287	4,966	12,473	19,356	23,744	31,331	-	-
3500	1/16" 1/8"	949 1980	0.253 0.169	2.60E+00 3.93E-01	3,043 4,313	5,448 6,365	7,194 7,663	8,187 8,354	9,756 9,393	373 223	16,890 25,375
3500 EPX	3/32"	174	0.424	2.03	1,228	3,260	5,193	-	8,652	902	44,242
3504	1/16" 1/8"	183 1008	0.375 0.221	4.01E-03 2.23E+00	947 2,793	2,155 4,649	3,190 5,928	3,828 6,638	4,903 7,739	3,097 141	14,817 72,992
3504 EPX	3/32"	76	0.508	13.6	786	2,532	4,427	-	8,163	591	21,724
3510	1/16" 1/8"	289 444	0.274 0.332	6.61E-11 1.29E-02	1,021 2,048	1,918 4,399	2,592 6,336	2,981 7,507	3,605 9,449	11,881 1,770	25,501 17,550
3510 EPX	3/32"	248	0.368	9.39 E-01	1,348	3,144	4,709	-	7,333	1,982	65,492
3522	1/16" 1/8"	38 687	0.484 0.153	1.77E+01 2.13E+01	354 1,390	1,080 1,977	1,839 2,338	2,351 2,530	3,294 2,811	551 858	21,060 18,700
3535	3/8"	430	0.286	1.69E-09	1,605	3,101	4,245	4,913	5,991	373	
3540	1/16"	550	0.304	7.64E-01	2,230	4,491	6,272	7,326	9,044	973	23,670
3545	1/16" 1/8" 3/16"	162.1 92.48 628	0.379 0.468 0.249	1.35E-09 2.50E-03 7.93E-05	927 799 1,977	2,217 2,349 3,507	3,361 3,930 4,611	4,079 4,992 5,236	5,303 6,907 6,222	18,209 4,460 373	61,985 53,307
3561	1/16"	72.3	0.466	2.16E-01	618	1,808	3,016	3,827	5,286	1,688	21,755
3700	1/8"	1,318	0.258	6.00E-01	4,324	7,833	10,400	11,865	14,188	373	-
5500	1/16"	1,247	0.249	1.10E+01	3,925	6,964	9,155	10,397	12,356	373	-
9850	1/16"	1,591	0.239	9.39E+00	4,783	8,292	10,782	12,182	14,377	141	110,005
9900	1/16"	2,322	0.133	1.80E+01	4,284	5,819	6,735	7,208	7,904	199	128,434

Gb = stress at which seal is initiated; "a" = the slope of the log/log tightness curve; Gs = intersection of the unload curve with the vertical axis (Tp1).

NOTE:
For a 5" OD gasket at 800 psig, Tp100 = 102ml/min. leakage, Tp1,000 = 1.02ml/min. leakage, Tp10,000 = 0.01ml/min. leakage.

Before Installation

- Remove old gasket, and clean flange surface of all debris. For best results, use a soft metal flange scraper, an aerosol gasket remover and a soft wire brush, then inspect the flange for damage. Be sure surface finish and flatness are satisfactory.
- Use the thinnest possible gasket. However, flanges that are warped, bowed or severely pitted require thicker gaskets.
- It is best to install gaskets as received. With compressed fiber gaskets, if additional release agents are needed, dry is better than wet. Never use metal based anti-seize, since particles may accumulate in the surface imperfections, thereby creating a flange surface that is too smooth to be effective.



Installation

- Center the gasket on the flange. This is extremely vital where raised faces are involved.

  NOTE: Standard ASME B16.21 ring gaskets, when properly cut, should center themselves when the bolts are in place.
- Fasteners must be new or "as new" condition
- Use of a torque wrench and well-lubricated fasteners with hardened flat washers is essential to ensure correct initial loading.
- Tighten bolts to compress gasket uniformly. This means going from side to side around the joint in a star-like crossing pattern. See diagrams on left.
- Starting with all fasteners "snug", bolts should be tightened in one-third increments, according to proper bolting patterns.
- Retorque 12 to 24 hours after start-up, whenever possible. All applicable safety standards including lockout/tag out procedure should be observed.
- Never use liquid or metallic based anti-stick or lubricating compounds on the gaskets. Premature failure could occur as a result.

Gasket Assembly Stress Recommendations

The minimum recommended assembly stress for Garlock compressed sheet such as BLUE-GARD®, GYLON® and GRAPH-LOCK® products differs from "M" and "Y" values. "M" and "Y" do not take factors such as flange condition and blowout resistance into account. Garlock offers the following minimum assembly stresses as rules of thumb for calculating installation bolt torques.

Operating Pressure	Minimum Assembly Stress Recommended psi (N/mm²)		
in psig (bar)	1/32" (0.8mm) Thick	1/16" (1.6mm) Thick	1/8" (3.2mm) Thick
Up to 300 (21)	2,500 (17)	3,600 (25)	4,800 (33)
Up to 800 (55)	4,800 (33)	5,400 (37)	6,400 (44)
Up to 2,000 (140)	7,400 (51)	8,400 (58)	9,400 (65)

FLAT FACE FLANGES

Minimum recommended gasket stress for GYLON® and Compressed Fiber gaskets in full face/flat faced flanges can be much lower. Stresses in the range of 1,500 to 2,000 psi are usually acceptable for liquid services. Please contact Applications Engineering when using these materials as full face gaskets in flat faced flanges, especially when dealing with gaseous media.

Maximum recommended compressive stress for:
- Compressed fiber and GYLON® gaskets = 15,000 psi
- THERMa-PUR® 4122-FC gaskets =7,500 psi
- Multi-Swell™ Style 3760/3760-U gaskets = 10,000 psi
- GRAPH-LOCK® gaskets[1] = 10,000 psi

Recommended compressive stress for:
- STRESS SAVER® gaskets[2] = 600 - 1,200 psi
- Rubber gaskets less than 70 duro = 600 - 900 psi
- Rubber gaskets to 70 duro and higher = 600 - 1,200 psi

* Maximum stresses assume standard ASME serrated flanges at 125-250 micro-inch flange finish.

[1] GRAPH-LOCK® styles 3125TC and 3128 have a max recommended compressive stress of 15,000 psi

[2] STRESS SAVER® 3504/3505 have a max recommended compressive stress of 15,000 psi

Torque and Stress Tables

Bolt Torque Tables for ASME B16.5 Raised Face Flanges with A193 Grade B7 Bolts

COMPRESSED FIBER* & GYLON® GASKETS 150# RAISED FACE FLANGES

Nom. Pipe Size (inches)	No. of Bolts	Size of Bolts (inches)	Internal Pressure (psig)	Minimum Torque (ft.-lbs.)	Preferred Torque (ft.-lbs.)
0.50	4	0.50	300	19	28
0.75	4	0.50	300	27	40
1.00	4	0.50	300	36	53
1.25	4	0.50	300	54	60
1.50	4	0.50	300	54	60
2.00	4	0.63	300	69	120
2.50	4	0.63	300	81	120
3.00	4	0.63	300	119	120
3.50	8	0.63	300	66	120
4.00	8	0.63	300	84	120
5.00	8	0.75	300	117	200
6.00	8	0.75	300	148	200
8.00	8	0.75	300	200	200
10.00	12	0.88	300	188	320
12.00	12	0.88	300	250	320
14.00	12	1.00	300	317	490
16.00	16	1.00	300	301	490
18.00	16	1.13	300	448	710
20.00	20	1.13	300	395	710
24.00	20	1.25	300	563	1,000

NOTE:
With smaller flanges higher minimum assembly stresses/torques are used in order to optimize the bolt and gasket stresses
* Refers to fiber gaskets such as BLUE-GARD®, 9900, etc.

COMPRESSED FIBER* & GYLON® GASKETS 300# RAISED FACE FLANGES

Nom. Pipe Size (inches)	No. of Bolts	Size of Bolts (inches)	Internal Pressure (psig)	Minimum Torque (ft.-lbs.)	Preferred Torque (ft.-lbs.)
0.50	4	0.50	800	19	28
0.75	4	0.63	800	34	51
1.00	4	0.63	800	44	67
1.25	4	0.63	800	68	102
1.50	4	0.75	800	75	151
2.00	8	0.63	800	46	108
2.50	8	0.75	800	60	141
3.00	8	0.75	800	88	200
3.50	8	0.75	800	99	200
4.00	8	0.75	800	125	200
5.00	8	0.75	800	156	200
6.00	12	0.75	800	131	200
8.00	12	0.88	800	205	320
10.00	16	1.00	800	219	490
12.00	16	1.13	800	319	710
14.00	20	1.13	800	287	652
16.00	20	1.25	800	401	912
18.00	24	1.25	800	439	1,000
20.00	24	1.25	800	484	1,000
24.00	24	1.50	800	662	1,552

NOTE:
With smaller flanges higher minimum assembly stresses/torques are used in order to optimize the bolt and gasket stresses
* Refers to fiber gaskets such as BLUE-GARD®, 9900, etc.

MULTI-SWELL™ & GRAPH-LOCK® GASKETS 150# RAISED FACE FLANGES

Nom. Pipe Size (inches)	No. of Bolts	Size of Bolts (inches)	Internal Pressure (psig)	Minimum Torque (ft.-lbs.)	Preferred Torque (ft.-lbs.)
0.50	4	0.50	300	14	20
0.75	4	0.50	300	20	27
1.00	4	0.50	300	27	35
1.25	4	0.50	300	41	54
1.50	4	0.50	300	54	60
2.00	4	0.63	300	69	120
2.50	4	0.63	300	81	120
3.00	4	0.63	300	119	120
3.50	8	0.63	300	66	120
4.00	8	0.63	300	84	120
5.00	8	0.75	300	117	200
6.00	8	0.75	300	148	200
8.00	8	0.75	300	200	200
10.00	12	0.88	300	188	320
12.00	12	0.88	300	250	320
14.00	12	1.00	300	317	490
16.00	16	1.00	300	301	490
18.00	16	1.13	300	448	710
20.00	20	1.13	300	395	710
24.00	20	1.25	300	563	1,000

NOTE:
With smaller flanges higher minimum assembly stresses/torques are used in order to optimize the bolt and gasket stresses

MULTI-SWELL™ & GRAPH-LOCK® GASKETS 300# RAISED FACE FLANGES

Nom. Pipe Size (inches)	No. of Bolts	Size of Bolts (inches)	Internal Pressure (psig)	Minimum Torque (ft.-lbs.)	Preferred Torque (ft.-lbs.)
0.50	4	0.50	800	14	20
0.75	4	0.63	800	25	34
1.00	4	0.63	800	33	45
1.25	4	0.63	800	51	68
1.50	4	0.75	800	75	101
2.00	8	0.63	800	46	72
2.50	8	0.75	800	60	94
3.00	8	0.75	800	88	138
3.50	8	0.75	800	99	154
4.00	8	0.75	800	125	196
5.00	8	0.75	800	156	200
6.00	12	0.75	800	131	200
8.00	12	0.88	800	205	320
10.00	16	1.00	800	219	341
12.00	16	1.13	800	319	498
14.00	20	1.13	800	287	435
16.00	20	1.25	800	401	608
18.00	24	1.25	800	439	1,000
20.00	24	1.25	800	484	1,000
24.00	24	1.50	800	662	1,035

NOTE:
With smaller flanges higher minimum assembly stresses/torques are used in order to optimize the bolt and gasket stresses

Bolt Reference Tables

LOAD ON MACHINE BOLTS AND COLD ROLLED STEEL STUDS/BOLTS UNDER TORQUE (UNC)

Nom. Diameter of Bolts (inches)	No. of Threads per inch	Diameter of Root of Thread (inches)	Area at Root of Thread (sq. in.)	Stress					
				7,500 psi		15,000 psi		30,000 psi	
				Torque (ft. lbs.)	Clamping Force (lbs./bolt)	Torque (ft. lbs.)	Clamping Force (lbs./bolt)	Torque (ft. lbs.)	Clamping Force (lbs./bolt)
1/4	20	0.185	0.027	1	203	2	405	4	810
5/16	18	0.240	0.045	2	338	4	675	8	1,350
3/8	16	0.294	0.068	3	510	6	1,020	12	2,040
7/16	14	0.345	0.093	5	698	10	1,395	20	2,790
1/2	13	0.400	0.126	8	945	15	1,890	30	3,780
9/16	12	0.454	0.162	12	1,215	23	2,430	45	4,860
5/8	11	0.507	0.202	15	1,515	30	3,030	60	6,060
3/4	10	0.620	0.302	25	2,265	50	4,530	100	9,060
7/8	9	0.731	0.419	40	3,143	80	6,285	160	12,570
1	8	0.838	0.551	62	4,133	123	8,265	245	16,530
1-1/8	7	0.939	0.693	98	5,190	195	10,380	390	20,760
1-1/4	7	1.064	0.890	137	6,675	273	13,350	545	26.700
1-3/8	6	1.158	1.054	183	7,905	365	15,810	730	31,620
1-1/2	6	1.283	1.294	219	9,705	437	19,410	875	38,820
1-5/8	5.5	1.389	1.515	300	11,363	600	22,725	1,200	45,450
1-3/4	5	1.490	1.744	390	13,080	775	26,160	1,550	52,320
1-7/8	5	1.615	2.049	525	15,368	1,050	30,735	2,100	61,470
2	4.5	1.711	2.300	563	17,250	1,125	34,500	2,250	69,000

LOAD ON ALLOY STEEL STUDS/BOLTS UNDER TORQUE (8UN)*

Nom. Diameter of Bolts (inches)	No. of Threads per inch	Diameter of Root of Thread (inches)	Area at Root of Thread (sq. in.)	Stress					
				25,000 psi		45,000 psi		60,000 psi	
				Torque (ft. lbs.)	Clamping Force (lbs./bolt)	Torque (ft. lbs.)	Clamping Force (lbs./bolt)	Torque (ft. lbs.)	Clamping Force (lbs./bolt)
1/4	20	0.185	0.027	3	675	6	1,215	8	1,620
5/16	18	0.240	0.045	7	1,125	12	2,025	16	2,700
3/8	16	0.294	0.068	10	1,700	18	3,060	24	4,080
7/16	14	0.345	0.093	17	2,325	30	4,185	40	5,580
1/2	13	0.400	0.126	25	3,150	45	5,670	60	7,560
9/16	12	0.454	0.162	38	4,050	68	7,290	90	9,720
5/8	11	0.507	0.202	50	5,050	90	9,090	120	12,120
3/4	10	0.620	0.302	83	7,550	150	13,590	200	18,120
7/8	9	0.731	0.419	133	10,475	240	18,855	320	25,140
1	8	0.838	0.551	204	13,775	368	24,795	490	33,060
1-1/8	8	0.963	0.728	296	18,200	533	32,760	710	43,680
1-1/4	8	1.088	0.929	417	23,225	750	41,805	1,000	55,740
1-3/8	8	1.213	1.155	567	28,875	1,020	51,975	1,360	69,300
1-1/2	8	1.338	1.405	667	35,125	1,200	63,225	1,600	84,300
1-5/8	8	1.463	1.680	917	42,000	1,650	75,600	2,200	100,800
1-3/4	8	1.588	1.980	1,250	49,500	2,250	89,100	3,000	118,800
1-7/8	8	1.713	2.304	1,667	57,600	3,000	103,680	4,000	138,240
2	8	1.838	2.652	1,833	66,300	3,300	119,340	4,400	159,120
2-1/4	8	2.088	3.423	2,650	85,575	4,770	154,035	6,360	205,380
2-1/2	8	2.338	4.292	3,667	107,300	6,600	193,140	8,800	257,520
2-3/4	8	2.588	5.259	4,933	131,475	8,800	236,655	11,840	315,540
3	8	2.838	6.324	6,433	158,100	11,580	284,580	15,440	379,440

These tables are for reference only. See torque tables for recommended installation torques. Values shown in these tables are based on steel bolting that has been well-lubricated with heavy graphite and oil mixture. Research has shown that a non-lubricated bolt has about 50% of the efficiency of a well-lubricated bolt. It has been further found that different lubricants produce results varying between the limit of 50% and 100% of the tabulated stress figures.

* 8UN (8 thread series) is the standard for ASTM A193 B7, A193 B8, B8M and A320 bolts and studs

Available Gasket Stress at Various Bolt Stresses

NOTE: The values shown are not recommended values. The intent of this table is to illustrate the relationship between bolt torque, bolt stress, gasket stress, and how these three factors relate to the contact area of ASME B16.5 & B16.47 Series A flat face flanges.

150# FLAT FACE FLANGES (ASME B16.5 & B16.47 SERIES A)

			Bolt Stress						Minimum Recommended Assembly Stress Compressed Fiber & GYLON®		
			25,000 psi		60,000 psi		75,000 psi				
Nom. Pipe Size (inches)	Number of Bolts	Size of Bolts (inches)	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	1/32" Thick (psi)	1/16" Thick (psi)	1/8" Thick (psi)
0.5	4	0.50	25	1,607	60	3,857	75	4,821	2,500	3,600	4,800
0.75	4	0.50	25	1,301	60	3,114	75	3,893	2,500	3,600	4,800
1	4	0.50	25	1,085	60	2,605	75	3,256	2,500	3,600	4,800
1.25	4	0.50	25	940	60	2,250	75	2,813	2,500	3,600	4,800
1.5	4	0.50	25	811	60	1,946	75	2,432	2,500	3,600	4,800
2	4	0.63	50	916	120	2,201	150	2,751	2,500	3,600	4,800
2.5	4	0.63	50	669	120	1,606	150	2,008	2,500	3,600	4,800
3	4	0.63	50	616	120	1,479	150	1,849	2,500	3,600	4,800
3.5	8	0.63	50	994	120	2,388	150	2,985	2,500	3,600	4,800
4	8	0.63	50	914	120	2,197	150	2,746	2,500	3,600	4,800
5	8	0.75	83	1,221	200	2,931	250	3,664	2,500	3,600	4,800
6	8	0.75	83	1,082	200	2,598	250	3,247	2,500	3,600	4,800
8	8	0.75	83	755	200	1,813	250	2,266	2,500	3,600	4,800
10	12	0.88	133	1,246	320	2,993	400	3,742	2,500	3,600	4,800
12	12	0.88	133	858	320	2,062	400	2,577	2,500	3,600	4,800
14	12	1.00	204	916	490	2,198	613	2,748	2,500	3,600	4,800
16	16	1.00	204	1,017	490	2,440	613	3,050	2,500	3,600	4,800
18	16	1.13	296	1,343	710	3,226	888	4,033	2,500	3,600	4,800
20	20	1.13	296	1,426	710	3,425	888	4,282	2,500	3,600	4,800
24	20	1.25	417	1,442	1,000	3,460	1,250	4,326	2,500	3,600	4,800
26	24	1.25	417	1,517	1,000	3,771	1,250	4,714	-	4,049	5,249
28	28	1.25	417	1,672	1,000	4,012	1,250	5,015	-	4,075	5,275
30	28	1.25	417	1,509	1,000	3,622	1,250	4,528	-	4,092	5,292
32	28	1.50	667	1,941	1,600	4,659	2,000	5,823	-	4,076	5,276
34	32	1.50	667	2,125	1,600	5,099	2,000	6,374	-	4,115	5,315
36	32	1.50	667	1,946	1,600	4,670	2,000	5,838	-	4,129	5,329
38	32	1.50	667	1,688	1,600	4,050	2,000	5,063	-	4,111	5,311
40	36	1.50	667	1,829	1,600	4,389	2,000	5,486	-	4,145	5,345
42	36	1.50	667	1,695	1,600	4,068	2,000	5,085	-	4,157	5,357
44	40	1.50	667	1,770	1,600	4,247	2,000	5,309	-	4,175	5,375
46	40	1.50	667	1,694	1,600	4,066	2,000	5,083	-	4,201	5,401
48	44	1.50	667	1,757	1,600	4,217	2,000	5,271	-	4,217	5,417
50	44	1.75	1,250	2,394	3,000	5,746	3,750	7,182	-	4,247	5,447
52	44	1.75	1,250	2,241	3,000	5,379	3,750	6,724	-	4,256	5,456
54	44	1.75	1,250	2,103	3,000	5,050	3,750	6,313	-	4,264	5,464
56	48	1.75	1,250	2,128	3,000	5,105	3,750	6,381	-	4,262	5,462
58	48	1.75	1,250	2,006	3,000	4,812	3,750	6,015	-	4,269	5,469
60	52	1.75	1,250	2,120	3,000	5,089	3,750	6,361	-	4,299	5,499

NOTES:

[1] Full face gaskets will typically seal at stresses well below the minimum recommended values shown. See also "Flanges" on page 53.

[2] Contact Garlock Applications Engineering at 1.800.448.6688 for further discussions regarding the use of compressed, GYLON® or GRAPH-LOCK® products in flat face flanges.

[3] For full face GYLON®, compressed sheet and GRAPH-LOCK® gasketing, 1,500 to 2,000 psi is normally acceptable for installation for liquid service.

Available Gasket Stress at Various Bolt Stresses

NOTE: The values shown are not recommended values. The intent of this table is to illustrate the relationship between bolt torque, bolt stress, gasket stress, and how these three factors relate to the contact area of ASME B16.5 & B16.47 Series A flat face flanges.

300# FLAT FACE FLANGES (ASME B16.5 & B16.47 SERIES A)

			Bolt Stress						Minimum Recommended Assembly Stress Compressed Fiber, GRAPH-LOCK® & GYLON®		
			25,000 psi		60,000 psi		75,000 psi				
Nom. Pipe Size (inches)	**Number of Bolts**	**Size of Bolts (inches)**	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	Bolt Torque (ft. lbs.)	Gasket Stress (psi)	1/32" Thick (psi)	1/16" Thick (psi)	1/8" Thick (psi)
0.5	4	0.50	25	1,360	60	3,264	75	4,081	4,800	5,400	6,400
0.75	4	0.63	50	1,428	120	3,427	150	4,284	4,800	5,400	6,400
1	4	0.63	50	1,299	120	3,119	150	3,898	4,800	5,400	6,400
1.25	4	0.63	50	1,140	120	2,736	150	3,421	4,800	5,400	6,400
1.5	4	0.75	83	1,248	200	2,996	250	3,745	4,800	5,400	6,400
2	8	0.63	50	1,602	120	3,848	150	4,810	4,800	5,400	6,400
2.5	8	0.75	83	1,837	200	4,409	250	5,512	4,800	5,400	6,400
3	8	0.75	83	1,548	200	3,715	250	4,643	4,800	5,400	6,400
3.5	8	0.75	83	1,306	200	3,135	250	3,919	4,800	5,400	6,400
4	8	0.75	83	1,045	200	2,507	250	3,134	4,800	5,400	6,400
5	8	0.75	83	916	200	2,198	250	2,748	4,800	5,400	6,400
6	12	0.75	83	1,118	200	2,682	250	3,352	4,800	5,400	6,400
8	12	0.88	133	1,155	320	2,771	400	3,464	4,800	5,400	6,400
10	16	1.00	204	1,646	490	3,952	613	4,939	4,800	5,400	6,400
12	16	1.13	296	1,593	710	3,824	888	4,780	4,800	5,400	6,400
14	20	1.13	296	1,536	710	3,686	888	4,608	4,800	5,400	6,400
16	20	1.25	417	1,659	1,000	3,982	1,250	4,978	4,800	5,400	6,400
18	24	1.25	417	1,712	1,000	4,108	1,250	5,135	4,800	5,400	6,400
20	24	1.25	417	1,464	1,000	3,513	1,250	4,391	4,800	5,400	6,400
24	24	1.50	667	1,635	1,600	3,923	2,000	4,904	5,000	5,600	6,400
26	28	1.63	917	2,135	2,200	5,124	2,750	6,405	-	6,171	7,171
28	28	1.63	917	1,893	2,200	4,544	2,750	5,680	-	6,193	7,193
30	28	1.75	1,250	2,075	3,000	4,982	3,750	6,228	-	6,247	7,247
32	28	1.88	1,667	2,253	4,000	5,406	5,000	6,758	-	6,299	7,299
34	28	1.88	1,667	2,078	4,000	4,987	5,000	6,234	-	6,336	7,336
36	32	2.00	1,833	2,550	4,400	6,115	5,500	7,644	-	6,378	7,378
38	32	1.50	667	2,436	1,600	5,841	2,000	7,301	-	7,365	8,365
40	32	1.62	917	2,522	2,200	6,052	2,750	7,566	-	7,286	8,286
42	32	1.62	917	2,398	2,200	5,756	2,750	7,194	-	7,378	8,378
44	32	1.75	1,250	2,562	3,000	6,155	3,750	7,693	-	7,369	8,369
46	28	1.88	1,667	2,333	4,000	5,600	5,000	7,000	-	7,323	8,323
48	32	1.88	1,667	2,599	4,000	6,237	5,000	7,796	-	7,441	8,441
50	32	2.00	1,833	2,741	4,400	6,574	5,500	8,217	-	7,428	8,428
52	32	2.00	1,833	2,531	4,400	6,311	5,500	7,889	-	7,506	8,506
54	28	2.25	2,650	2,578	6,360	6,190	7,950	7,737	-	7,372	8,372
56	28	2.25	2,650	2,483	6,360	5,963	7,950	7,453	-	7,443	8,443
58	32	2.25	2,650	2,787	6,360	6,693	7,950	8,366	-	7,552	8,552
60	32	2.25	2,650	2,690	6,360	6,460	7,950	8,075	-	7,623	8,623

NOTES:

[1] Full face gaskets will typically seal at stresses well below the minimum recommended values shown. See also "Flanges" on page 53.

[2] Contact Garlock Applications Engineering at 1.800.448.6688 for further discussions regarding the use of compressed, GYLON® or GRAPH-LOCK® products in flat face flanges.

[3] For full face GYLON®, compressed sheet and GRAPH-LOCK® gasketing, 1,500 to 2,000 psi is normally acceptable for installation for liquid service.

Torque and Stress Tables

Rubber (Elastomeric) Full Face Gaskets

ASME B16.5 CLASS 150# FLAT FLANGES WITH ASTM A307 STUDS/BOLTS

Nom. Pipe Size (inches)	Number of Bolts	Size of Bolts (inches)	Minimum Torque (ft. lbs.)	<70 Durometer Shore A Preferred Torque (ft. lbs.)	≥70 Durometer Shore A Preferred Torque (ft. lbs.)
0.5	4	0.50	9	14	19
0.75	4	0.50	12	17	23
1	4	0.50	14	21	25
1.25	4	0.50	16	24	25
1.5	4	0.50	19	25	25
2	4	0.63	33	49	50
2.5	4	0.63	45	50	50
3	4	0.63	49	50	50
3.5	8	0.63	30	45	50
4	8	0.63	33	49	50
5	8	0.75	41	61	82
6	8	0.75	46	69	83
8	8	0.75	66	83	83
10	12	0.88	64	96	128
12	12	0.88	93	133	133
14	12	1.00	134	201	204
16	16	1.00	120	181	204
18	16	1.13	132	198	264
20	20	1.13	124	187	249
24	20	1.25	173	260	347

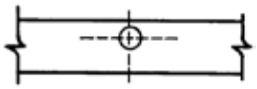
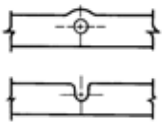
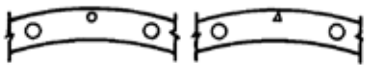
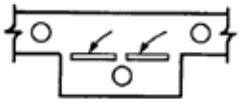
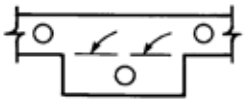
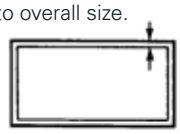
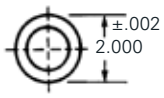
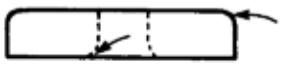
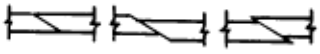
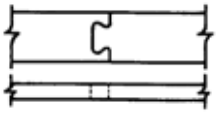
ASME B16.47 SERIES A CLASS 150# FLAT FLANGES WITH ASTM A307 STUDS/BOLTS

Nom. Pipe Size (inches)	Number of Bolts	Size of Bolts (inches)	Minimum Torque (ft. lbs.)	<70 Durometer Shore A Preferred Torque (ft. lbs.)	≥70 Durometer Shore A Bolt Torque (ft. lbs.)
26	24	1.25	238	238	318
28	28	1.25	224	224	299
30	28	1.25	248	248	331
32	28	1.50	309	309	412
34	32	1.50	283	283	377
36	32	1.50	309	309	411
38	32	1.50	356	356	474
40	36	1.50	328	328	438
42	36	1.50	354	354	472
44	40	1.50	339	339	452
46	40	1.50	354	354	473
48	44	1.50	342	342	456
50	44	1.75	470	470	626
52	44	1.75	502	502	669
54	44	1.75	535	535	713
56	48	1.75	528	528	705
58	48	1.75	561	561	747
60	52	1.75	530	530	707

NOTES:

- This torque table applies for 1/16" and 1/8" thick homogeneous elastomeric gaskets. The pressure rating of the material may vary depending on the grade.
- The above mentioned torque values are based on a maximum bolt stress of 25,000 psi. These tables can be used with other studs/bolts having a minimum yield strength of 30,000 psi, such as ASTM A193 B8/B8M Class 1 stainless steel studs/bolts.
- This table does not take flange strength into consideration. We recommend consulting the flange manufacturer to confirm the suitability of the above-mentioned values.
- Apply torque in increments. When the gasket extends past the OD of the flange by 1/4" to 3/8", stop tightening.

Gasket Design Tips

PROBLEM	RESULT	SUGGESTED SOLUTIONS
Bolt holes close to the edge. 	Causes breakage in stripping and assembling.	Projection or "ear". 
Very small bolt holes or non-circular openings. 	Require handpicking.... easy to miss.	Avoid hole sizes under 3/32" diameter. If small hole is for locating or indexing, change to notch. 
Tear-away parts with open slots at attached edges. 	Slots require handpicking, costly dies and die maintenance.	Simple perforation. 
Thin walls, delicate cross-section in relation to overall size. 	High scrap loss; stretching or distortion in shipment or use. Restricts choice to high tensile strength materials.	Have the gasket in mind during early design stages.
Metalworking tolerances applied to gasket thickness, diameters, length, width, etc. 	Results in perfectly usable parts being rejected at incoming inspection. Requires time & correspondence to reach agreement on practical limits. Increases cost of parts and tooling. Delays delivery.	Most gasket materials are compressible. Many are affected by humidity changes. Try standard or commercial tolerances before concluding that special accuracy is required.
Transference of fillets, radii, etc. from mating metal parts to gasket. 	Unless part is molded, such features mean extra operations and higher cost.	Most gasket stocks will conform to mating parts without pre-shaping. Be sure radii, chamfers, etc., are functional, not merely copied from metal members.
Large gaskets made in sections with beveled joints. 	Extra operations to skive or glue. Difficult to obtain smooth, even joints without steps or transverse grooves. 	Die-cut dovetailed joint. 

Gasket Terms

3A
GYLON® Style 3522 is 3A compliant. For documentation, please contact Garlock Applications Engineering.

AMERICAN BUREAU OF SHIPPING
Garlock styles on the American Bureau of Shipping Type Approval program:

- » BLUE-GARD® 3000, 3200
- » GRAPH-LOCK® 3125SS, 3125TC
- » GYLON® 3500, 3504, 3510
- » 5500*
- » 9900*
- » 3128
- » 3545
- » 3760
- » THERMa-PUR®**

NOTES:

* Accepted for use where "fire safe" requirements are specified by ABS rules and US Coast Guard regulations

** THERMa-PUR® filled spiral wounds and faced Kammprofiles are acceptable where "Fire Safe" requirements are specified by ABS Rules requirements)

ANTI-STICK
While we prefer that gaskets be installed with only the factory-applied anti-stick, experience shows that additional anti-stick is helpful in some situations, such as areas where flanges cannot be separated easily. Coatings should be as light as possible. Dry powders are strongly recommended over pastes and grease-type compounds, which can drastically reduce the crush strength and blowout resistance of the gasket. Additionally, grease or paste type materials may deteriorate or dissolve in service, leaving a possible leak path across the gasket.

AVIATION GASOLINE
Gasoline with a high octane number is used for prop driven airplane engines, as opposed to jet fuel for jet engines. Aviation gasoline contains a high percentage of aromatics. GYLON® is preferred; compressed sheet styles with nitrile binders can be successful in some applications (see Jet Fuel). Consult Engineering if you are unsure.

BUBBLE TESTS
Some end users perform bubble tests of their system to check gasket tightness. This information is helpful before specifying a gasket. Bubble tests are an extremely tough test for a gasketed joint, and may not be an appropriate means to verify correct installation. Lightweight flanges with low available compressive load may never achieve "bubble tight" results.

CHLORINE SERVICE
Several Garlock products including GYLON® 3500, 3504, 3510 and 3545, 3504 STRESS SAVER®, STRESS SAVER® 370, Style 8314, and the GRAPHONIC® are listed in the Chlorine Institute Pamphlet 95 as products that have found to be acceptable for use in chlorine related services by chlorine producers. GYLON® 3510 is particular is one of the most widely used products for chlorine tank car manways in North America.

CLOTH INSERTED (CI) RUBBER
Most CI rubber styles are designed for use as diaphragms, not gaskets. While CI rubber is more crush resistant than unreinforced rubber, customers have reported media "wicking" or leaking through the insert over time.

COMPRESSION
The amount of compression expected on a particular gasket type depends on its compressibility data and the load applied. Sealing problems are often a result of lack of compression. Graphs of compression vs. load on popular gasketing styles are available upon request. Close tolerance sheet should be considered for applications requiring tight internal clearances such as split case pumps (see Modulus of Elasticity).

COMPRESSIVE STRESS
Under compression: Under loaded gaskets will have higher leak rates and lower blowout resistance than properly loaded gaskets. This has a profound effect on performance and is the most frequent cause of joint problems.

Over compression: Over compression can lead to crushing, which accelerates the degradation of the gasket and can even cause immediate failure.

Uneven Compression: Gaskets resist blowout based on the friction of the gasket against the flange. The higher the compressive load, both initially and during service, the higher the blowout resistance. When areas of high and low compression exist in a flange joint, the areas of low compression are prime candidates for blowout.

CREEP RELAXATION
A term used to describe the loss of bolt load over time which typically increases with temperature and gasket thickness.

CRUSH STRENGTH
Garlock recommends a maximum compressive stress of 15,000 psi on compressed fiber and GYLON® gasketing, and 10,000 psi on GRAPH-LOCK® and Multi-Swell™ gasketing. The actual crush strength of these materials is typically higher.

CRYOGENIC SERVICE
We recommend our GYLON® and GRAPH-LOCK® styles down to -450°F (-268°C), and our compressed fiber gasketing is typically recommended to -100°F (-75°C).

DIELECTRIC BREAKDOWN VOLTAGE
Many applications require a gasket which is not a good conductor of electricity. Garlock has dielectric breakdown voltage test data available on our most popular gasketing styles. Generally speaking, GYLON® styles and compressed fiber gasketing that does not use carbon or graphite fibers have high dielectric breakdown values. Under humid or wet conditions, Styles 3504 and 3565 are particularly resistant to dielectric breakdown.

EMISSIONS
There is certainly a great deal of interest in limiting emissions of the numerous chemicals and other substances regulated under the Clean Air Act. Garlock has performed testing in this area and our report, available on request, covers the effects of gasket type, compressive load, internal pressure and flange finish on relative emissions levels. The use of heavier flanges where possible and the selection of premium gasket materials with good sealability numbers are the easiest ways to reduce emissions.

FDA
Style 3500 (Fawn) and **Style 3510** (Off-White) comply with FDA regulation 21CFR177.1550. They meet ingredient and extract requirements. The fillers are also acceptable under 21CFR177.2600 and coloring agents (where used) under 21CFR178.3297. Style 3500 (Fawn) has USDA approval for direct contact in meat and poultry applications.

Gasket Terms

FDA

Style 3504 (Blue) and **Style 3565** (ENVELON®) comply with FDA regulation 21CFR177.1550. They meet the ingredient and extract requirements. The filler is listed in the Food Chemicals Codex (FCC 3rd Edition) and is considered GRAS (generally recognized as safe – 21CFR170.30).

Style 3522 (Clear) complies with FDA regulation 21CFR177.1550.

The ingredients for **Style 3540** (Microcellular) and **Style 3545** (Microcellular with Rigid Core) comply with FDA regulations 21CFR177.1550, 21CFR182.1, 21CFR182.1217, and 21CFR175.300.

The PTFE resins used in **Style 3535** PTFE joint sealant comply with FDA regulation 21CFR177.1550. The PSA tape used to hold the joint sealant material in place meets 21CFR175.105.

FIRE TESTS

Historically gasket fire testing was performed using industry standards like API-589 and API-607 valve fire tests. The industry has moved toward the API-6FB as the preferred test method for gaskets. The method is very similar with the main difference being the API 6FB standard uses flange spools instead of valves. Garlock styles 9900, 9850, 5500, GRAPH-LOCK® and GRAPHONIC® gaskets have successfully passed one or more of the API test methods and are considered fire safe. Testing performed on gasketing products most recently and going forward are done so in accordance with the API-6FB standard.

FLANGES

Flanges come in all shapes and sizes, and the type of flange used in a service has a large impact on the type of gasketing material recommended. Standard ASME raised face flanges are best suited for use with compressed fiber and GYLON® gaskets. Elastomer (rubber) gaskets may be crushed in these flanges.

Flat faced non-metallic flanges seal best with elastomeric (rubber) gaskets, such as the various STRESS SAVER® gasket styles. GYLON® Style 3545 may also be suitable for some applications. Compressed fiber and standard GYLON® are frequently used in flat-faced carbon steel flanges, but the compressive stress available in these flanges is well below our minimums. The result is that the gaskets are compressed very little; if there is a significant flange irregularity present, the gasket may not seal. Since leakage rates of gaskets depend on the available compressive stress, the joint may not be as tight as the customer would like.

Glass-lined flanges are found in many chemical applications. Due to the inherent "waviness" created when these flanges are fired to apply the glass, the softer GYLON® styles such as Styles 3545 and 3504 are preferred. The gap between the flanges, when placed together empty, must be measured before the gasket is ordered. Gasket thickness should be four to five times the maximum gap observed.

Stainless steel (SS) flanges are common in many plants for chemical service, and often utilize low strength SS bolts. Due to the chemicals present and the low compressive stress generated by the bolts, Styles 3545 and 3504 are often recommended. We do prefer, however, the use of high strength, strain-hardened stainless steel bolts. Styles 3000, 98206 and STRESS SAVER® XP are the preferred choices in water service in stainless steel flanges, due to their very low leachable chlorides. Consult Garlock Engineering when considering other styles. See STRESS SAVER® XP on page 17.

FLANGE FINISH

We recommend the flange finish conform, whenever possible, to 45-55 serrations per inch, in a concentric or spiral pattern, cut with a 1/16" radius, round-nosed tool. This finish is usually difficult or impossible to create in non-circular flanges. We recommend that machined surfaces which can not be serrated have a surface finish with a multi-directional lay and roughness of 125-250 micro-inch RMS.

FUEL ADDITIVES

The chemical MTBE (methyl t-butyl ether) has become a very common fuel additive and gasketing compatibility inquiries on this material are frequent. Garlock in-house testing has shown GYLON® gasketing to be unaffected by MTBE. We have also found compressed fiber gasketing Styles 9850 and 3000 to be suitable for MTBE service. These materials are recommended for MTBE alone or mixed with gasoline.

F104 LINE CALLOUTS

These designations are not intended to be used as specification limits; intended for generic description of physical properties.

FULL FACE GASKETS

See Flanges.

GASKET CONSTANTS

The ASME and ASTM committees are working on a new system and new set of numbers to be used in the ASME code calculations for flange design. These new constants address leak rates at installation and during loss of compressive load and therefore are meant to help end users design for a certain leak level. The use of a defined leak rate will often generate higher bolt load requirements for the flanges, which should improve performance of designed joints. **For gasket constant values, see page 43.** Also see M & Y Values and Emissions.

GASKET IN GROOVES OR RECESSED FLANGES

Gaskets installed in grooves or tongue and groove flanges require one extra consideration: the compressed height of the gasket must be considered. This is typically important where a highly compressible gasket such as GYLON® Styles 3545 and 3540 or one of the GRAPH-LOCK® styles is used to replace a compressed sheet gasket. The fully compressed thickness, not the original thickness, must be greater than the groove depth or the space between the tongue and groove when flanges contact each other. Ideally, the tongue should be at least as tall as the groove depth.

GASOHOL

Gasohol is a blend of gasoline with an alcohol— usually 10-15% ethyl alcohol. GYLON® styles are preferred; nitrile-bound compressed sheet styles should be acceptable; most rubber gaskets are not recommended.

INSTALLATION

Garlock strongly recommends the use of calibrated torque wrenches to tighten bolts to the correct load. We have an installation procedure and discussion available upon request. An interactive installation training module is also available on garlock.com.

Gasket Terms

INSULATION KITS
Customers will occasionally ask for a flange insulation or isolation kit or gasket to electrically insulate one flange from the mating flange. Kits are available from many authorized distributors and include an insulating gasket along with a sleeve for the bolts and insulating washer to be installed under the steel washers and nuts. (see Dielectric Breakdown Voltage).

JET FUELS
Most jet fuels are typically refined petroleum products similar to kerosene. We recommend our GYLON®, nitrile bound compressed sheet and GRAPH-LOCK® products. (See Aviation Gasoline) For JP9 or JP10, please contact Applications Engineering.

LEACHABLE LEVELS (CHEMICAL)
Some pipe specifications call out maximum levels of "leachables" for gaskets. These limits are usually concerned with leachable chlorides, fluorides, halogens and sulfur. These ions, or charged particles, are of concern due to their tendency to promote corrosion of piping systems. Garlock keeps test results for numerous gasket styles on file and we will test and certify leachable chlorides, etc., where required. There is a charge for these tests.

"M" AND "Y" VALUES FOR FLANGE DESIGN
See page 43. Our testing shows an increase in "M" and "Y" values as gasket thickness increases. This is the opposite of the trend found in the ASME Code. Fugitive emission and gasket blowout studies have validated this trend.

MILITARY SPECIFICATIONS
Due to the variation of the certification and specification requirements, a manual review must be performed on each inquiry or order to verify certification and specification demands and to ensure the order is processed to meet the needs of the requestor. Certification and specification charges will vary with the number of sheets due to the number of batches required to complete the order.

Garlock has three gasketing products that meet Navy specifications. Garlock Style 3125SS is specified for MIL-DTL-24696 Type I, Style 3200 is specified for MIL-DTL-24696 Type II and Style 9900 is specified for STR-508. Ordinarily the products are certified prior to sale to the Navy or shipyards. Testing charges apply.

MODULUS OF ELASTICITY
Some flange programs ask for the modulus of elasticity for the gasket material. Since only rubber gaskets are elastic the other types of gasketing do not have a true modulus. However, Garlock Applications Engineering does have compression vs. load curves which can be used to calculate a rough estimate for use in these calculations (see Compression).

MONOMERS
Monomers are materials, such as styrene and vinyl chloride, which can combine with themselves or other monomers and form polymers, such as polystyrene and polyvinyl chloride (PVC). GYLON® Styles 3510 and 3530 are recommended for monomers, since elastomer-bound gaskets are rarely compatible with monomers. Some monomers, under certain conditions, will penetrate a gasket and polymerize inside the gasket, causing the gasket to swell and, occasionally, rupture. This effect is known as "popcorning". This effect can be reduced or eliminated with proper compressive load which lowers the void space inherent in a gasket.

NSF/ANSI/CAN 61 FOR DRINKING WATER
Current certified styles include MULTI-SWELL™ 3760-U, GYLON® 3505, GYLON® 3505 EPX, STRESS SAVER® 3505, STRESS SAVER® 3522, and Style 98206 (EPDM).

OXIDIZERS
Certain chemicals are known as strong oxidizers and, as such, will readily combine with organic compounds. We recommend our GYLON® material for use in oxidizers.

OXYGEN SERVICE
We recommend GYLON® Styles 3502, 3505, and 3503. These gaskets are specially manufactured and packaged to eliminate contamination by organic material.

The two best GRAPH-LOCK® styles to evaluate in oxygen service are GRAPH-LOCK® 3123 and 3128. These style should be limited to 650°F in oxygen. Style 3123 is made of homogeneous graphite and style 3128 is made of homogeneous graphite bonded to multiple layers of stainless steel. Laminated graphite (GRAPH-LOCK® 3125) and metal inserted graphite (GRAPH-LOCK® 3125SS, 3124/3126 and 3125TC) all contain an adhesive, which is not recommended in O_2 service.

NOTE: GRAPH-LOCK® styles are NOT cleaned or packaged specifically for oxygen service. We would recommend wearing gloves when handling the gaskets to minimize contamination.

pH
The pH scale is a measure of the acidity or alkalinity of a solution. A pH of 7 is a neutral reading; it is neither acidic or alkaline. Readings of 1-2 are strongly acidic, while 13-14 indicates a strong alkaline or caustic media.

NOTE: A pH reading alone without the names of the chemicals involved is not enough to select a gasket. Also, since the pH scale is quite limited in range, a reading of "1" or "14" does not fully describe the concentration. We need the concentration expressed as a percentage. For example, sodium hydroxide at a concentration of around 4% will "peg" the pH scale at 14, the same reading produced by a 40% concentration.

PRESSURE SPIKES
Very high pressure spikes can occur in any line pumping a liquid if a valve is closed rapidly, leaving the fluid flow nowhere to go. The inertia of the fluid may create extreme pressure spikes. These spikes occur too rapidly to be detected by a pressure gage but can cause a gasket to blow out.

RADIATION RESISTANCE
We have conducted gamma radiation tests on our compressed fiber gasketing Styles 3000, 3200, 3400, 3700, 5500, 9800, 9850, 9920. These tests indicate our compressed fiber gasketing styles will handle a total exposure of approximately 5×10^7 rads of gamma radiation. GYLON® Styles 3510 and 3545 have been tested and will handle a total exposure of approximately 1×10^5 rads of gamma radiation.

Gasket Terms

REFRIGERANTS
Refer to the Chemical Resistance chart for a complete listing of refrigerants. Gaskets with a "B" rating are usually acceptable in refrigerants. The compatibility of the lubricants used with these refrigerants is rarely an issue with fiber gaskets.

REUSE OF GASKETS
We are frequently asked about reusing a gasket. We do not recommend this practice. A gasket's function is to conform to flange high and low spots when compressed, and its ability to reseal decreases after it is compressed. Gaskets which contain rubber and which have experienced elevated temperatures will be even less likely to reseal.

SHELF LIFE
Garlock has spec sheets detailing proper storage conditions and expected shelf life for our products. Available upon request.

SPACERS IN FLANGES
Some installations require a very thick gasket to fill a large gap between flanges. We do not recommend stacking numerous gaskets in the same flange. In-house tests have shown that a better way to fill a 1/2" gap, for example, is to install a 1/16" gasket on each side of a 3/8" thick incompressible spacer ring. Ideally, the spacer ring will be consistent with piping metallurgy, serrated, and cut to the same dimensions as the gasket. We recommend higher minimum torques when using this arrangement.

STEAM
Steam can be found in plants in two forms: saturated and superheated. Saturated steam is standard boiler steam and has a definite temperature for each pressure. Superheated steam is steam at a higher temperature than is found on the saturated steam curve for that particular pressure. We recommend our GRAPH-LOCK® styles, THERMa-PUR® 4122-FC or metal gaskets with THERMa-PUR® or graphite filler/facing for superheated steam. Please consult with Garlock Engineering when steam pressure exceeds 150 psig. Also see notes on steam service found on fiber gasket specification pages.

SURFACE TREATMENTS
Liquids such as RTV Silicone, greases, oils, etc. are often added to the surface of gaskets to either prevent sticking (see ANTI-STICK) or to create a seal. Garlock does not recommend this practice, as liquids are incompressible fluids and can prevent the gasket from receiving the compressive force and friction required to create a seal and hold system pressure. The lack of friction between the gasket and flange faces due to a layer of liquid can also reduce the crush and extrusion resistance of the gasket. Lastly if the liquid treatment chemically and/or thermally degrades during operation any volume loss may lead to premature gasket failure.

THERMAL CONDUCTIVITY
Values available from Applications Engineering.

THICKNESS, GASKET
Garlock recommends the use of thinner gaskets wherever possible. This not only lowers the cost of the gasket, it increases the performance of the joint by lowering emissions and product loss and increasing blowout resistance. Thinner gaskets will not seal as many flange irregularities as thicker gaskets, however, and require flatter flanges. Experience with the particular flange system is often an important guide when specifying a gasket thickness. A more complete discussion of the subject is available.

TORQUE, BOLT
We realize many end users resist using a torque wrench for installation. We have found the use of a torque wrench to be the least costly and most effective way to gain a substantial increase in performance. Any method which accurately controls the compressive load on the gasket is acceptable.

See Bolt Torque Tables for ASME B16.5 raised face flanges on page 46. For non-standard flanges, contact Applications Engineering.

Garlock recommends consulting the flange manufacturer for recommended torque values when working with flanges such as glass-lined, polymer PTFE-lined, FRP, CPVC or PVC flanges to avoid damage to the flanges. The allowable torque values for these flange types are often much lower than the values published in the Garlock catalog for the given flange sizes and classes.

TRACED LINES (HEAT TRACED)
Heat traced lines pumping materials which are solid at ambient temperature can present a number of problems for gaskets:

1. The bolts are usually hotter than the flanges since the heat is applied from outside the pipe. This causes the bolts to expand more than the pipe, which lowers the compressive stress on the gasket.
2. Any line which is shut down will solidify as it cools. When the line is reheated on start-up, there is occasionally a plug of solid material blocking a section of the pipe. The heating may cause some areas of the material to liquefy and then expand. The expansion can create extremely high pressures inside the joint if the solid plug is blocking a section of the line.

USDA
See FDA.

USP (UNITED STATES PHARMACOPEIA)
GYLON® Style 3500, 3504, 3510, 3522, 3540, and 3545 are USP Class VI approved. For documentation, please contact Garlock Applications Engineering.

VACUUM
We are often asked if a particular gasket material can handle vacuum. One approach is to treat vacuum like a 150 psig application. Meaning that if the flanges can create sufficient compressive stress to hold 150 psig, the gasket should work under full vacuum. The problem occurs with light-weight flange designs, because the flanges do not have to hold pressure they have insufficient bolting to achieve the minimum stress needed to seat the gasket. A more complete discussion is available from Application Engineering as well as guidance on specific recommendations. Flange and bolting information will be required.

Test Procedures

BLOWOUT OF GASKET PRODUCTS
(No ASTM Designation)

Garlock developed the equipment and test procedure used for testing the blowout resistance of gaskets at varying pressures and temperatures.

This test method and procedure enable us to compare the blowout resistance of all types of non-metallic gasketing products. The test fluid is nitrogen gas. Internal pressures can be varied from atmospheric to approximately 5,000 psig (345 bar). The flanges and gaskets can be exposed to temperatures up to 1,000°F (540°C).

Garlock blowout tests are primarily used to compare various products, and do not represent results that can be expected under actual field conditions. The experience gained over many years in blowout testing provides part of the technical backup for product ratings.

COMPRESSIBILITY AND RECOVERY OF GASKET MATERIAL
ASTM Designation: F36

This method covers determination of the short-time compressibility and recovery at room temperature of sheet gasket materials.

This test method is not intended as a test for compressibility under prolonged stress applications, generally referred to as "creep", or for recovery following such prolonged stress applications, the inverse of which is generally referred to as "compression set".

Some initial compressibility is essential for proper installation of a gasket and is required to compensate for any flange irregularities such as minor flaws or nicks, non-parallelism, corrosion and variations in groove depth. Voids must be filled to obtain proper seating of the gasket or premature failure will occur.

In addition, good recovery upon release of load is indicative of torque retention of a gasketed joint.

Compressibility and recovery as defined by ASTM are two worthwhile physical property criteria for supplier and purchaser to agree upon as routine tests.

CREEP RELAXATION OF GASKET MATERIAL
ASTM Designation: F38 Method B

Measured by means of a calibrated bolt with dial indicator, ASTM F38 provides a means for measuring the amount of creep relaxation of a gasket material at a stated time after a compressive stress has been applied. There is no fluid involved.

This method is designed to compare related products under controlled conditions in regard to their ability to maintain a given compressive stress as a function of time. A portion of the torque loss on the bolted flange is a result of creep relaxation. Creep relaxation is defined by ASTM as: "A transient stress-strain condition in which the strain increases concurrently with the decay of stress." The result of creep relaxation is loss of thickness of a gasket, which causes bolt torque loss, resulting in leakage.

Torque loss also can be caused by elongation of bolts, flange distortion and vibration. Therefore, results obtained in lab conditions should be correlated with field results.

Also see Torque Retention Test for further information.

FLUID RESISTANCE OF GASKET MATERIALS
ASTM Designation: F146

These methods provide a standardized procedure for measuring the effect of immersion on physical properties of non-metallic gasketing materials in specified fluids under defined conditions of time and temperature. The types of materials covered are those included in the first numeral described in Classification F104. They are not applicable to the testing of vulcanized rubber, a method described in Test Method D471.

The test fluids and conditions outlined were selected as typical for the purposes of comparing different materials, and can be used as a routine test when agreed upon between the supplier and purchaser. The results of immersion tests are not intended to give any direct correlation with service conditions in view of the wide variations in temperature and special uses encountered in gasket applications.

GAS PERMEABILITY
DIN* Designation: 3535

This standard provides a means of measuring leakage of a gas through a gasket. This test is designed to compare the leakage rates of different products.

The fluid used is nitrogen gas at an internal pressure of 580 psig (40 bar) and a gasket loading of 4,640 psi (32 N/mm^2). The apparatus is considerably more versatile than that used in ASTM F37. The sample gasket size can be varied; much higher internal pressures can be used. Normally measurements are made at room temperature. However, we have the ability to test at elevated temperatures.

The test measures the effects on leakage rates due to changes in gasket products themselves, in gasket thicknesses, in gasket flange widths, in varying internal pressures, in varying gasket loads, and at varying temperatures.

HELIUM MASS SPECTROMETER TEST

The ability to control and detect leakage on an ever-decreasing scale is a requirement of industry today. Mass spectrometer technology is used where stringent leak detection is needed, such as in the manufacture of devices used in body implants, nuclear vessels and cathode ray tubes.

The Helium Mass Spectrometer Leak Detector (HeMSLD) develops a high vacuum, which enables it to detect trace amounts of helium that are present. Helium gas is used as a test media in standard flange fixtures on the DIN 3535 gas permeability fixture. The HeMSLD detects the helium leakage through the gasketed joint by way of a hand-held "sniffer" probe or by a hard-piped connection from the DIN 3535 fixture or equipment where other leak detection systems are used. Leakage as low as 1×10^{-9} standard cc He/second can be detected.

OTHER ASTM TESTS

Purchasers may want to consider the use of the following ASTM test methods, depending on their gasketing needs:

F147 - Test Methods for Flexibility of Non-Metallic Gasket Materials

F607 - Test Method for Adhesion of Gasket Materials to Metal Surfaces

NOTES:
* DIN Deutsches Institut für Normung e.v.

Test Procedures

SEALABILITY OF GASKET MATERIALS

ASTM Designation: F37

Test methods A and B provide a means of evaluating fluid sealing properties at room temperature. Method A is restricted to liquid measurements and Method B (most common) can be used for both gas and liquid measurements.

These test methods are suitable for evaluating the sealing characteristics of a gasket product under differing compression flange loads. Since this physical property is so important to the proper function of a gasket, it should be used as an acceptance test when test methods are agreed upon between supplier and purchaser as follows: fluid, internal pressure of fluid, and flange load on the gasket specimen.

The most commonly used fluids are isooctane and nitrogen gas. Gasket load, fluid and internal pressures can vary according to customer needs. However, our experience indicates a strong preference for nitrogen gas, with a gasket load of 3,000 psi (20.7 N/mm^2) at an internal pressure of 30 psig (2 bar).

These precise measurements of leakage rates are designed to compare gasketing products under controlled conditions. The leakage measured comes either through the gasket, or between the gasket and the flange faces, or both. Our experience over many years with thousands of test samples indicates that, in most cases, the leakage measured is a result of leakage through the gasket.

It is not a question of whether or not any fibrous type gasketing product allows leakage through the gasket, but how much leakage, under any set of given conditions of time, temperature and pressure.

STANDARD CLASSIFICATION FOR NON-METALLIC GASKET MATERIALS

ASTM Designation: F104

This classification system provides a means for describing pertinent properties of commercial non-metallic gasket materials. Materials composed of PTFE, organic or inorganic fibers, and other fiber materials in combination with various binders or fillers are included. Materials normally classified as rubber compounds are covered in ASTM D2000.

Since all the properties that contribute to gasket performance are not included, use of the classification system as a basis for selecting materials is limited.

The purpose of the classification system is intended to provide a common language for communication between suppliers and purchasers; to guide engineers and designers in the test methods commonly used for commercially available materials, and be versatile enough to cover new materials and test methods as they are introduced.

It is based on the principle that non-metallic gasket materials should ideally be described in terms of specific physical and functional characteristics. An infinite number of such descriptions can be formulated by use of one or more standard statements based on standard tests.

Tensile of Non-metallic Gasket Materials

ASTM Designation: F152

The Universal Tester is used to determine the tensile strength of non-metallic gasketing products. The types of products covered are those containing various organic fibers, inorganic fibers, flexible graphite, or fluorocarbons as described in F104.

F152 is not applicable to the testing of vulcanized rubber, a method that is described in Test Method D142, nor for rubber O-rings, a method that is described in D1414.

The measurement of tensile strength characterizes various classes and grades of products of a given type. It also will aid the purchaser in determining whether the gasketing product approved for a given application is being manufactured to acceptable quality. Various procedures are given for different types of materials, and in order to compare results from one lab to another, it is imperative that the applicable procedure be used.

The measurement of tensile strength should not be construed as an indication of the performance of that product in use.

THERMAL ANALYSIS SYSTEM

Thermal Analysis, often referred to as TA, is a series of techniques that characterize materials by measuring and analyzing changes in their physical and chemical properties resulting from controlled and measured changes in temperature. The TA techniques include DSC (Differential Scanning Calorimetry), TGA (Thermal Gravimetric Analysis) and TMA (Thermal Mechanical Analysis).

DSC measures heat flow into or out of a material as it is undergoing a programmed thermal profile. The resulting plot of heat flow vs. temperature can reveal a great deal of information about a material. DSC is being used to determine such things about a material as specific heat, melting point, crystallinity, glass transition temperature, degree of cure of thermosets, purity, oxidative stability, and reaction kinetics.

TGA measures changes in the weight of a material. By heating a sample in a controlled manner in various atmospheres, the composition of various materials can be determined. The technique is also useful for performing thermal stability studies.

TMA provides measurements of penetration, expansion, contraction, extension, and relaxation of materials as a function of either time or temperature. By using various probes and accessories, TMA can be used to determine expansion coefficients, softening points, heat deflection temperatures, viscosity, creep, and stress relaxation.

TORQUE RETENTION

DIN 52913

This test is designed to determine the torque retention capabilities of gasketing products, when subjected to the compression load and operating temperature as defined by the test procedure.

The test consists of applying a predetermined load on the test gasket via a tension screw, then heating the gasket/flange assembly to the desired temperature (there is no internal pressure). The standard test period is either sixteen (16) hours or one hundred (100) hours. At the end of the required time period, the compression load which is left acting on the test gasket is measured. This allows one to calculate the torque retention capabilities of various gasketing products.

Test Equipment

Quick Reference Selection Guide

FOURIER TRANSFORM INFRARED SPECTROMETER (FTIR)

This instrument is equipped with a number of attachments that allow scanning of liquids and solids either by transmittance or reflectance. The spectrum of the scanned sample can be compared against standard spectra contained in internal libraries within the instrument. The search program automatically finds the best match. The sample and library spectra can be displayed together on the screen for comparison.

IMAGING SYSTEM

System consists of a Polarized Light Microscope (PLM), Stereo Microscope, Macro Stand, Digital Camera and Image Analysis Software. The System is useful in many areas including investigating new materials, analysis of competitive products and in failure analysis.

The state of polarization of a light beam is generally modified when it is reflected or transmitted through a material. That phenomenon allows PLM to be useful in material identification and characterization, especially fibers and fillers. Magnification in excess of 400X is possible.

The Stereo Microscope provides 3D images with a maximum magnification of approximately 100X.

The Digital Camera / Image Analysis Software permits for achieving, manipulation and measurement of the images of interest.

Stereo microscope or Dissecting microscope: Stereoscopic (3D) vision is possible by the combined action of two eyes. This requires an independent optical system for each eye (similar to how binoculars work). A stereo microscope features two tubes with independent optical systems with two eyepieces and two objectives. Which means that a stereo microscope is in fact, a combination of two compound monocular microscopes whose optical axes are at a right angle to each other and directed to the same specimen area.

Stereo microscopes are used for viewing natural specimens such as minerals, insects, plant parts; they are also used for technical applications such as illuminating coins, textiles, and electronic components. Because of its long working distance, dissection and precision assembly are possible under the stereo microscope.

A stereo microscope uses two different paths of light. This allows you to see a specimen in 3-D. Stereo microscopes have high depth perception but low resolution and magnification. These microscopes are great for dissecting as well as for viewing fossils and insect specimens. The best models have a built-in light source and zoom capabilities.

PROGRAMMABLE, MULTI-FUNCTIONAL TEST STAND (A.S.T.—Advanced Seal Tester)

This highly sophisticated, PC-driven test stand evaluates properties of gasketing materials under varying conditions; it can be programmed to test leak rates from high vacuum to 300 psig internal pressure, with different compressive loads or test temperatures. Any of the parameters listed below can be programmed to ramp up while the other conditions are held constant, to study the effects these conditions have on the sealability of materials. A Helium Mass Rate Spectrometer can monitor leak rates; gasket thickness and leak rates are monitored to determine percent compression vs. load, leak rate vs. compressive stress, maximum crush resistance, and more.

Programmable Parameters:

- Compressive load (stress)
- Time
- Temperature
- Internal pressure or vacuum
- Leak rate measurement

Capabilities:

- Compressive load:
  To 107,000 lbs force (475 KN) at room temperature
  To 73,000 lbs force (325 KN) at 570°F (300°C)
- Temperature: to 840°F (450°C)
- Gasket thickness: 0-5/16" (0-8mm)
- Internal pressure: High vacuum (10^{-3} mbar) to 300 psig He (20 bar)
- Helium leak rate measurement: 1 standard cc/ second down to 1 x 10^{-11} standard cc/ second

Application Data Form

Date:_____

For: Garlock Gasketing Engineering

Email: gasketapps@garlock.com

Page: 1 of _____

Drawing attached ❑ Yes ❑ No

From: _____

Title:_____

Company:_____

Address:_____

Phone Number:_____

Email Address:_____

APPLICATION

❑ Pipe Flange
❑ Heat Exchanger
❑ Manway
❑ Compressor
❑ Pumps - centrifugal / horizontal split case
❑ Flue Duct
❑ Valve Bonnet
❑ Other _____

SERVICE CONDITIONS

Maximum Temperature _____ °F/°C

Continuous Operating Temperature_____°F/°C

Internal Pressure_____ psig/bar

PSIG / bar ❑ Continuous ❑ Intermittent

Thermal Cycling_____/24 hours

Vibration ❑ Yes ❑ No

Other (specify)_____

BOLTS

Grade_____

Diameter_____

Length_____

Number_____

CHEMICAL COMPATIBILITY

Media_____

pH_____

Concentration_____

Liquid or Gas_____

FLANGE

Standard

Material_____

Size_____ Rating_____

Surface Finish_____RMS

❑ Phonographic ❑ Concentric

Face (raised, flat, tongue & groove, etc.) _____

_____

Non-Standard

Material_____

I.D. / O.D._____

Flange Thickness_____

Bolt Circle Diameter_____

Surface Finish_____RMS

❑ Phonographic ❑ Concentric

Face (raised, flat, tongue & groove, etc.) _____

_____

Comments:_____

_____

WARNING:

The failure to select the proper sealing product for your application can result in property damage and/or serious personal injury. You should not purchase or use any of the products identified in this brochure without undertaking a thorough, independent study, and obtaining an evaluation of your particular application by qualified professionals. The descriptions of the products contained in this brochure constitute general guidelines as to product selection and installation and may not be appropriate for your particular project.

The performance data and metrics contained in this brochure are not specification min/max limits, or guarantees of performance, but instead represent typical values that have been established based upon field testing, customer field reports, and/or in-house testing. Actual performance will vary from these values and you should not rely upon these figures in determining the suitability of the use of the product for any particular application.

While the utmost care has been used in compiling this brochure, we assume no responsibility for errors. Specifications subject to change without notice. This edition cancels all previous issues. Subject to change without notice.

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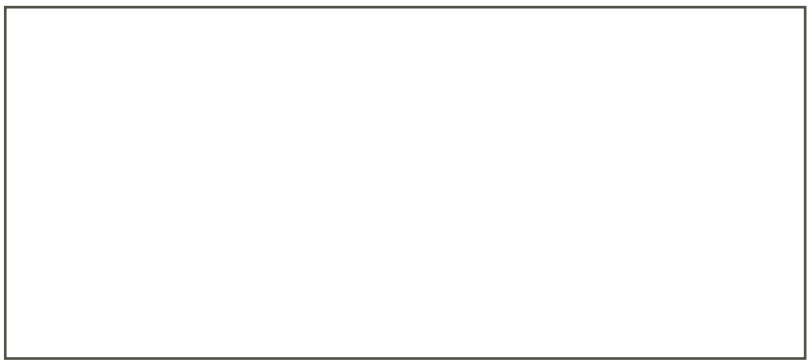

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