

GYLON®

High performance PTFE gasketing



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GYLON®

Family of PTFE Gasketing

GYLON® family history

When PTFE* was developed in 1938, the importance of the material to industrial sealing was quickly recognized because of the tremendous chemical resistance characteristics. While use of PTFE as a gasket material increased in industrial applications, complaints about certain properties started to build: skive marks made initial sealing difficult, cold flow caused leakage and premature failure, and temperature/pressure cycling was a problem.

Resistance to cold flow

These drawbacks were eliminated when Garlock introduced GYLON® Fawn, Style 3500, in 1967. The GYLON® process minimizes creep and cold flow normally associated with PTFE products, while retaining other positive characteristics of PTFE. GYLON® Fawn was so innovative that it received Chemical Processing magazine's Vaaler Award in 1968. As the variety and quantity of industrial chemicals increased, Garlock realized that new products would be required to serve the growing market. Two additional GYLON® styles were introduced to meet those demands: GYLON® Style 3504, and GYLON® Style 3510.

High pressure service, chemical compatibility

As production demands increased, pipe hammering and/or pressure spikes became more common. GYLON® Series HP 3560 and HP 3561 were designed to meet those extreme conditions. These perforated stainless steel-inserted GYLON® gasket materials outperform any other gasketing available for high pressure service where chemical compatibility is a concern.

* PTFE – polytetrafluoroethylene

Low bolt load sealing

In 1994, Garlock introduced GYLON® Style 3545 for low bolt load applications. It was designed specifically to seal pitted, warped or wavy flanges. Featuring soft, compressible outer layers and a rigid PTFE inner core, Style 3545 is ideal in situations where a rigid gasket is required, such as hard-to-reach piping systems, valves and flanges. The layers of rigid PTFE and microcellular PTFE are sandwiched together using the proprietary GYLON® thermal bonding process, rather than adhesives, for longer gasket life.

Unlimited sizes and dimensions

With growing concern over fugitive emissions, the traditional dovetailing method of creating larger sized gaskets no longer met many customer demands. In response, Garlock created the Welded GYLON® process. Welded GYLON® eliminated dovetail leak paths and allowed the use of large gaskets without handling problems or premature blowout. Today, GYLON® gaskets can be thermally bond (without the use of any adhesive or low melt temperature polymers) to any size or dimension; another breakthrough for Garlock gasketing.

Unparalleled reliability and service

The Garlock family of GYLON® products has evolved over the years with a focus on quality to meet and exceed customer expectations. The use of Employee Involvement, Statistical Process Control, Vendor Assurance Programs, and a continuous improvement philosophy continues to guarantee end users the highest quality products available.

Testing is performed regularly on all styles and thicknesses to ensure the consistency of Garlock quality in GYLON® sheets. Quality products, years of experience and value-added service programs, all are reasons why the GYLON® family of products has become such a major sealing component in the industry today.

There is no doubt that demands will change in the future. But one thing is certain - Garlock will continue to answer those changes and demands with products that are innovative and timely. GYLON®, a name you can trust and a complete family of products to choose from for your gasketing needs.

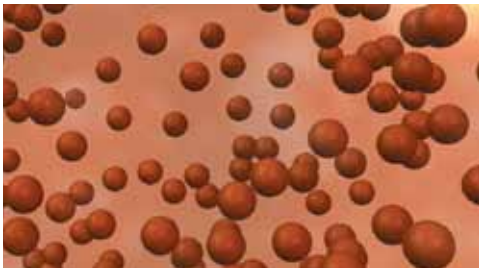
Conventional PTFE Gasketing vs. GYLON®

A comparison of the production process shows the clear answers

Conventional PTFE Gasketing Production Process: Rotary tumbling gives uneven mixing



Only the GYLON® Process guarantees consistent mixing and even dispersion.



Only the GYLON® process secures gasket tightness.



The proprietary multi-layer construction is the basis for permanent resilience.

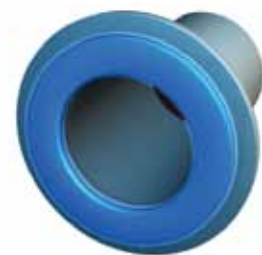
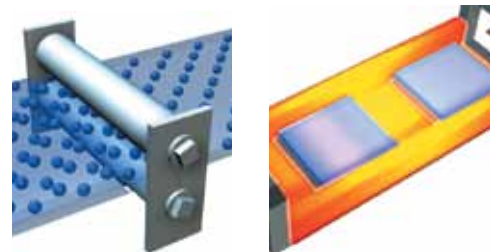
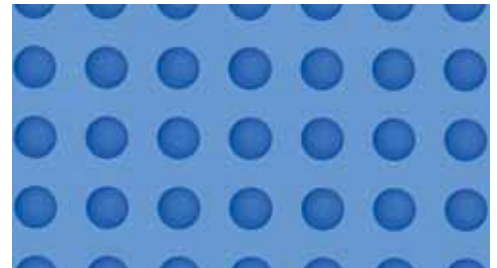
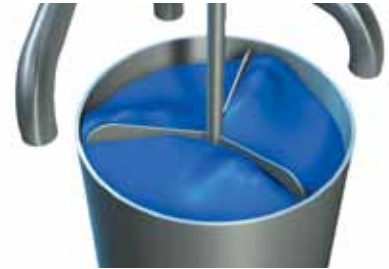


GYLON® gaskets offer homogeneous properties under every condition. Safety is synonymous with GYLON®.



GYLON® eliminates coldflow problems present in the past.

GYLON® Gasketing Production Process: Blade mixer gives homogeneous mix



Your Benefits at a Glance



A comparison between GYLON® flat gaskets and un-filled PTFE after exposure to a load of 14 MPa for one hour at a temperature of 260 °C.

Benefits at a glance

- » Excellent chemical resistance
- » Minimal cold flow
- » Can be used in high pressure/temperature combinations
- » High resilience
- » Temperature range from -268 °C to +260 °C
- » Excellent dimensional stability under thermal stress
- » Good electrical insulating properties
- » High wear, abrasion, weather and UV resistant

GYLON® Certificates

In order to meet the requirements of your special applications, we have subjected our materials to special tests. Detailed records on the tests listed below are available upon request.

	BAM Federal Institute for Materials Research and Testing	TA-Luft including blow-out proof certificate	FDA	USP Class VI	EC1935/2004 & EC10/2011 EC = European Comission	DIN EN 13555 Datasheet up to 80 bar
GYLON® Style 3501-E	x	x	x			x
GYLON® Style 3504	x	x	x	x	x	x
GYLON® Style 3510	x	x	x	x	x	x
GYLON® Style 3545		x	x			x

Additional certificates for individual styles are available upon request (i.e. ABS, EC10/2011, USP class 87, Hydrocheck).

GYLON® Styles



GYLON® Style 3501-E and Style 3500

The first choice for universal applications in the chemical and petrochemical industries. The combination of high pressure/temperature (P x T) and minimal cold flow far exceeds the performance of conventional PTFE.



GYLON® Style 3504

Highly compressible and flexible through the well controlled and uniform process of alumino silicate microspheres filler distribution. Excellent for low-stress components requiring low bolt torque loads, i.e. enameled and plastic flanges, glass tubes, GRP (Glass Reinforced Plastic) and FRP (Fiberglass Reinforced Plastic).



GYLON® Style 3510

The product with the broadest chemical resistance. The preferred choice for extremely aggressive media including hydrofluoric acid, aluminum fluorides, chlorine/alkali, caustic potash solutions and electroplating baths. Inhibits the polymerization (“pop-corning”) of monomers.

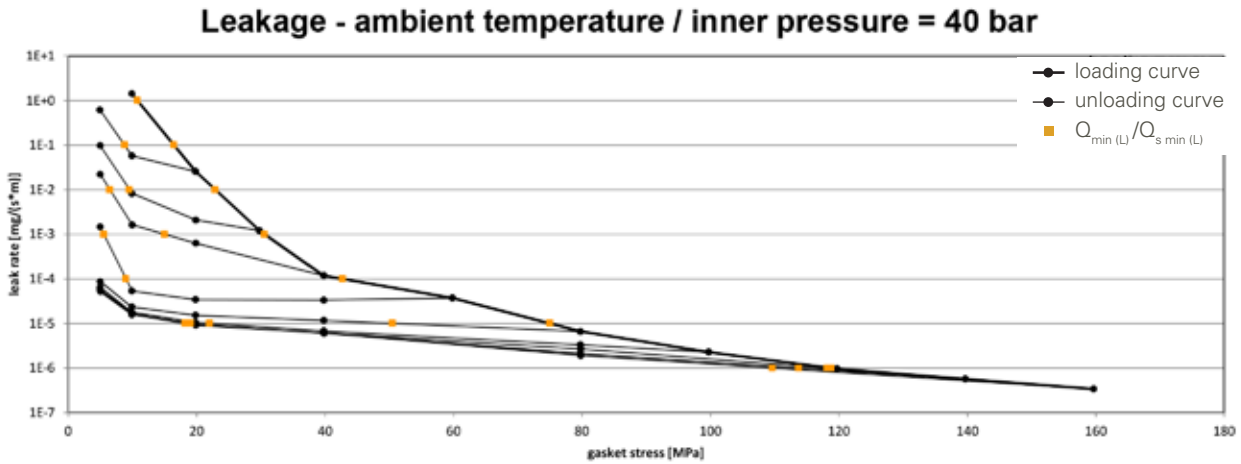


GYLON® Style 3545

Manufactured from soft compressible micro-cellular PTFE outer layers with a hard PTFE pressure resistant central layer, homogeneously sintered together. Ideal for uneven surfaces and with a maximum chemical resistance of 100% PTFE. An excellent alternative to expanded PTFE on applications requiring consistent and reliable performance.

Technical Information

The technical data as stated here are laboratory values which have been determined in accordance with DIN or ASTM guidelines. In practice, deviations may result due to differing operating conditions.



GYLON® Style 3501-E – Really leak tight

The diagram depicts the characteristics of GYLON® at high compressive surface pressures as well as subsequent rapid relaxation. Even at a high load of 160 MPa (up to 220 MPa at room temperature) no physical or structural changes to the material is detectable. In the case of the subsequent relaxation to approximately 5 MPa, the leakage values still remain far below the values specified by the German TA Luft (Technical Instructions on Air Quality) (criteria and accordance to VDI2200 and VDI2440).



These values were determined by CST (Center of Sealing Technology, Steinfurt Germany/ University of Münster) at an inside pressure of 40 bar. Many PTFE-based materials – when severely compressed – tend to change significantly by sudden cold flowing, rupturing or other failure mechanisms. Highly sophisticated DIN EN 13555 characteristics like PQR and Creep/relaxation are available as well.

Technical Information

General sealing characteristics

	GYLON® Style 3501-E	GYLON® Style 3500	GYLON® Style 3504	GYLON® Style 3510	GYLON® Style 3545
Temperature Range	-268 °C up to +260 °C	-268 °C up to +260 °C	-268 °C up to +260 °C	-268 °C up to +260 °C	-268 °C up to +260 °C
Maximum Pressure Load	83 bar	83 bar	55 bar	83 bar	83 bar
P x T, max.* thickness 0,8 and 1,6 mm, 3,2 mm	12000 8600	12000 8600	12000 8600	12000 8600	12000 8600
Compressive creep strenght (DIN 52913) 150 °C - 30 MPa 175 °C - 50 MPa	16 25	16 25	15 -	14 -	14 -
Compressibility (ASTM F 36)	7-12%	7-12%	25-45%	4-10%	60-70%
Recovery (ASTM F 36)	40%	40%	30%	40%	15%
Creep relaxation (ASTM F 38)	18%	18%	40%	11%	15%
Tensile strength (ASTM D 1708)	14 MPa	14 MPa	14 MPa	14 MPa	-
Sealability (ASTM F 37 B) ASTM Fuel A: internal presure = 0,7 bar, Gasket load = 7 MPa	0,1 ml/h	0,22 ml/h	0,12 ml/h	0,04 ml/h	0,15 ml/h
Gas sealability (DIN 3535/6)	0,10 cm³/min	0,25 cm³/min	0,15 cm³/min	0,10 cm³/min	0,04 cm³/min
Leak rate (DIN 28090-2), λ2,0	<0,001 mg/ (s x m)	<0,001 mg/ (s x m)	<0,001 mg/ (s x m)	<0,001 mg/ (s x m)	<0,002 mg/ (s x m)
Density (DIN 28090-2)	2,19 g/cm³	2,10 g/cm³	1,70 g/cm³	2,80 g/cm³	-

*Operating temperature and pressure values may not be attained simultaneously. The P x T factor (pressure x temperature) allows for limits to the actual operating data in the use of GYLON®.

Thickness (mm)	Tolerance (mm)	GYLON® Style 3501-E	GYLON® Style 3504	GYLON® Style 3510	GYLON® Style 3545
0,8*	+0,13 / -0,13	x	x	x	
1,0	+0,13 / -0,13	x	x	x	
1,6	+0,15 / -0,15	x	x	x	
2,0	+0,15 / -0,15	x	x	x	x
3,2	+0,25 / -0,25	x	x	x	x
4,8	+0,40 / -0,40	x	x	x	x
6,4	+0,50 / -0,50	x	x	x	x
Sheet Size* (mm)		1500 x 1500 1500 x 2280 1780 x 1780	1500 x 1500 1500 x 2280 1780 x 1780	1500 x 1500 1500 x 2280 1780 x 1780	1500 x 1500

*Thickness 0,8 mm: available sheet size 750x750 mm only

Technical Information

Sealing characteristics in accordance with DIN EN 13555:12-2004

		Test Method	Unit	GYLON® Style 3501-E 2,0 mm	GYLON® Style 3504 2,0 mm	GYLON® Style 3510 2,0 mm	GYLON® Style 3545 2,0 mm
Maximum load during installation $Q_{s \max}$	20 °C	EN 13555	MPa	230	200	200	180
	150 °C	EN 13555	MPa	180	80	160	100
	200 °C	EN 13555	MPa	180	80	140	80
	250 °C	EN 13555	MPa	140	60	100	60
Minimum load during installation $Q_{s \min}$ (L = 0,01)	10 bar	EN 13555	MPa	15	7	10	12
	40 bar	EN 13555	MPa	23	13	14	18
	80 bar	EN 13555	MPa	30	20	20	21
Minimum load during operation $Q_{s \min}$ (L = 0,01)		EN 13555	MPa (10, 20 and 40 bar)	<5, <5, <10	<5	<5	<5
Maximum sealand class $T_{p=20\text{ °C}, p=40\text{ bar}}$		EN 13555	L[mg/(s*m)]	1,0x10E-06	1,0x10E-04	1,0x10E-05	1,0x10E-05

(L) = Sealability rate

Relaxation value P_{QR} under stiffness $C = 500 \text{ kN/mm}$

	Test Method	Unit	GYLON® Style 3501-E 2,0 mm				GYLON® Style 3504 2,0 mm				GYLON® Style 3510 2,0 mm			
			20	150	200	250	20	150	200	250	20	150	200	250
Temperature		°C												
Stress Level 1	EN 13555	(10 MPa)	0,92	0,84	0,81	0,65	0,90	0,46	0,41	0,31	0,89	0,87	0,61	0,58
Stress Level 2	EN 13555	(30 MPa)	0,93	0,76	0,45	0,53	0,80	0,39	0,32	0,23	0,90	0,50	0,34	0,30
$Q_{s \max}$	EN 13555	(230/180/140 MPa)	0,92	0,72	0,74	0,59	0,95	0,55	0,52	0,36	0,94	0,73	0,71	0,45

Installation Recommendation

Please note the information given below is to ensure a long service life and sealing integrity of your gasket.

1 First check

- » Is the selected material suitable for the application?
Do temperature, pressure and medium agree with the process data?
- » Does the gasket have the correct dimensions regarding thickness, inside and outside diameter for the components?
- » Can the bolts deliver the necessary seating stress to the gasket?
- » Has the bolt torque been correctly calculated?

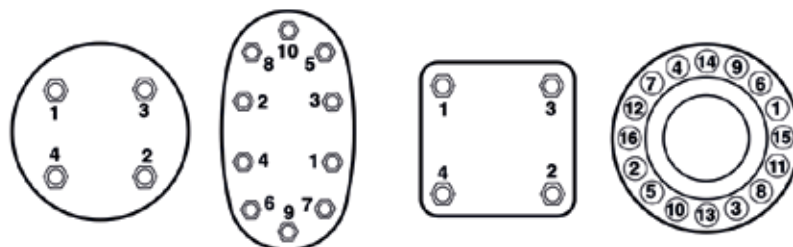
Garlock will calculate the correct torque levels upon request!

2 Before installation

- » Remove old gasket, and clean flange surface of all debris. For best results, use a metal flange scraper, an aerosol gasket remover and a wire brush, suitable for the flange, 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.
- » Whenever possible, on metric flanges, use ring gaskets. Full face gaskets have more surface area, requiring additional compressive load on the gasket.
- » Never use metal-based anti-seize on gaskets, since particles may accumulate in the surface imperfections, thereby creating a flange surface that is too smooth to be effective. Such coatings will also greatly impair the resistance of the gasket pressure.

3 Installation

- » Center the gasket on the flange. This is extremely vital where raised faces are involved.
Note: Standard ANSI ring gaskets, when properly cut, should center themselves when the bolts are in place.
- » Use a torque wrench and well-lubricated fasteners with hardened flat washers 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 figures below).
- » All bolts should be tightened in one-third increments, according to proper bolting patterns.
 - A) initially to 30% of the specified torque
 - B) 2nd step to 70% of the specified torque
 - C) 3rd step to 100% of the specified torque
 - D) 4th step round clockwise with 100% torque
- » We do not recommend retorquing pressurized systems. Retorques should be performed on room temperature (non-pressurized) systems 12-24 hours after initial installation.
- » All applicable safety standards including lockout/tagout 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.



Training

Garlock is offering mounting crew trainings in accordance to DIN EN 1591-4 (Europe) in order to fulfill demands of VDI 2290 (Germany only). The training is available at Garlock Neuss or anywhere on site.

Topic

All assembly-teams in Germany and their supervisors who install joint connections in pressurized systems which are in critical use must be specially trained and certified. This is specified by DIN EN 1591-4, which has been released in September 2014. In-House trainings are not permitted under the new standard, a third-party arrangement is mandatory in which the assessor and the trainer must be different and neutral people.

Training center

At the newly established training center, Garlock sealing specialists will explain the correct handling of various flange seals. Topics include storage, transportation, removal and fitting of seals, occupational safety issues, suitable bolts, tools and equipment, tightening methods and handling tightening equipments. The individual installation steps are practiced on various sealing systems. Particular focus is placed on the importance of specific torque and correct handling of gaskets or sealing elements. The aim is to enable all participants to produce a joint connection that remains "leak-proof" throughout the entire service life. The training course concludes on the second day with an examination.

We offer the solution

Garlock is offering certified installation training courses as a service at its facility in Neuss or anywhere on site. The two-day, exam-based course, can be completed by employees from industry and installation companies. At the end is an exam as well as a certificate. Successful participants receive a credit-card-sized card that certifies their level of competence, a diploma, as well as a batch for their international safety training book.

Additional training modules

- » Installation of packings for valves
- » Installation of hydraulic sealing elements
- » Correct handling of calculation programs
- » Theory and practice for the selection and the use of dynamic sealing systems
- » Trainings can be held at customer plants
- » Individual training modules



Approved training provider with assessment of competence in accordance with the requirements of DIN EN 1591-4 training by qualified instructors and testing by accredited assessors.

Comprehensive Service

More than just water jet cutting technology

Several “water jet” systems are available for cutting precise, accurate and complex gasket geometries and sizes. Rapid fabrication to tight manufacturing tolerances, for one-off and small production batches, can be produced economically without expensive tooling costs.

GYLON® endless gaskets

Large diameter gaskets, exceeding standard sheet sizes, can be supplied quickly. Individual segments are joined in a customized sintering/welding process without additives (“dry” welding technique) maintaining the original material homogeneity and density, increasing the safety of your plant.

Segmented gaskets

We manufacture larger flange gaskets in multiple segments with jigsaw, multibotton or dovetail joints. The precision waterjet cutting technology with its high accuracy ensures an extremely small gap width, fabricating gaskets close to endless ones.

Volume production

Our well-equipped range of press tool equipment is available for larger batches. A wide selection of standard and custom tools, with Kanban stocking procedures for volume standard gasket production, guarantees optimum order processing in the shortest time.



Flange Calculations

Garlock offers flange calculations according to DIN EN 1591-1 as a service.

For the calculation of pipe classes and flanges, the following parameters are considered:

- » Detailed flange dimensions as well as gasket style and dimension (if non standard)
- » Relevant testing and operating temperatures
- » Applied test and operating pressures, as well as additional forces
- » Flange, screws and sealing materials, type of screws and nominal width

Benefits

- » VDI 2290 compliance
- » Detection of weak components/joints within piping classes
- » TÜV-certified software to calculate flange connections
- » Proof of technical sealability prior to mounting
- » Increased plant availability possible
- » Determining an applicable tightening torque

Example Cases

Carob beans food processing – GYLON® Style 3501-E

Food Industries

A major manufacturer active in many sectors of food and beverage, with facilities located in all regions across the globe. The customer's plant in Spain produces food ingredients from carob beans for food, ice creams, and beverages.

Operating Conditions

1. Media: Sulphuric acid 98% concentration
2. Cover lid gasket size: 1640 x 1670 x 3,2 mm
3. Temperature: 100 - 120 °C
4. Pressure: 3 bar

Challenges faced

The original virgin PTFE gasket was dramatically leaking each month which required replacement of the cover lid by a new one after less than 5 years. The customer struggled with high costs and risks.

Solution

Discussions and investigations with the customer resulted in the optimal solution being GYLON® Style 3501-E welded gasket in 3,2 mm. Garlock supported the proposal with a EN 1591-1 calculation service. GYLON® 3501-E was installed and no leakage has been reported since then. The customer changed the lid gaskets of their other two reactors to GYLON® 3501-E and started replacing all nozzle gaskets as well.



Microwave hybrid processing technology - GYLON® Style 3504

Medical technology - OEM

The customer is an Italian company specialized in advanced microwave instrumentation for analytical and organic chemistry labs.

Operating Conditions

1. Media: Kerosene, xylene, 4% formalin, ethanol, isopropanol, isoparaffin at ambient pressure. Vapours of isopropanol and xylene at 600 mBar absolute and kerosene at 150 mBar absolute.
2. Temperature: Max 70°C
3. Pressure: From 60 mBar to 1 bar absolute
4. Size: Special dimensions: 58,0 x 101,5 x 4,8 mm; acc. to customer drawing

Challenges faced

The original FFKM seals were showing leaks. Also, the FFKM seals blocked the microwaves making the equipment less efficient.

Solution

As well as ensuring that the sealing solution should solve the leakage problem, it was also required, that the sealing material should be transparent to microwaves, chemically resistant to the process media, and have enough elasticity to ensure good sealing.

Garlock and the customer's specialists discussed issues and solutions. Finally, the perfect solution was identified: GYLON® Style 3504 in special dimensions, according to the customer's drawing perfectly sealed the equipment. The customer replaced all the previous seals because GYLON® fulfilled all of their requirements.

GYLON® Style 3504 is transparent to microwaves, chemically resistant to the process media, and has enough elasticity to ensure good sealing.



Example Cases

Wine Production – GYLON® Style 3504 and GYLON® Style 3545

Food & Beverage

An award-winning, family owned winery in a major wine-growing region.

Operating Conditions

1. Media (process): Grape Juice, Must, Fermented Wine
2. Media (sterilisation): Steam 82 °C
3. Seal size (pipe/hose): various ½" to 3"
4. Seal size (tanks): 8" ring
5. Temperature: 100 °C
6. Ambient pressure: 0 bar

Challenges faced

The original EPDM seals were showing leaks. This was occurring during various stages of the wine making process, but especially so during the sterilization procedures between each batch, with subsequent leaks creating issues with production reliability, housekeeping and potential contamination.

Solution

Green light was provided to carry out production trials, but only after all compliance documentation had been supplied and reviewed. Garlock's recommendation was to implement GYLON® Style 3504 and GYLON® Style 3545 materials for their active connections, since the compression and recovery characteristics would be ideal for low pressure sanitary connections and vessel seals.

Following successful trials the customer managed to increase the service life of the gaskets even through extended sterilization cycles. Additionally, by switching to a non-elastomeric product, shelf life is no longer a concern which has allowed them to stock ample replacement parts for all of their regular and emergency needs. Overall, moving to a taste-tested and approved sealing product made this an easy transition for the customer and has improved their process.



Pharmaceutical APIs - GYLON® Style 3545

Pharmaceutical – Active Ingredients (APIs)

One of the world's largest pharmaceutical companies.

Operating Conditions

1. Media (process): Solvent and Organic Chemicals
2. Media (cleaning): DI water, Methanol, Methylene chloride
3. Size (pipe): 2" PTFE Lined Pipe
4. Size (vessels): various up to 40" glass-lined
5. Temperature: 100 °C
6. Pressure: 10 bar

Challenges faced

The customer was facing ongoing problems with reliable sealing of glass lined reactors and PTFE-lined pipework. The original PTFE-envelope seals were failing prematurely on both manhole covers and standard flange applications causing leaks that compromised batch integrity, and reduced manufacturing efficiency.

Solution

It was determined that the best solution to implement was GYLON® Style 3545 gaskets as standard. The soft, compressible outer PTFE layers ensured an effective seal on pitted, warped or wavy surfaces typically encountered on non-metallic flanges. The rigid PTFE inner core helped to maintain a robust seal over time, and also provided the customer with much easier handling & installation compared to envelope gaskets.



Application Data Sheet: Gasketing

Contact Information

Company _____
 Name _____
 Address _____
 Phone No. _____
 E-Mail _____

Other Manufacturers Information

Date _____
 Enquiry No. _____
 Attachment Yes No
 Garlock ID _____

Application

Flange Heat Exchanger Manway Compressor
 Pumps Valve Bonnet Flue Duct Other

Service Conditions

Max. Temperature [°C] _____
 Continuous Temperature [°C] _____
 Internal Pressure [mm] _____
 Thermal Cycling [24 hours] _____
 Pressure continuous intermittent
 Vibration Yes No
 Other specify _____

Chemical Compatibility

Media _____ CAS No. _____
 Concentration _____ Liquid or Gas _____

Bolts

Rating	Size	Number	Details		
			Dry <input type="checkbox"/>	Lubricated <input type="checkbox"/>	Coated <input type="checkbox"/>
			Standard Bolts <input type="checkbox"/>	Tension Bolts <input type="checkbox"/>	<input type="checkbox"/>

Flange

Norm _____ Face (raised, flat) _____
 Material _____ Surface finish _____
 Inner ø x Outer ø _____ Thickness _____

Comments

GARLOCK GMBH

an Enpro Company

Falkenweg 1, 41468 Neuss, Germany

+49 2131 349 0

garlockgmbh@garlock.com

www.garlock.com

Garlock Sealing Technologies

Garlock USA

Garlock Australia

Garlock Canada

Garlock China

Garlock Germany

Garlock India

Garlock de México

Garlock New Zealand

Garlock Singapore

Note:
Properties/applications shown throughout this brochure are typical. Your specific application should not be undertaken without independent study and evaluation for suitability. For specific application recommendations consult Garlock. Failure to select the proper sealing products could result in property damage and/or serious personal injury. Performance data published in this brochure has been developed from field testing, customer field reports and/or in-house testing. 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 GARLOCK is a registered trademark for packings, seals, gaskets, and other products of Garlock.
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GARLOCK GMBH

an Enpro Company

Falkenweg 1, 41468 Neuss, Germany

+49 2131 349 0

garlockgmbh@garlock.com

www.garlock.com

Garlock Sealing Technologies

Garlock USA

Garlock Australia

Garlock Canada

Garlock China

Garlock Germany

Garlock India

Garlock de México

Garlock New Zealand

Garlock Singapore