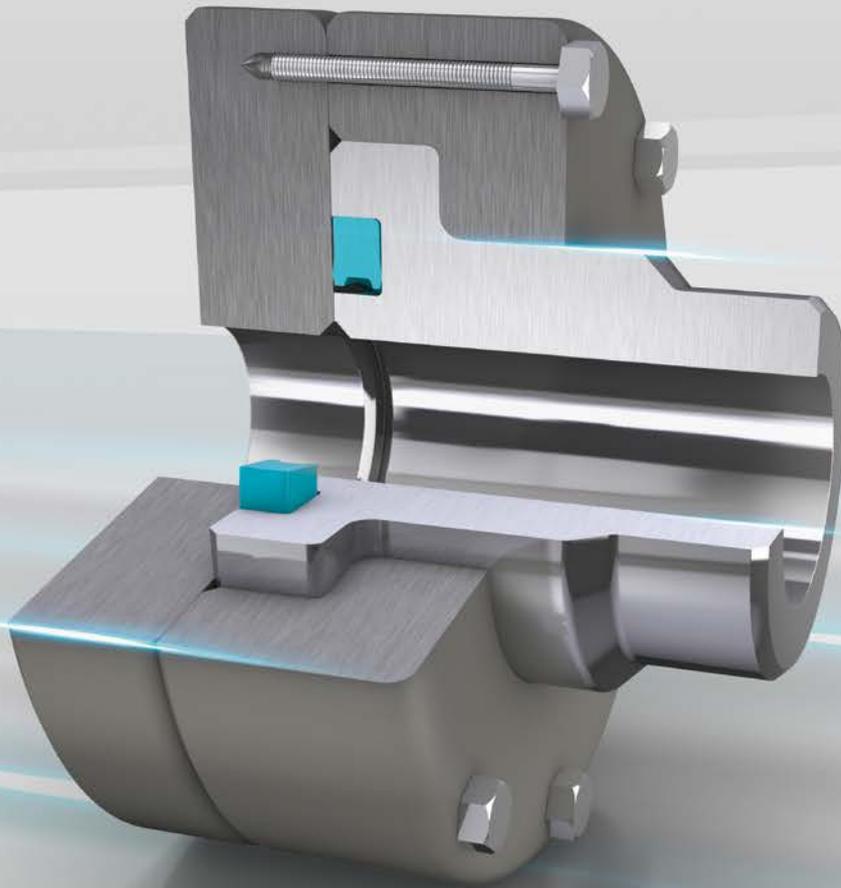


Static Seals





Together We Shape a Sustainable Future

Trelleborg Sealing Solutions is one of the world's leading developers, manufacturers and suppliers of precision seals, bearings and custom-molded polymer components. We collaborate closely with customers to develop unique, innovative solutions to tomorrow's challenges. Utilizing our dedicated product design, material development and testing capabilities, we are a one-stop-shop providing the best in elastomer, silicone, thermoplastic, PTFE and composite technologies for applications in aerospace, automotive, general industrial and healthcare & medical industries.

With over 70 years of experience, we serve as long-term business partners to help our customers bring products to market faster. Through strategically positioned material and product laboratories, specializing in design and applications, Trelleborg Sealing Solutions engineers support customers with design, prototyping, production, testing, installation and quality assurance using state-of-the-art tools. Our ServicePLUS portfolio of value-added services is designed to help customers optimize their business across the entire value chain.

Trelleborg Sealing Solutions brings leading edge technology and an in-depth, experience-based understanding of applications to

customers through a global, but local approach. An international network of over 100 facilities worldwide includes over 40 manufacturing sites, more than 60 Customer Solution Centers and 10 R&D centers. Developing and formulating materials in-house, our material database includes over 2,000 proprietary compounds. We fulfill challenging service requirements, supplying standard parts in volume or a single custom-manufactured component, through our integrated logistical support, which effectively delivers over 40,000 sealing products to customers worldwide.

Trelleborg Sealing Solutions facilities are certified according to current market-related quality standards. In addition to the established ISO 9001 standard, our facilities are certified to environmental, health and safety standards, as well as specific customer specifications. These certifications are in many cases prerequisites, allowing us to comply to all market segment requirements.



The information in this catalog is intended for general reference only and not for specific applications. Application limits for pressure, temperature, speed and media are maximum values determined in laboratory conditions. In application, due to operating parameters, maximum values may not be achievable. Customers must satisfy themselves of a product and material's suitability for their individual applications. Any reliance on information is therefore at the user's own risk. In no event will Trelleborg Sealing Solutions be liable for any loss, damage, claim or expense directly or indirectly arising or resulting from the use of any information provided in this catalog. While every effort is made to ensure the accuracy of information contained herewith, Trelleborg Sealing Solutions cannot warrant the accuracy or completeness of information.

Contact your local Customer Solution Center to obtain the best recommendation for a specific application from Trelleborg Sealing Solutions. This edition supersedes all previous catalogs. This catalog or any part of it may not be reproduced without permission.

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Company Profile



Welcome to Trelleborg Sealing Solutions

SEALING TECHNOLOGY

Trelleborg Sealing Solutions offers an outstandingly comprehensive sealing portfolio – a one-stop-shop providing the best in elastomer, silicone, thermoplastic, PTFE and composite technologies; solutions that feature in virtually every application conceivable within the aerospace, industrial and automotive industries.

A WORLDWIDE PRESENCE

We are uniquely placed to offer a dedicated design and development service for sealing solutions; globally servicing, supporting and supplying customers through an unrivaled international network.

COMMITMENT TO CUSTOMER, NEEDS LONG-TERM

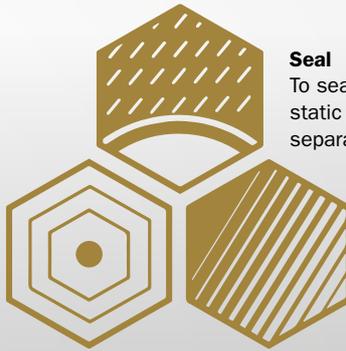
Trelleborg Sealing Solutions is one of the world's foremost experts in polymer sealing technology. Using our expertise and experience, we facilitate customers in achieving cost-effective, durable solutions that match their specific business requirements.



**Trelleborg Sealing Solutions -
Together We Shape a Sustainable Future**
Scan the QR-Code to watch the movie
about our ability to add value and improve
the business of our customers.

A world leader in engineered polymer solutions

Protect
To protect is to help the environment, people, infrastructure and other assets to manage the impact from natural and man-made forces.



Seal
To seal is to fill a gap when joining two static or moving (dynamic) surfaces, thereby separating different media from each other.

Damp
To damp is to absorb energy, thereby reducing vibration and noise.

THE TRELLEBORG GROUP



Trelleborg Industrial Solutions

is a leading supplier of polymer-based critical solutions in selected industrial application areas and infrastructure projects.



Trelleborg Sealing Solutions

is a leading developer, manufacturer and supplier of precision seals, bearings and custom-molded polymer components. It focuses on meeting the most demanding needs of aerospace, automotive, healthcare & medical and general industrial customers with innovative solutions.

BLUE DIMENSION™



At Trelleborg we believe that the benefits of our solutions stretch beyond functionality and business performance.
For more information scan the QR-Code or visit the website:
www.trelleborg.com



Our Global Resources

55+

Customer
Solution Centers



40+

Manufacturing
Sites



15

R&D Centers



Contact us

Find out more about us and
our global distributor network:

www.trelleborg.com/seals/about-us



9,500
employees

More than
100
worldwide
locations

More than
2,000
proprietary material
formulations

8
Logistics
Centers SCM



■ North & South America ■ Europe ■ Asia & other markets

15
ServicePLUS
Centers



■ North & South America ■ Europe ■ Asia & other markets

■ North & South America ■ Europe ■ Asia & other markets

Solutions & Capabilities, Brands & Materials

Decades of experience designing and manufacturing polymer solutions to meet the changing needs of our customers, as well as the latest industry trends and regulations, has led Trelleborg Sealing Solutions to develop, manufacture and supply a range of unique materials and proprietary product designs, many of which have become industry standards.

STANDARD PRODUCTS



Linear Seals



Bearings & Bushings



O-Rings & Static Seals



Rotary Seals

CUSTOMIZED SOLUTIONS (MAKE-TO-PRINT, MAKE-TO-DESIGN)



Engineered Molded Parts



Liquid Silicone Rubber (LSR) Components



Aerospace Solutions



Healthcare & Medical Solutions



Brake Shims, Tuned Absorbers, Rubore® Seals



Custom HMF FlatSeal™ Gaskets



Micro Parts



Assembly Units

ADVANCED CAPABILITIES



Multicomponent Technology



Cleanroom Production, Packaging, Assemblies



High Performance Polymers



Advanced Composites

WORLD RENOWNED NAMES UNITED

We own many of the longest established and leading names.

These include:

- American Variseal
- Automated Dynamics
- Busak+Shamban
- Dowty Seals
- Chase Walton
- Forsheda
- GNL
- Impervia
- Minnesota Rubber & Plastics
- Nordex
- Orkot
- Palmer Chenard
- Polypac
- SSF
- SF Medical
- Shamban
- Silcofab
- Silcotech
- Sil-Pro
- Skega
- Stefa
- Wills

MATERIAL FAMILIES

Ongoing development has yielded some of the most successful sealing, bearing and custom materials available:

- HiMod®
- HiPlast®
- Isolast®
- Orkot®
- Turcite®
- Turcon®
- Turel®
- Zurcon®
- BioPharmaPro™
- FoodPro®
- H₂Pro™
- PureFab™
- Rubore®
- XploR™



One-Stop-Shop for Sealing Solutions

Scan the QR-Code or visit our website to find out more about our portfolio of solutions for industry-specific needs and applications.

www.trelleborg.com/seals

Markets & Technologies



Aerospace



Agriculture



Automotive, Truck & Transportation



Chemical Transport & Process Industries



Construction & Mining Equipment



Electrification



Energy & Hydrogen



Fluid Power



Food & Beverage



Healthcare & Medical



Industrial Automation



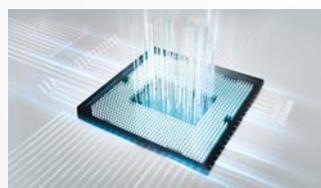
Manufacturing & Machine Tools



Marine Equipment & Construction



Material Handling



Semiconductor



Water



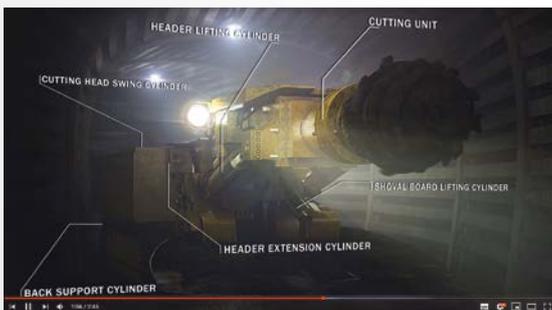
Accelerating performance in your industry
Scan the QR-Code or visit our website to find out more about our tailor-made solutions for your industry.
www.trelleborg.com/seals



Films & Animations

SEEING IS BELIEVING

Complex sealing configurations can feature a large number of sealing elements. Trying to illustrate these on a 2-D page is difficult and can never properly show their function or characteristics. Trelleborg Sealing Solutions uses the latest graphic technologies to produce 3-D animations of applications and typical sealing solutions for them.



View at
[YouTube.com/
trelleborgseals](https://www.youtube.com/trelleborgseals)
You
Tube

View at
[www.trelleborg.com/
seals/films](http://www.trelleborg.com/seals/films)
Trelleborg logo



Films and Animations online

A range of films specific to different industries and products are available to view on the Trelleborg Sealing Solutions website or via YouTube.



ServicePLUS

THE PLUS FOR YOUR BUSINESS

When you partner with Trelleborg Sealing Solutions through our ServicePLUS program, you can focus on your core business while we focus on ensuring all of your value chain needs are covered. We concentrate on business activities, which typically offer the largest resource saving opportunities.

Scan the QR-Code to learn how you can simplify your business with ServicePLUS:



TECHNICAL COLLABORATION

Apply Trelleborg's expertise to your business. Whether starting a new development or enhancing existing products, access our experts in materials and design for sealing solutions with optimal application performance. Take advantage of digital tools, sealing technology training and customized seminars to support your technical and commercial teams.



SURFACE TECHNOLOGIES

Surface quality matters as much as the seals you use. Improve friction characteristics and eliminate sticking with surface modifications, such as Seal-Glide® to reduce costs in automated assembly and improve application performance. Ensure parts are as clean as they should be for sensitive applications and strict regulations with FlexClean™.



TAILORED PRODUCTION SERVICES

Enhance your manufacturing with tailored production services. State-of-the-art 3D printing and rapid prototyping help bring products to the market faster. Strengthen your core business processes by outsourcing subcomponent assembly and secondary operations to Trelleborg Sealing Solutions.



TESTING & QUALITY ASSURANCE

Trelleborg Sealing Solutions is set up to run a full suite of material and product tests to improve efficiency and help reduce your inspection expenses. Fully automated inspection cells and quality clinics can verify performance and accordance with standards, with full documentation produced.



PACKAGING SOLUTIONS

Our packaging and labeling solutions aim to support your business and boost your aftermarket care. They are customized to meet your specific needs, including custom tubing for direct insertion into automated feeding stations, bespoke machine-readable labeling for replacement part sets and aftermarket kits directly drop-shipped to your service centers or customers.



ADVANCED DELIVERY & STOCK MANAGEMENT SERVICES

Simplify, streamline and enhance your supply chain with our delivery and stock management services. Let Trelleborg Sealing Solutions manage your important C-parts or benefit from automated ordering services that optimize your replenishment processes and align with production flows.



Design Support & Engineering Tools

ONLINE TOOLS MAKE LIFE EASIER

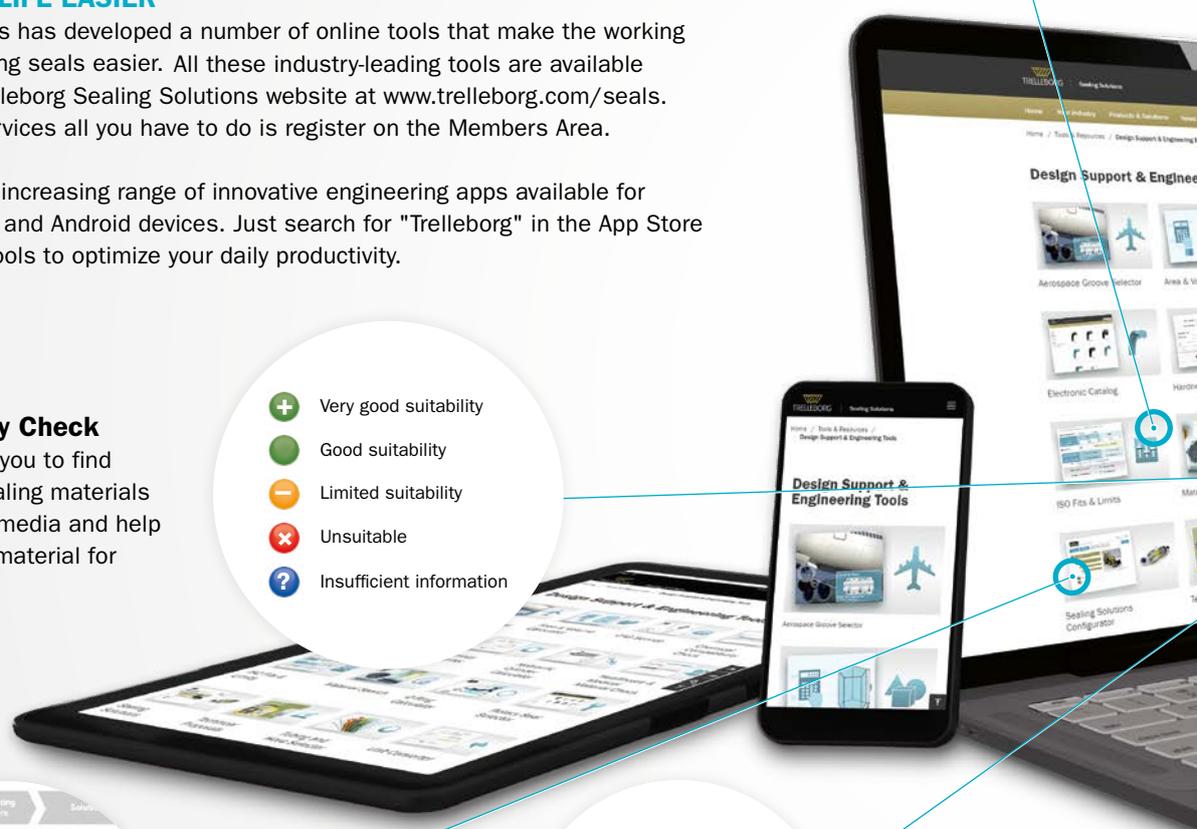
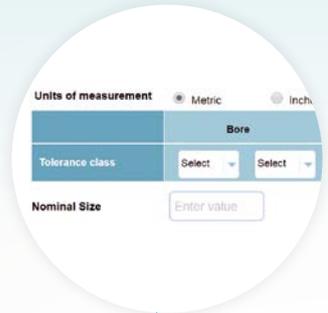
Trelleborg Sealing Solutions has developed a number of online tools that make the working life of an engineer specifying seals easier. All these industry-leading tools are available free-of-charge from the Trelleborg Sealing Solutions website at www.trelleborg.com/seals. To use these advanced services all you have to do is register on the Members Area.

There is also a continually increasing range of innovative engineering apps available for smartphones, both for iOS and Android devices. Just search for "Trelleborg" in the App Store or GooglePlay to find the tools to optimize your daily productivity.

Materials Search and Chemical Compatibility Check

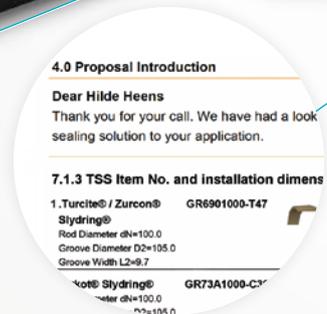
These two programs allow you to find out the compatibility of sealing materials with hundreds of different media and help identify the most suitable material for your application.

- + Very good suitability
- Good suitability
- Limited suitability
- ✗ Unsuitable
- ? Insufficient information



Sealing Solutions Configurator

The Sealing Solutions Configurator is the first tool of its kind offered by any seal supplier. It allows engineers to identify a proven sealing solution for their specific application in just four easy steps.



Technical Proposals Online

Enhance your communication with Trelleborg Sealing Solutions with the Technical Proposals Online tool. Instantly access all your proposed solutions anywhere at any time and benefit from quicker dialog with our sealing specialists.



ISO Fits & Tolerances

Our Fits & Tolerances Calculator allows you to easily determine type of fits using the tolerances according to DIN ISO 286. In addition, upon entering the nominal diameter the tool calculates lower and upper limit deviations plus the maximum and minimum interferences dependent on the selected tolerance classes for bore and shaft.



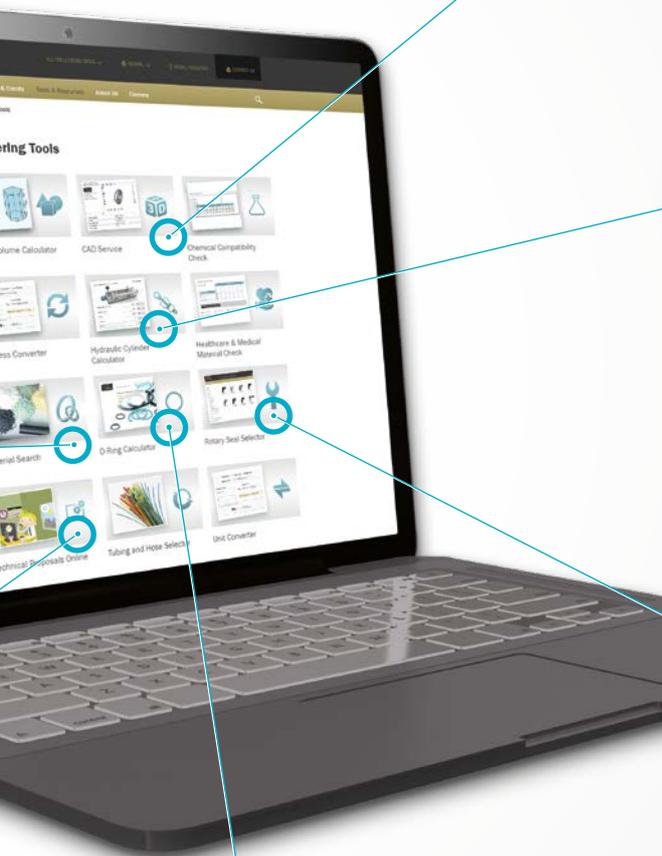
Versatile CAD Service

The CAD download functionality provides thousands of drawings of a wide range of seals. It gives the option of 2- or 3-dimensional files in a range of formats to suit most commonly used CAD systems.



Hydraulic System Calculator

Hydraulic System Calculator helps you design a solution around the cylinder which may involve motor, pump, orifice and pipe calculations. The application is in compliance with ISO 3320, ISO 3321 & ISO 4393.



Rotary Seal Selector

The Rotary Seal Selector allows you to search through the wide range of rotary seals and materials available based on application conditions and offers detailed information on installation and seal capabilities.



O-Ring Calculator

An industry-leading tool, the easy to use O-Ring calculator includes sizing capabilities, compression forces, design parameter recommendations and complete measurements. Results and comments may be printed, shared or filed as PDF.

Discover our design support
and engineering tools at
www.trelleborg.com/seals



Mobile Tools & Apps

We understand the needs of engineers on the go. Check out our latest mobile tools and apps, ranging from an O-Ring calculator to unit and hardness converters. Just search for "Trelleborg" in the App Store or Google Play to find the tools to optimize your daily productivity.

Discover our wide range of mobile tools and apps at www.trelleborg.com/seals

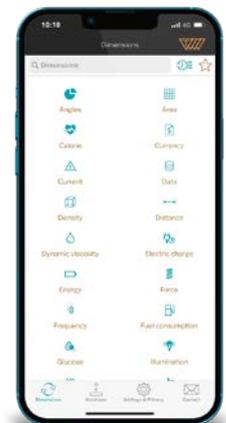
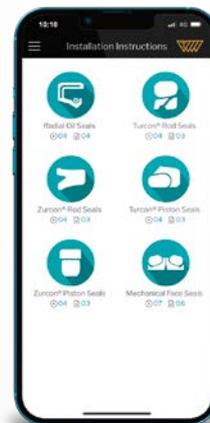
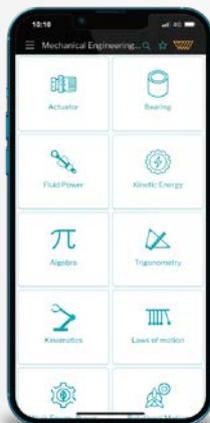


MANY MORE APPS available

Available on the APP STORE



Android App on Google Play



ISO Fits & Tolerances

Simply enter the nominal diameter and select the tolerance classes for bore and shaft to find the complete ISO fits definition. It contains all relevant values, including type of fit, with handy graphs to illustrate the classes by bore and shaft. The results of this application are based on DIN ISO 286.



Mechanical Engineering Calculator

A useful app containing over 250 formula calculators in 16 categories, with more being added with every update. Categories include the fields of mathematics, physics and mechanical engineering.



Aerospace Groove Selector

This app covers five of the most important SAE Aerospace groove standards for hydraulic systems, making it quick and easy to find the size of grooves and hardware needed. Includes dimensions for AS4716 Rev B, AS5857 Rev A, AS6235 Rev A, AS4088 Rev E and AS4832 Rev A.



Installation Instructions

Videos demonstrate the best practice methods for installing seals, providing all relevant documentation within the interface. It guides you to successful installation of Radial Oil Seals, Mechanical Face Seals and Turcon® and Zircor® rod and piston seals.



Converter – Universal

By simply selecting the dimension and entering a value for conversion, the app offers a wide range of engineering and scientific units for each dimension. It also has other useful features like currency conversion, timezone conversion, percentage calculations, a running pace calculator and more.



in the groove

Our *in the groove* magazine provides news, technical and product information on seals, as well as insights into the markets they are used in. The magazine is also available in print and as an interactive PDF.



Rotary Seal Selector

This app is specifically for the selection of rotary seals based on application information, including size, operating parameters and the lubricant used. It also considers installation type and seal function.



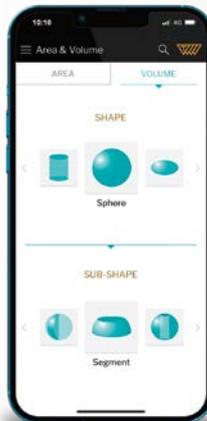
O-Ring Selector

When a user enters installation specifications into the O-Ring Selector app, such as the bore or rod/shaft diameter, the app quickly calculates O-Ring and housing dimensions in both metric and inch. Standards covered are ISO 3601-1, NFT 47-502, JIS B 2401 and SMS 1586.



Hydraulic System Calculator

The Hydraulic System Calculator helps you design a solution around the cylinder, which may involve motor, pump, orifice and pipe calculations. The application is in compliance with ISO 3320, ISO 3321 and ISO 4393.



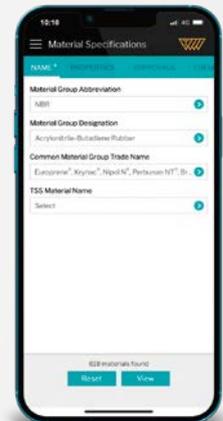
Area and Volume Calculator

Speeds up and simplifies calculating the area and volume of more than 170 geometric shapes. The app supports both metric and inch, and conveniently displays the formulas used. Fill your shape with solids or liquids, choosing from 1500 different materials to calculate the weight.



Healthcare Materials

A quick and easy overview of the compatibility of 34 materials with 35 chemical environments that are commonly encountered in the healthcare and medical industries. Select up to 20 materials and environments at once to produce a chart that rates each material from 'excellent' to 'not recommended'.



Sealing Materials Selector

Enter material specifications and required parameters, such as application temperature or hardness, to receive instant material proposals. The app features filters to limit searches based on chemical compatibility, institute approvals and product type. Data sheets can be requested from within the interface.

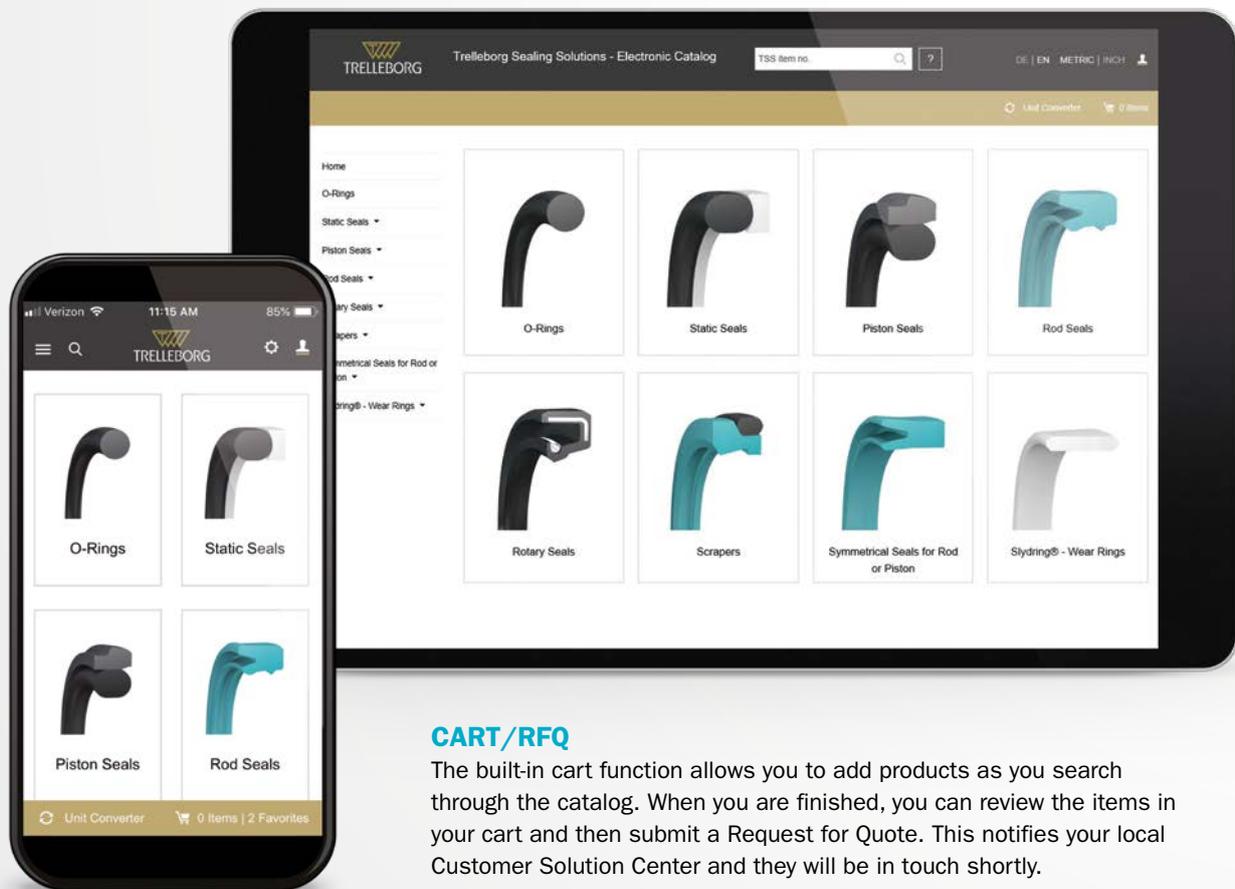
Electronic Catalog

Discover the Electronic Catalog online as an app or on our website



The Electronic Catalog is a user-friendly service that connects you to the broad range of products Trelleborg Sealing Solutions offers. The products are arranged based on product type and product group, making it easy to find the exact one you need.

Many functions are also included within the Electronic Catalog that allow you to understand product capabilities, compare similar seals, request a quote and much more. The Electronic Catalog is available from the Trelleborg Sealing Solutions website and in the App Store and GooglePlay for mobile use.



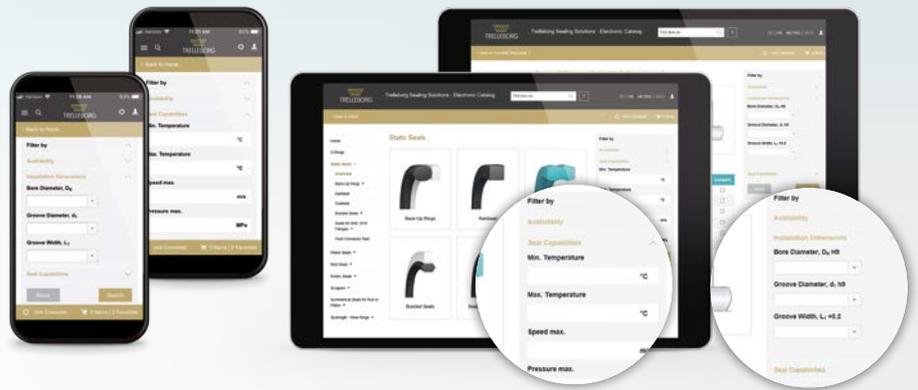
CART/RFQ

The built-in cart function allows you to add products as you search through the catalog. When you are finished, you can review the items in your cart and then submit a Request for Quote. This notifies your local Customer Solution Center and they will be in touch shortly.



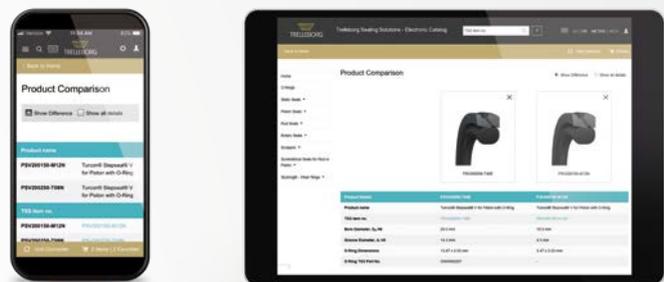
FILTERING

If you have specific operating conditions that the seal must meet and/or installation dimensions, the Electronic Catalog offers a filtering function within the product groups. Here you can input your temperatures, pressure, speed and various installation dimensions to filter products that can meet your needs.



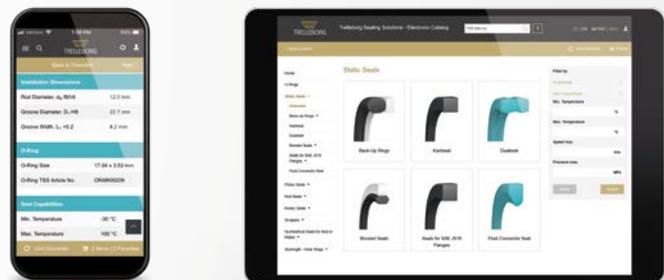
PRODUCT COMPARISON

When looking through the catalog, you can choose to compare multiple products. The product comparison function allows you to select which products you are interested in, and then puts all relevant information into a table for your review. You can even choose to display all product details side by side or to only show the fields where they differ.



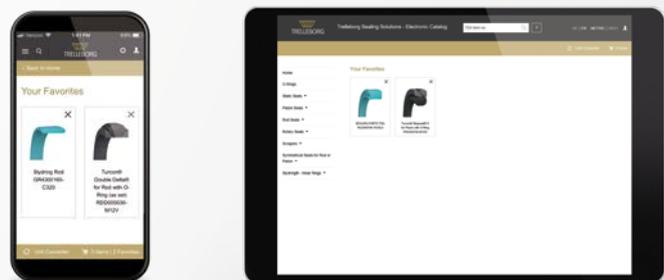
PRODUCT INFORMATION

Detailed product information is available for each part number. Once you select a specific part number, you will be able to see its installation dimensions, seal capabilities, related catalogs and other information. From this page, registered users can access the material data sheets that are applicable to the part number.



ADD TO FAVORITES

Do you have a part that you frequently look up or need information on? You can now save any of our part numbers as a favorite that is linked to your account. Anytime you log in to the Electronic Catalog, your favorites will be a click away!



UNIT CONVERTER

If you are looking at a product and need to know the conversion between metric and imperial, you can use the Unit Converter tool that is available at the top of the screen for web users and at the bottom for mobile.

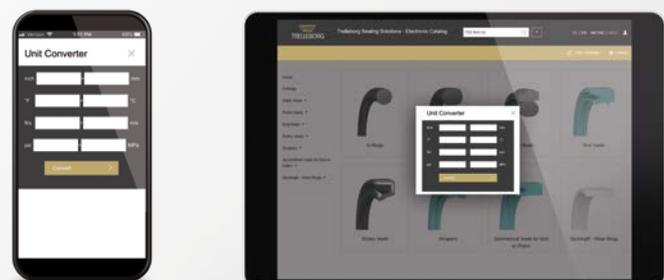


Table 1: Selection Criteria for Static Seals

Seal		Application	Application				Standard	Size Range	Operating Temp. Range	Pressure	Material
Type	Page		radial	axial	internal	external						mm inch	°C °F min. / max.	MPa psi max.
O-Ring 	27	See O-Rings and Back-up Rings catalog	•	•	•	•	ISO3601-1 AS568 SMS1586 JIS B 2401	0.5 - 8,000 0.02 - 315	-60 / +325 -76 / +617	40 5,801	Elastomers Polyurethane PTFE FEP
Back-up Ring 	37	See O-Rings and Back-up Rings catalog	•		•	•		6 - 500 0.24 - 197	-200 / +260 -328 / +500	250 36,250	PTFE NBR FKM
Kantseal 	45	Flanges, valves, plates, locks			•	•		7 - 470 0.28 - 185	-30 / +100 -22 / +212 -15 / +200 +5 / +392	50 7,250	NBR FKM
Bonded Seal 	49	Flanges, bolts, plates, valves, engines, hydraulics, pneumatics, cylinder heads			•	•		4 - 76 0.6 - 3	-30 / +100 -22 / +212 -18 / +200 0 / +392	100 14,500	NBR FKM
Dualeal 	69	Fork lifts, mobile hydraulics, industrial hydraulics, tooling machines, injection molding machines, hydraulic presses	•	•				6 - 280 0.24 - 11	-35 / +110 -31 / +230 -30 / +100 -22 / +212	50 7,250 21 3,000	Polyurethane NBR Polyurethane NBR
Flange-Seals 	81	SAE & ISO flanges			•	•	SAE J518 ISO 6162-1	0.5 - 2 13 - 51	-50 / +110 -58 / +230	42 6,100	Polyurethane NBR
Fluid Connector Seal DRV1 	89	Threaded parts, stud ends			•	•	ISO 9974 ISO 1179	M10x1 to M48x2 G1/8 A to G 1 1/2 A	-25 / +100 -13 / +212 -18 / +200 0 / +392	63 9,100	NBR FKM
XploR™ S-Seal XploR™ FS-Seal 	93	High pressure wellhead sealing environments, such as casing strings and tubing hangers, static HPHT connections, downhole tools, subsea risers				•	•	15 - 500 0.80 - 20	-20 / +200 -4 / +392	103 15,000	NBR, HNBR, FKM, FFKM

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O-Rings



Double-acting

Static and partly dynamic sealing applications

Material:

Elastomers, Zurcon® and others



O-RINGS AND BACK-UP RINGS CATALOG



For more information on this product, see the full O-Rings and Back-up Rings Catalog at www.trelleborg.com/seals/literature.



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■ O-Rings



DESCRIPTION

O-Rings offer the designer an efficient and economical sealing element for a wide range of static or dynamic applications.

Inexpensive production methods and its ease of use have made the O-Ring the most widely used seal.

A broad range of elastomer materials for both standard and special applications allow the O-Ring to be used to seal practically all liquid and gaseous media.

O-Rings are vulcanized in molds and are characterized by their circular form with annular cross-section. The dimensions of the O-Ring are defined by the inside diameter d_1 and the cross-section d_2 (Figure 1).

Cross-sections of approximately 0.35 mm (0.014 inch) to 40 mm (1.575 inch) and inside diameters up to 5,000 mm (196.850 inch) and more are available.

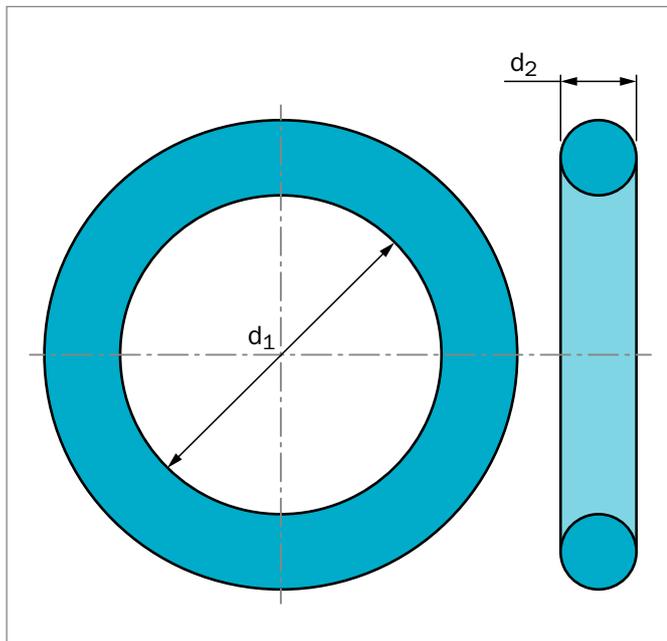


Figure 1: O-Ring dimensioning

FEATURES AND BENEFITS

Compared with other sealing elements, the O-Ring has a wide range of advantages:

- Simple, one-piece groove design reduces hardware and design costs
- Compact design allows smaller hardware
- Easy, failsafe installation reduces risk
- Applicable to a wide range of sealing problems: static, dynamic, single- or double-acting
- Wide compound choice for compatibility with most fluids
- Ex-stock availability of many sizes worldwide for easy maintenance and repair

APPLICATIONS

O-Rings are used as sealing elements or as energizing elements for hydraulic slipper seals and wipers and thus cover a large number of fields of application. There are no fields of industry where the O-Ring is not used. From an individual seal for repairs or maintenance to a quality assured application in aerospace, automotive or general engineering.

The O-Ring is used predominantly for static sealing applications:

- As a radial static seal, e.g. for bushings, covers, pipes, cylinders, rods.
- As an axial static seal, e.g. for flanges, plates, caps.

O-Rings in dynamic applications are recommended **only for moderate service conditions**. They are limited by the speed and the pressure against which they are to seal:

- For low duty sealing of reciprocating pistons, rods, plungers, etc.
- For sealing of slowly pivoting, rotating or spiral movements on shafts, spindles, rotary transmissions leadthroughs, etc.



METHOD OF OPERATION

O-Rings are double-acting sealing elements. The initial squeeze, which acts in a radial or axial direction depending on the installation, gives the O-Ring its initial sealing capability. This force is superimposed with the system pressure to create the total sealing force, which increases as the system pressure increases (Figure 2).

Under pressure, the O-Ring behaves in a similar way to a fluid with high surface tension. The pressure is transmitted uniformly in all directions.

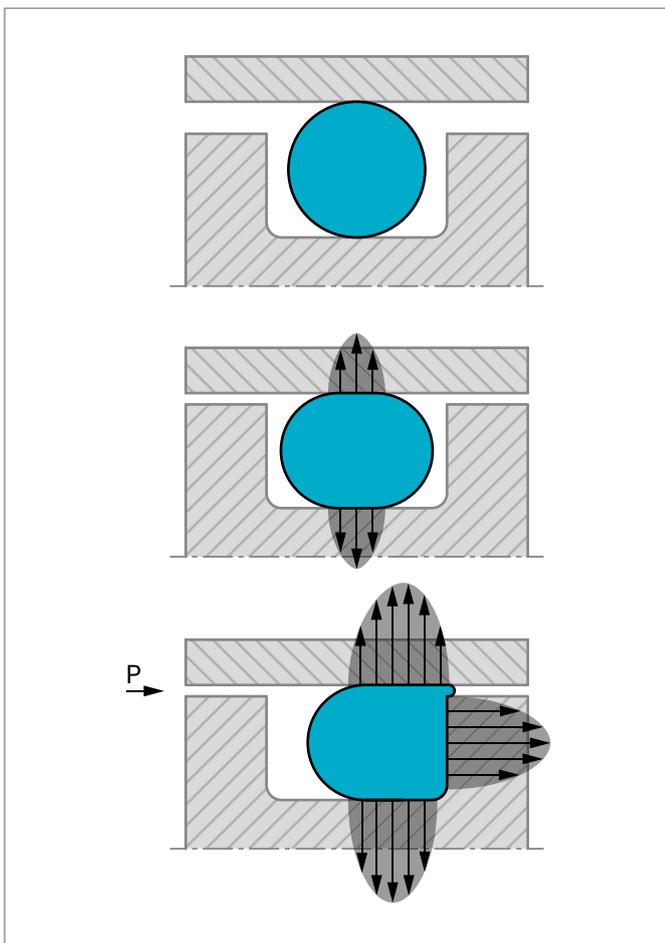


Figure 2: O-Ring sealing forces without and with system pressure



Materials

ELASTOMERS

Equipment manufacturers and end users expect sealing systems to operate leak-free over a long service life. Reliability is crucial to effective low maintenance-cost operations. To find the perfect sealing solution in each individual case, both material performance and seal design are critically important. One of the most used material groups for seals are the elastomers. Compounds can be chosen according to the properties required, such as elasticity or chemical resistance.

The following tables provide a summary of the various elastomer material groups. Trelleborg Sealing Solutions can offer a large number of materials within each group.

Table 2: Elastomer Materials

Designation	Abbreviation		
	ISO 1629	ASTM D 1418	TSS
Acrylonitrile-Butadiene Rubber (Nitrile Rubber)	NBR	NBR	N
Hydrogenated Acrylonitrile-Butadiene Rubber	HNBR	HNBR	H
Polyacrylate Rubber	ACM	ACM	A
Chloroprene Rubber	CR	CR	WC
Ethylene Propylene Diene Rubber	EPDM	EPDM	E
Silicone Rubber	VMQ	VMQ	S
Fluorosilicone Rubber	FVMQ	FVMQ	F
Tetrafluorethylene-Propylene Copolymer Elastomer	FEPM	TFE/P*	WT
Butyl Rubber	IIR	IIR	WI
Styrene-Butadiene Rubber	SBR	SBR	WB
Natural Rubber	NR	WR	WR
Fluorocarbon Rubber	FKM	FKM	V
Perfluoro Rubber	FFKM	FFKM	J
Polyester Urethane Polyether Urethane	AU, EU	AU, EU	WU, Z
Chlorosulphonated Polyethylene Rubber	CSM	CSM	WM
Polysulphide Elastomer	-	TWT	WY
Epichlorohydrin Elastomer	-	-	WO

* Abbreviation not yet standardized.

ASTM = American Society for Testing and Materials
ISO = International Organisation for Standardization



APPLICATION PARAMETERS OF ELASTOMERS

Elastomers, as all other organic chemicals, have limited use. External influences such as media, oxygen or ozone, as well as pressure and temperature, will affect the material properties and therefore their sealing capability.

Elastomers can swell, shrink or harden and develop cracks or even tears. Figure 3 and Figure 4 illustrate the performance of various elastomers under different application parameters.

ELASTOMER HEAT RESISTANCE / SWELLING IN OIL

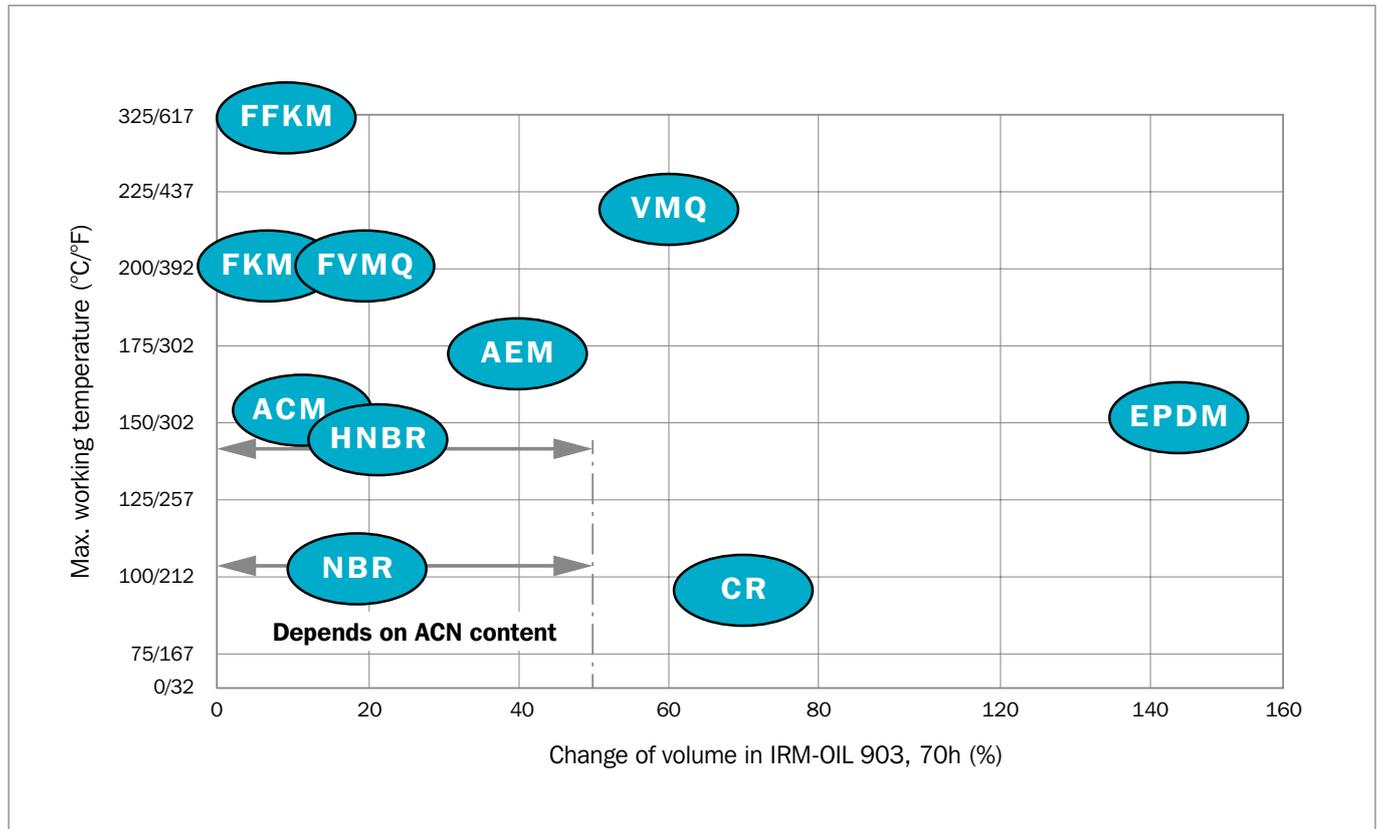


Figure 3: Change of volume in IRM-Oil 903 (old ASTM-Oil No. 3)



TEMPERATURE RANGE

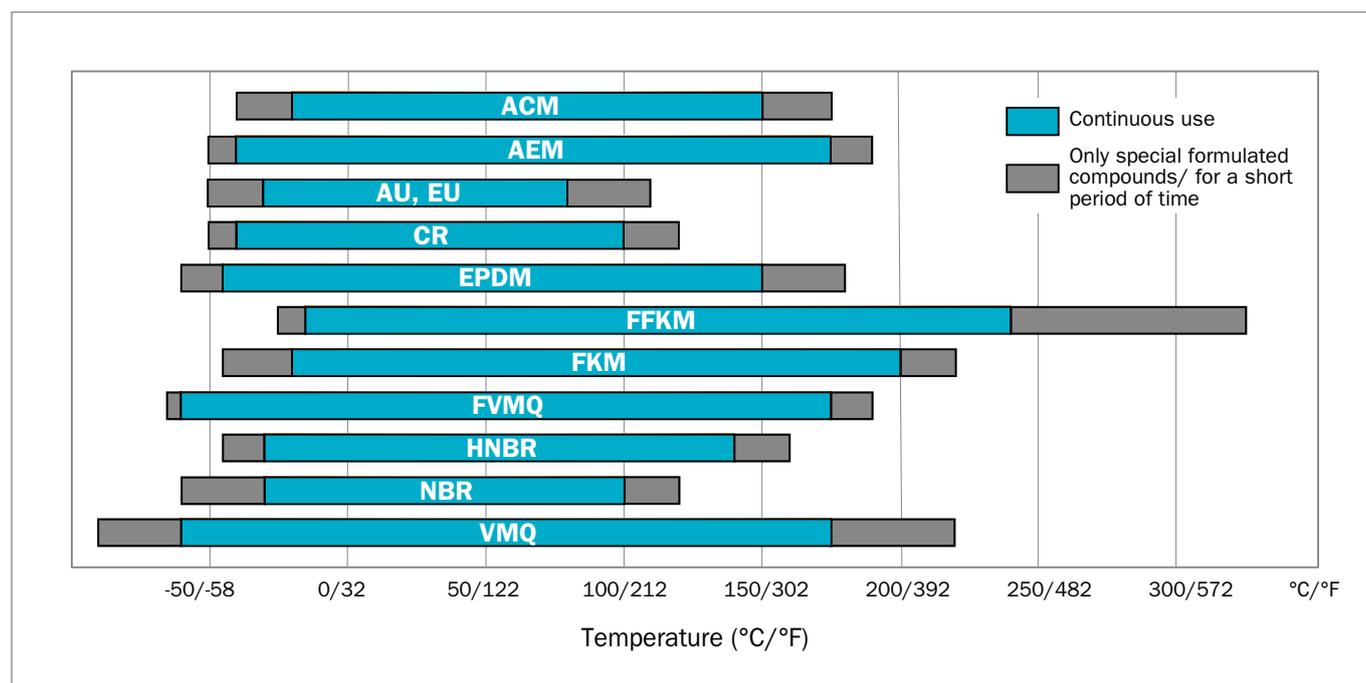


Figure 4: Temperature ranges of various elastomers. Temperature ranges only apply when used with compatible media.

Table 3: General field of application

Material and Properties	Applications	Operating Temperature			
		Normal		Short Period	
		°C	°F	°C	°F
ACM (Polyacrylate Rubber) - Excellent resistance to ozone, weathering and hot air, although it shows only medium physical strength - Low elasticity - Relatively limited low temperature capability	ACM is used in automotive applications which require special resistance to lubricants containing many additives (incl. sulfur) at high temperatures	-20 to +150 (special types -35 to +150)	-4 to +302 (special types -31 to +302)	up to +175	up to +347
CR (Chloroprene Rubber) - Good resistance to ozone, weathering, chemicals and aging - Good non-flammability - Good mechanical properties and cold flexibility	CR is used in sealing applications involving refrigerants, outdoor applications and in the glue industry	-35 to +90 (special types -55 to +90)	-31 to +194 (special types -67 to +194)	up to +120	up to +248
EPDM (Ethylene Propylene Diene Rubber) - Good heat, ozone and aging resistance - High levels of elasticity - Good low temperature behavior - Good insulating properties	EPDM can often be found in applications with brake fluids (based on glycol) and hot water	Peroxide cured EPDM Types			
		-45 to +150	-49 to +302	up to +175	up to +347
		Sulfur cured EPDM Types			
		-45 to +130	-49 to +266	up to +150	up to +302



Material and Properties	Applications	Operating Temperature			
		Normal		Short Period	
		°C	°F	°C	°F
FFKM (Perfluoro Rubber) - Broad chemical resistance like PTFE - Good heat resistance - Low swelling with almost all media	FFKM is used in chemical and process industries and in all applications with either aggressive environments or high temperatures	-25 to +240	-13 to +464	up to +325	up to +617
FKM (Fluorocarbon Rubber) - Non-flammability, low gas permeability - Excellent resistance to ozone, weathering and aging	FKM is also often used with mineral based oils and greases at high temperatures	-20 to +200 (special types -40 to +200)	-4 to +392 (special types -40 to +392)	up to +230	up to +446
FVMQ (Fluorosilicone Rubber) - Good heat resistance and electrical properties - Very good low temperature flexibility - Excellent resistance to weather, ozone and UV rays - FVMQ shows a significantly better chemical resistance than standard silicone especially in hydrocarbons, aromatic mineral oils, fuel and low molecular aromatic hydrocarbons e.g. benzene and toluene	FVMQ is used in aerospace and automotive applications	-50 to +175	-58 to +347	up to +200	up to +392
HNBR (Hydrogenated Nitrile Butadiene Rubber) - HNBR is made via selective hydrogenation of NBR butadiene groups - The properties of HNBR rubber depend on the ACN content which ranges between 18% and 50%, as well as on the degree of saturation - Good mechanical properties	HNBR is used with mineral based oils and greases	-30 to +140 (special types -40 to +140)	-22 to +284 (special types -40 to +284)	up to +160	up to +320
IIR (Butyl Rubber) - Very low gas and moisture permeability - Good resistance to many organic and inorganic chemicals, ozone, weathering and aging - Excellent insulating properties	IIR is used for vacuum seals and membranes	-40 to +110	-40 to +230	up to +120	up to +248
NBR (Nitrile Butadiene Rubber) - The properties of nitrile rubber depend mainly on the ACN content, which ranges between 18% and 50% - Good mechanical properties	NBR is mostly used with mineral based oils and greases	-30 to +100 (special types -60 to +90)	-22 to +212 (special types -76 to +194)	up to +120	up to +248
Polyurethane (Zurcon® Polyurethane) - Excellent elastic properties and optimum abrasion resistance - Outstanding tensile strength, low compression set - Good resistance to O ₂ and O ₃	Polyurethane is mostly used for pneumatic and hydraulic seals	-50 to +110	-58 to +230	-	-



Material and Properties	Applications	Operating Temperature			
		Normal		Short Period	
		°C	°F	°C	°F
VMQ (Silicone Rubber) - Excellent heat resistance, cold flexibility, dielectric properties - Good resistance to weather, ozone and UV rays - Specific VMQ formulations are resistant to aliphatic engine and gear oils, water up to +100 °C (+212 °F) and high-molecular-weight chlorinated hydrocarbons	VMQ is used for seals in food and medical applications	-50 to +175	-58 to +347	up to +230	up to +446

Chemical compatibility

For the pre-selection of a suitable material group, a comprehensive chemical compatibility guide is available. This can be downloaded from our website www.trelleborg.com/seals or you can contact your local Customer Solution Center for further details.

It is important to recognize that when using this guide, the ratings shown are based on published data and immersion tests. These tests are conducted under laboratory conditions at room temperature predominantly and may not adequately represent conditions in the field. Relative short term laboratory tests may not pick up all the additives and impurities which may exist in long term service applications.

Care must be taken to ensure that all aspects of the application are considered carefully before a material is selected. For example, at elevated temperatures some aggressive fluids can cause a much more marked effect on an elastomer than at room temperature.

ORDERING

For more information on this product, or for orders and enquiries, see the full O-Rings and Back-up Rings Catalog or contact your local Customer Solution Center.

Physical properties, as well as fluid compatibility, need to be considered. Compression set, hardness, abrasion resistance and thermal expansion can influence the suitability of a material for a particular application.

It is recommended that users conduct their own tests to confirm the suitability of the selected material for each application.

Our experienced technical staff can be consulted for further information on specific applications.

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Back-up Rings

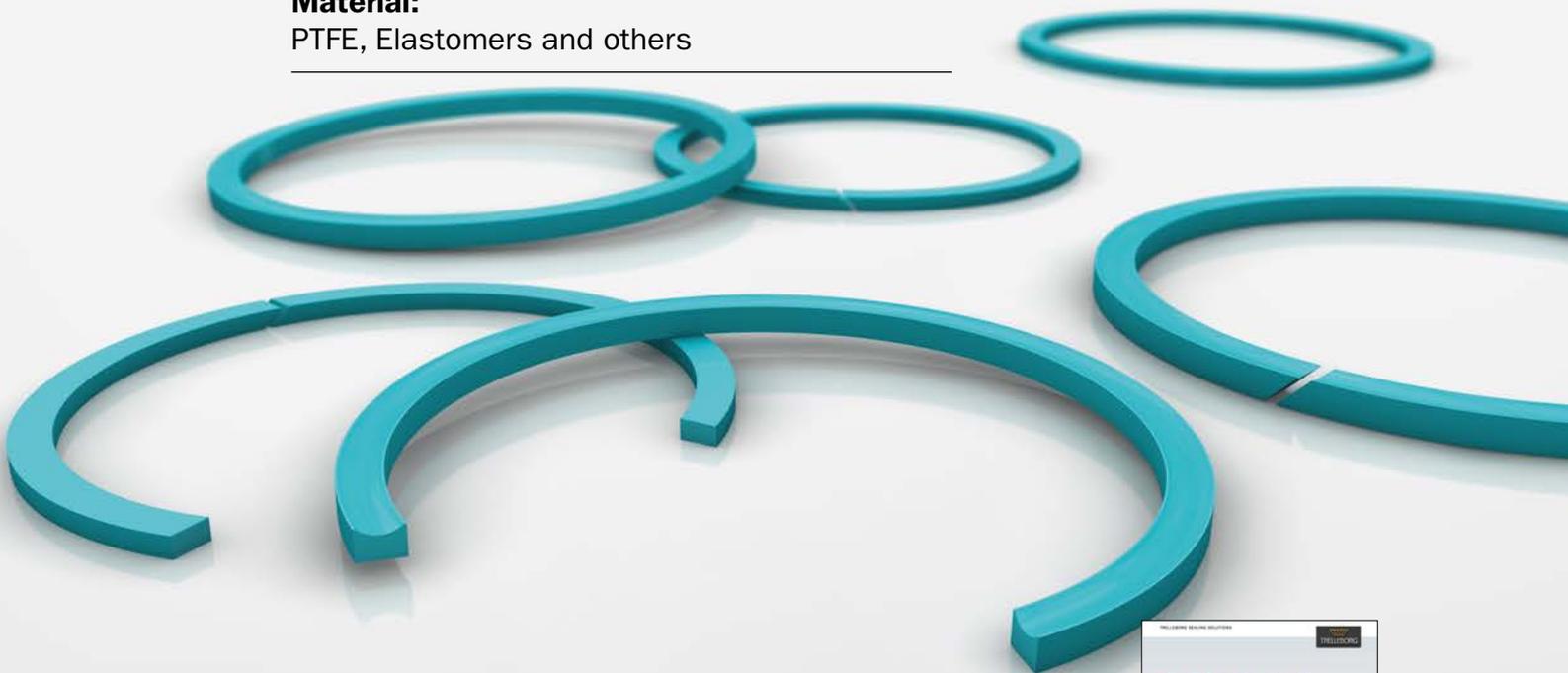


Protective and supporting element

Static and dynamic applications, high pressure

Material:

PTFE, Elastomers and others



O-RINGS AND BACK-UP RINGS CATALOG



For more information on this product, see the full **O-Rings and Back-up Rings Catalog** at www.trelleborg.com/seals/literature.



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■ Back-up Rings



DESCRIPTION

Back-up Rings have no intended sealing function. Instead, as their name indicates, they are protective and supporting elements made from extrusion-resistant materials which generally have a rectangular cross-section. They are installed in a groove together with an elastomeric sealing element, preferably with a corresponding O-Ring in static applications.

Due to the tight fit of the Back-up Ring in the housing, they prevent extrusion of the pressurized elastomeric sealing element into the sealing gap.

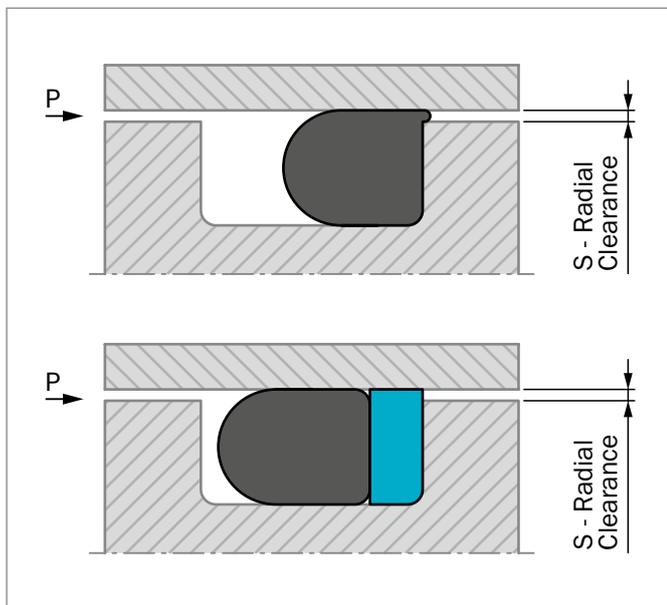


Figure 5: O-Ring installation with and without Back-up Ring

APPLICATION EXAMPLES

- Injection molding machines
- Machine tools
- Presses
- Excavators
- Agricultural machines
- Valves for hydraulic circuits

OPERATING CONDITIONS

Static applications:	Up to approximately 250 MPa / 36,259 psi depending on the Back-up Ring material and sealing gap
Operating temperature:	-200 °C / -328 °F up to +260 °C / +500 °F depending on the material

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.

FEATURES AND BENEFITS

- Allows use of O-Rings in high pressure applications
- Permits manufacturing from O-Ring materials with a low hardness
- Compensation of radial sealing gaps
- Can be used for internal and external sealing applications
- Reciprocating and rotating movements possible
- Compensation for large temperature fluctuations
- Static and dynamic applications



Back-up Ring Types

Overview

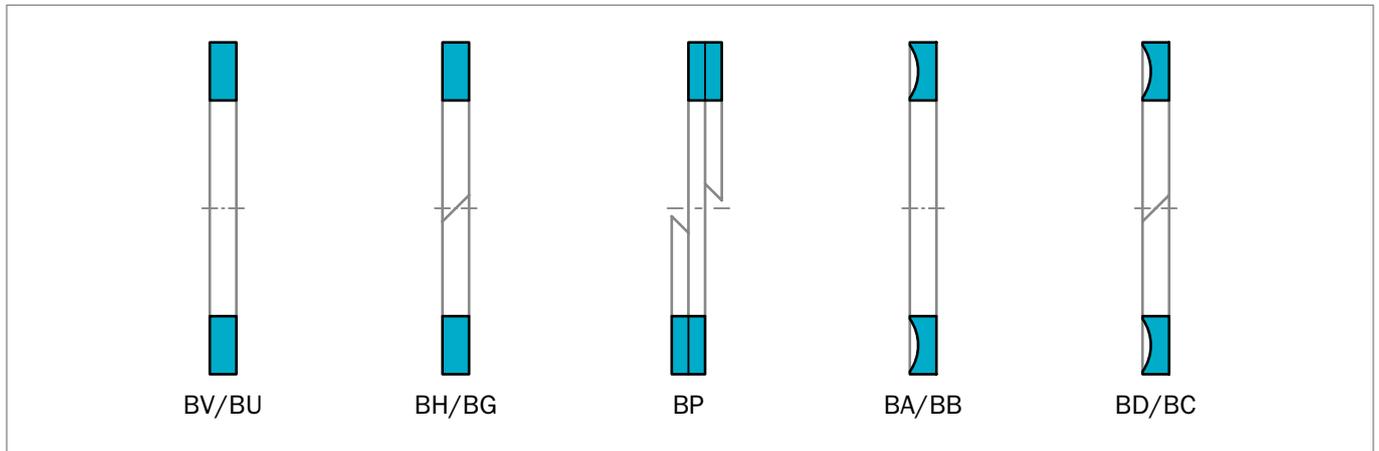


Figure 6: Back-up Ring types

External sealing (piston)

Type BV

- Rectangular, uncut, PTFE

Type BH

- Rectangular, cut, PTFE

Type BP

- Spiral, PTFE

Type BA

- Concave, uncut, PTFE

Type BB

- Concave, uncut, NBR + FKM

Type BD

- Concave, cut, PTFE

Internal sealing (rod)

Type BU

- Rectangular, uncut, PTFE

Type BG

- Rectangular, cut, PTFE

Type BP

- Spiral, PTFE

Type BB

- Concave, uncut, PTFE

Type BB

- Concave, uncut, NBR + FKM

Type BC

- Concave, cut, PTFE



Back-up Ring Types for External Sealing (Piston)

Back-up Ring types, uncut

Type BV

- Rectangular cross-section
- Material: PTFE
- Static

Type BB

- Concave cross-section
- Material: NBR, FKM
- The large contact surface protects the O-Ring against deformation in case of high pulsating pressures
- Dimensional stability of the O-Ring improves the sealing force and increases the service life
- Preferably for static use

Type BA

- Concave cross-section
- Material: PTFE
- The large contact surface protects the O-Ring against deformation in case of high pulsating pressures
- Dimensional stability of the O-Ring improves the sealing force and increases the service life
- Static

Snap-back Back-up Ring, special Type

- Easy installation in closed grooves due to the snap-back effect of the material
- The dimensions are different compared to the standard Back-up Rings. Production only on request

Back-up Ring types, cut

Type BH

- Rectangular cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- Static
- Preferred for installations in a closed groove where uncut Back-up Rings are not suitable

Type BD

- Concave cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- The large contact surface protects the O-Ring against deformation in case of high pulsating pressures
- Dimensional stability of the O-Ring improves the sealing force and increases the service life
- Static
- Preferred for installations in a closed groove where uncut Back-up Rings are not suitable

Back-up Ring types, spiral

Type BP

- Rectangular cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- Consists of standard two spiral windings which are cut at the ends at an angle
- Static
- Preferred for installations in a closed groove where uncut Back-up Ring are not suitable
- Compensation of large temperature changes and tolerances through a screw-like elongation and contraction. Easy installation in closed grooves for external sealing applications
- The dimensions are different compared to standard Back-up Rings
- Recommended only if service diameter does not exceed 40 times the radial groove depth



Back-up Ring Types for Internal Sealing (Rod)

Back-up Ring types, uncut

Type BU

- Rectangular cross-section
- Material: PTFE
- Static

Type BB

- Concave cross-section
- Material: PTFE, NBR, FKM
- The large contact surface protects the O-Ring against deformation in case of high pulsating pressures
- Dimensional stability of the O-Ring improves the sealing force and increases the service life
- Static

Back-up Ring types, cut

Type BG

- Rectangular cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- Static
- Preferred for installations in closed grooves where uncut Back-up Rings are not suitable

Type BC

- Concave cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- The large contact surface protects the O-Ring against deformation in case of high pulsating pressures
- Dimensional stability of the O-Ring improves the sealing force and increases the service life
- Static
- Preferred for installations in a closed groove where uncut Back-up Rings are not suitable

Back-up Ring type, spiral

Type BP

- Rectangular cross-section
- Material: PTFE
- Cut angle of 30° or 45°
- Consists of standard two spiral windings which are cut at the ends at an angle
- Static
- Preferred for installations in a closed groove where uncut Back-up Rings are not suitable
- Compensation of large temperature changes and tolerances through a screw-like elongation and contraction
- Recommended only if service diameter does not exceed 40 times the radial groove depth



Materials

Back-up Rings are manufactured from virgin PTFE as standard. In view of the unfavorable cold flow behavior of virgin PTFE, these Back-up Rings are only used for low to medium loads. For higher load requirements, filled PTFE materials (with glassfiber, bronze, carbon, etc.) have to be used. For sealing against high pressures, Back-up Rings made from specially modified thermoplastic materials are available.

For the series production of larger quantities, injection molded Back-up Rings can be manufactured, e.g. NBR 90 Shore A, FKM 90 Shore A, or thermoplastic elastomers (TPE) on request.

Table 4: Back-up Ring materials

Base material	Material code	Type					Dynamic application	
		BU/ BV	BG/ BH	BP	BB/ BA	BC/ BD	Pressure	
							MPa	psi
PTFE (virgin) - standard	PT00	.	.	.	.	.	25	3,626
PTFE - glassfiber-filled	PTGB	.	.	.	.	.	40	5,801
PTFE, carbon-filled	PTKC	.	.	.	.	.	40	5,801
PTFE, bronze-filled	PTB4	.	.	.	.	.	40	5,801
TPE-E	PR	.	.	-	.	.	30	4,351
NBR, 90 Shore A	N962N	-	-	-	.	-	20	2,901
FKM, 90 Shore A	V96E1	-	-	-	.	-	20	2,901

ORDERING

For more information on this product, or for orders and enquiries, see the full O-Rings and Back-up Rings Catalog or contact your local Customer Solution Center.

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Kantseal



Double-acting

Radial and axial sealing

Material:
Elastomers



KANTSEAL CATALOG



For more information on this product, see the full Kantseal Catalog at www.trelleborg.com/seals/literature.



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Kantseal



DESCRIPTION

The Kantseal is a good alternative to the O-Ring as an axial static seal in applications requiring higher gap extrusion resistance and minimal deformation of the cross-section.

Their application and handling is comparable with those of O-Rings. It is used as a static seal so that the square form remains practically constant even under high pressures.

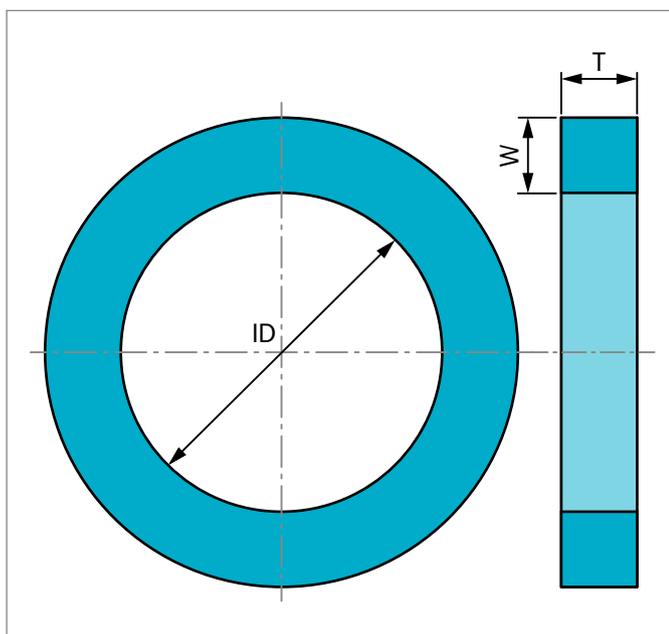


Figure 7: Kantseal dimensioning

FEATURES AND BENEFITS

- High resistance to gap extrusion
- Minimum mechanical deformation of the cross-section
- Outstanding sealing behavior over long periods
- Low compression set
- No twisting in the groove
- No relative movements during pressure cycles
- Dimensionally stable under pressure
- No additional Back-up Ring required
- No parting line or flash on the seal
- Long service life
- High leak tightness

APPLICATION EXAMPLES

- Flanges
- Valves
- Plates
- Locks

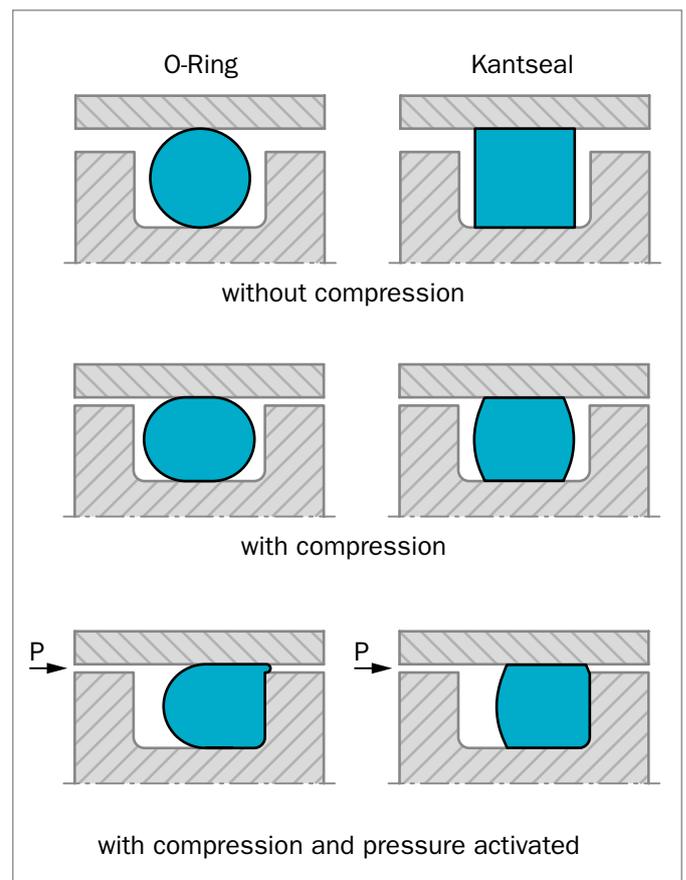


Figure 8: Installation comparison - O-Ring/Kantseal



OPERATING CONDITIONS

Pressure:	Up to 50 MPa / 7,250 psi and higher (depending on sealing gap)
Temperature:	-30 °C to +100 °C / -22 °F to +212 °F NBR 70 Shore A -25 °C to +100 °C / -13 °F to +212 °F NBR 90 Shore A -15 °C to +200 °C / +5 °F to +392 °F FKM 70 Shore A -15 °C to +200 °C / +5 °F to +392 °F FKM 90 Shore A
Media:	Depending on material selected. Oil-based hydraulic fluids, lubricating oils, water, air and other media.

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

Bonded Seals



Double-acting

Static seal for screw and flange connections

Material:

Elastomers bonded to metal



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■ Bonded Seals

DESCRIPTION

Bonded Seals, also known as U-Seals and Usit Rings, are composed of a metal washer with an elastomer sealing lip vulcanized to the inner diameter. They are primarily used to seal bolted connections and mounting elements, mostly in industrial applications, such as pipe connections and couplings. When the bolted connection is tightened, the sealing lip is pressed against the flat surfaces for a leak-tight seal.

The metal washer ensures that the components to be connected are reliably and securely held. Its thickness limits the compression of the elastomer seal, ensuring a reliable seal. Internal pressure increases sealing force by energizing the elastomer lip.

Various types of Bonded Seals are suitable for sealing continuous or stepped threads in general engineering. They are applicable to smooth flanges, countersinks and a number of different screw types.

Bonded Seals are available with special designs for use in aerospace applications or in accordance with MIL specifications. Contact your local Customer Solution Center for more information.

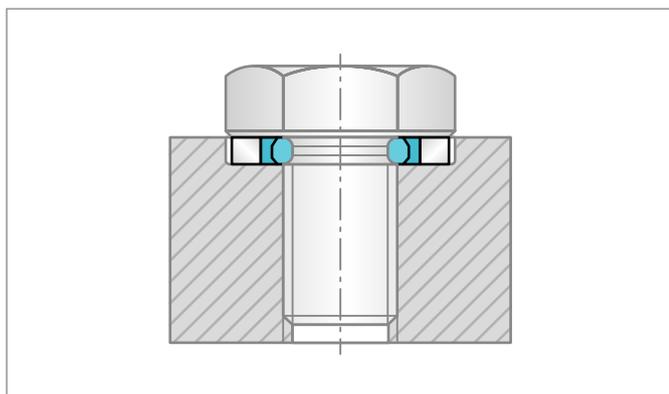


Figure 9: GM500

FEATURES AND BENEFITS

- Cost-effective solution for sealing of bolt/thread, bolt heads and flanges
- Versatile and applicable to all threaded bolts, studs and clearance holes
- Available in metric, Whitworth, BSP and other European thread sizes
- Large choice of elastomer and metal materials for different media and application conditions
- Wide temperature resistance
- Reliable high and low pressure sealing
- Metal washer prevents over compression and extrusion
- Usable for overhead installation
- Can be automatically installed
- Visible from the outside for assembly

APPLICATIONS

- Flanges
- Plates
- Engines
- Bolts
- Valves
- Hydraulics
- Cylinder / valve connections

OPERATING CONDITIONS

Pressure:	Depending on size and material selected.
Temperature:	-30 °C to +100 °C / -22 °F to +212 °F NBR -15 °C to +200 °C / +5 °F to +392 °F FKM
Media:	Depending on material selected. Oil-based hydraulic fluids, lubricating oils, water, air and other media.



GM500

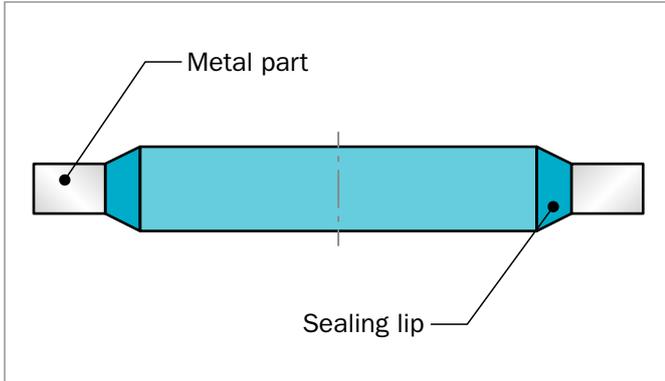


Figure 10: GM500

GM500 SELF-CENTERING

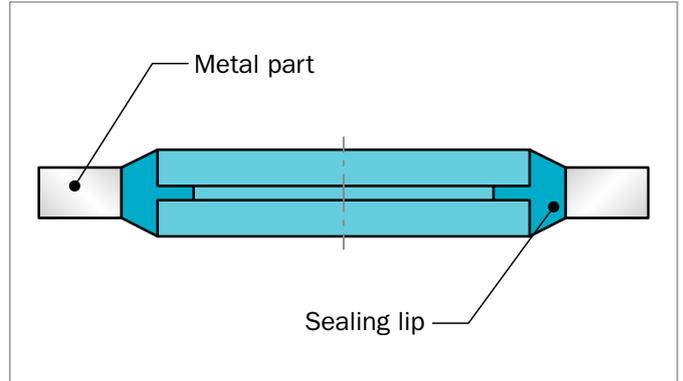


Figure 12: GM500 self-centering

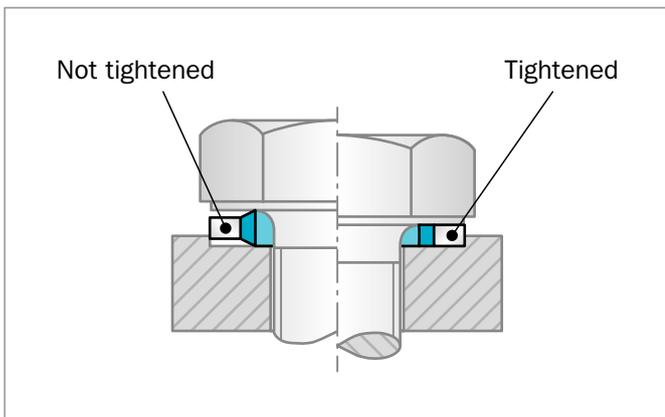


Figure 11: Installation GM500

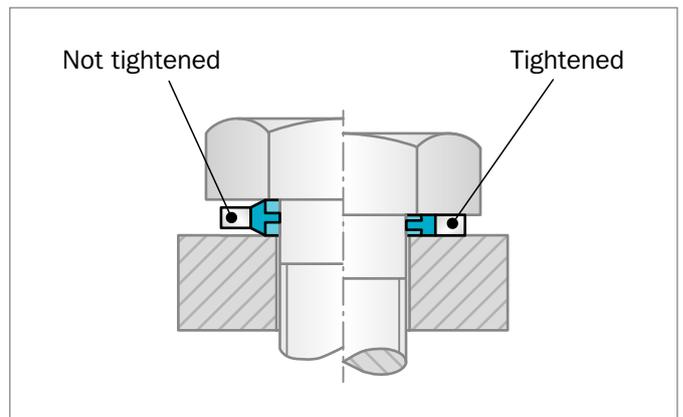


Figure 13: Installation GM500 self-centering

GM500 was originally designed to replace copper-type washers in high-pressure systems. Simple in construction, the seal comprises a metal ring with a square or rectangular cross-section, bonded to an elastomeric ring with a trapezoidal cross-section. The metal ring resists bursting force and limits deformation of the elastomer element.

- Used with a wide range of different bolts
- Suitable for flat flanges or recessed bolt holes

Developed to eliminate leakage due to seal offset, GM500 self-centering has the additional benefit of pre-assembling on to threads for savings on secondary operations. The thin seal membrane offers little resistance during assembly.

- Centrally located
- Positively retained
- Ability to pre-assemble
- Easy to assemble
- All European thread sizes available



GM 1000 SELF-CENTERING

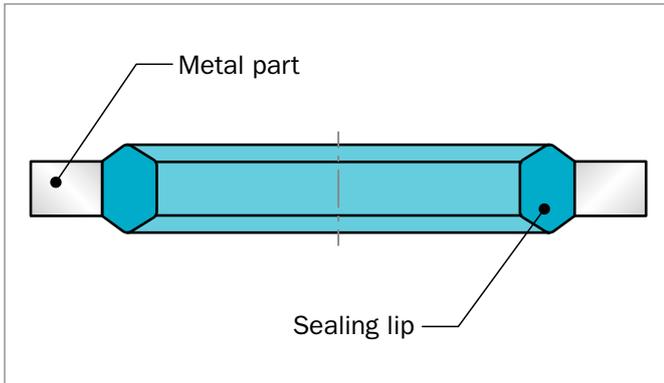


Figure 14: GM1000

GM2000 SELF-CENTERING

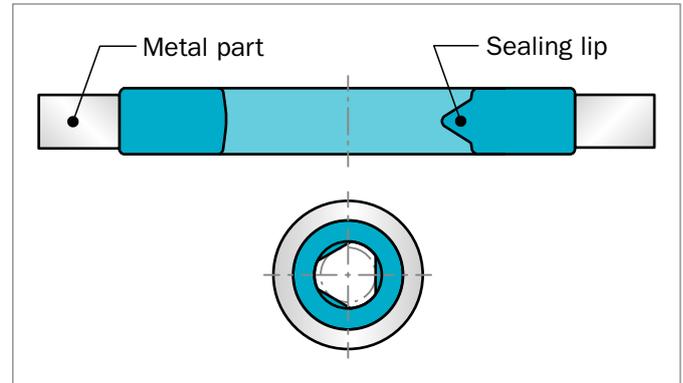


Figure 16: GM2000

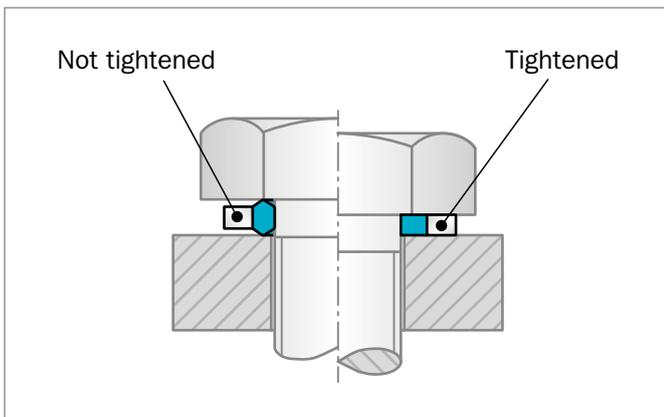


Figure 15: Installation GM1000

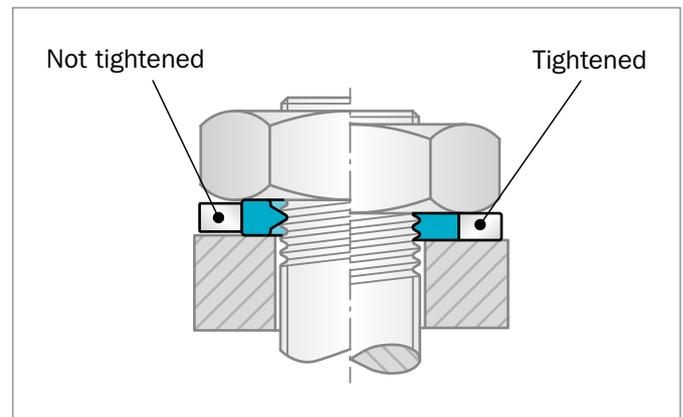


Figure 17: Installation GM2000

GM1000 is a more robust version of self-centering Bonded Seal.

- Easy to install: during assembly, screw connections can be tightened and loosened several times
- Good sealing even with low tightness
- No need for a countersink to center the seal due to lip design
- For metric bolts with hexagonal heads as per DIN specifications
- Can be manufactured to inch sizes or with special designs

A self-centering Bonded Seal for threads and nuts.

- No need for a countersink to center the seal due to lip design
- Three contact lips seal the thread to the nut and machine component to prevent leakage
- Positively retained

IMPORTANT NOTE

During assembly, make sure that the seal is pushed over the thread and not turned.



CUSTOMIZED SOLUTIONS

Sealing plates can be manufactured to customer drawings and specifications. The sealing lip is customized based on application requirements and can be used to replace O-Rings, square rings and other molded parts.



Figure 18: Customized solutions

**Table 5: Sealing lip - standard compounds**

Basic Polymer	Compound code	Color	Hardness Shore A	Temperature Range *
HNBR 80	H8M_H	black	80 ± 5	-30 °C to +130 °C
NBR 70	N7M_H	black	70 ± 5	-30 °C to +100 °C
NBR 90	N9M_H	black	90 ± 5	-35 °C to +100 °C
FKM 75	VCM_H	black	75 ± 5	-20 °C to +200 °C
EPDM 75	E7M_H	black	70 ± 5	-45 °C to +150 °C

Table 6: Sealing lip - aerospace compounds

Basic Polymer	Compound code	Color	Hardness Shore A	Temperature Range *
NBR 90	N9M_V	black	90 ± 5	-30 °C to +100 °C
NBR 80	NCM_G	black	80 ± 5	-30 °C to +100 °C
FVMQ	F8L_G	blue	80 ± 5	-60 °C to +200 °C
FVMQ	F6W_G	white	60 ± 5	-60 °C to +200 °C
EPDM 80	E8M_G	black	80 ± 5	-54 °C to +135 °C
VMQ	SCG_G	black	75 ± 5	-50 °C to +175 °C
FKM 75	VCM_G	black	80 ± 5	-20 °C to +200 °C

Table 7: Metal part - materials and coatings

Metal Code	Segment Type	Reference Code	Material Type	Min. Tensile Strength	Standard	Plating DIN EN ISO 19598	White Rust **	Red Rust **
							Corrosion resistance ISO 9227	
B	Industrial/ Aerospace	.74	Stainless Steel	485 N/mm ²	SUS316L	-	-	-
J	Industrial/ Aerospace	.41	Standard Steel	540 N/mm ²	1.0540	Fe//Zn8//An//T0	8h	72h
Y	Industrial/ Aerospace	.95	Standard Steel	540 N/mm ²	1.0540	Fe//ZnNi8//Cn//T0	120h	720h
5	Industrial/ Aerospace	.08	Stainless Steel	590 N/mm ²	SUS416	-	-	-
Q	Aerospace	.05	Aluminum	370 N/mm ²	AL-Alloy	-	-	-
1	Aerospace	.31	Stainless Steel	540 N/mm ²	1.4550	-	-	-

Other compounds are available on request. Please contact your local Customer Solution Center for more information.

* Maximum and minimum working temperatures have to be agreed with Trelleborg Sealing Solutions according to specific application criteria.

** Indication values for corrosion resistance in salt spray test in accordance with DIN 50021 SS (ISO 9227).



GALVANIC COATINGS

Galvanic coatings consist of zinc or zinc alloys.

Table 8: Zinc and zinc alloys (extract from DIN 50979)

Abbreviation	Definition
Zn	Zinc coating without alloy
ZnFe	Zinc alloy coating with a mass share of 0.3% to 1.0% iron
ZnNi	Zinc alloy coating with a mass share of 12% to 16% nickel

PASSIVATION

Passivating involves making conversion layers using suitable Cr(VI)-free solutions in order to improve the corrosion resistance of the coatings. Coloring is possible.

Table 9: Passivation procedure summary (extract from DIN EN ISO 19598)

Passivation or procedure group	Abbreviation	Appearance of the surface
Transparent passivated (thin layer passivation)	An	Colorless to colored, iridescent
Iridescent passivated (thick layer passivation)	Cn	Colored iridescent
Black passivated	Fn	Black

TREATMENTS

Treatments increase corrosion resistance and usually have a layer thickness of up to 2 µm. They consist of Cr(VI)-free organic and/or inorganic compounds.

Products that can be removed with cold cleaners, for example, oil, grease, or wax, are not considered as treatments in the context of DIN EN ISO 19598. The influence of treatments on the functional properties of the component, such as transition resistance, weldability, compatibility with fuels, or glued joints, is to be assessed based on the component. In case of special requirements for surface functionality, the use of and type of treatment must be agreed with Trelleborg Sealing Solutions.

In most cases, treatments also eliminate interference colors (iridescences) formed by passivating.

Table 10: Codes for products supplied with/without sealant (extract from DIN EN ISO 19598)

Abbreviation	Definition
T0	Without sealant
T2	With sealant

CONSTRUCTION DETAILS

Bonded Seals can be used for shaft screws with external hexagonal heads. Through holes should be in accordance with DIN / EN 20273, grade: fine, medium or rough. For cylinder shafts with hexagonal sockets in accordance with DIN 74 T2, any quality grade is suitable for the access hole, in accordance with DIN / EN 20273.

The inner diameter (d_1) of the Bonded Seal must be larger than the bore (d_4) or the thread or bolt diameter.

Sealing is most reliable when the elastomer is squeezed until the flat metal surfaces are in full contact. Therefore, bores or threaded roofs to be sealed must not have any countersinks on the support surface of the seal.

It is important that all possible leakage paths are removed, such as spiral or longitudinal machined ridges and excessive roughness. Spot facing is recommended to clean these surfaces.

SURFACE FINISH RECOMMENDATIONS

It is recommended that surface roughness values of Rz1 are a maximum of 12 and Rz values are a maximum of 6.3 µm for the plane surface, which must also be free of scratches and machining marks. Bonded Seals are suitable up to a maximum pressure of 2,000 bar (200 MPa) depending on seal size and material. For higher pressures, alternative materials are available on request.

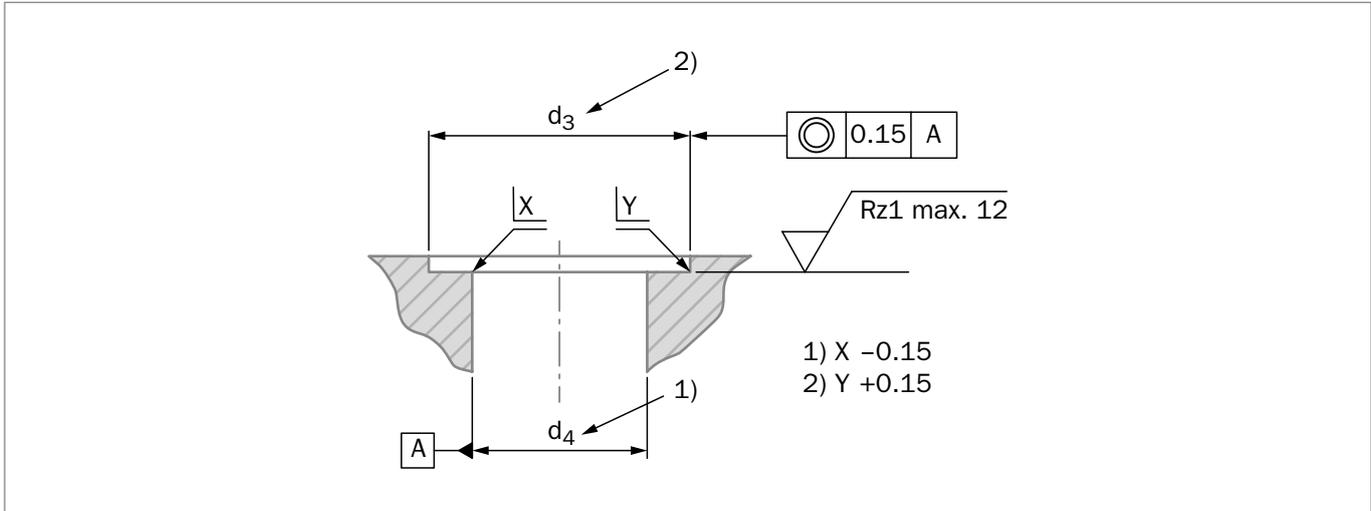


Figure 19: Chamfer and bore design - metric

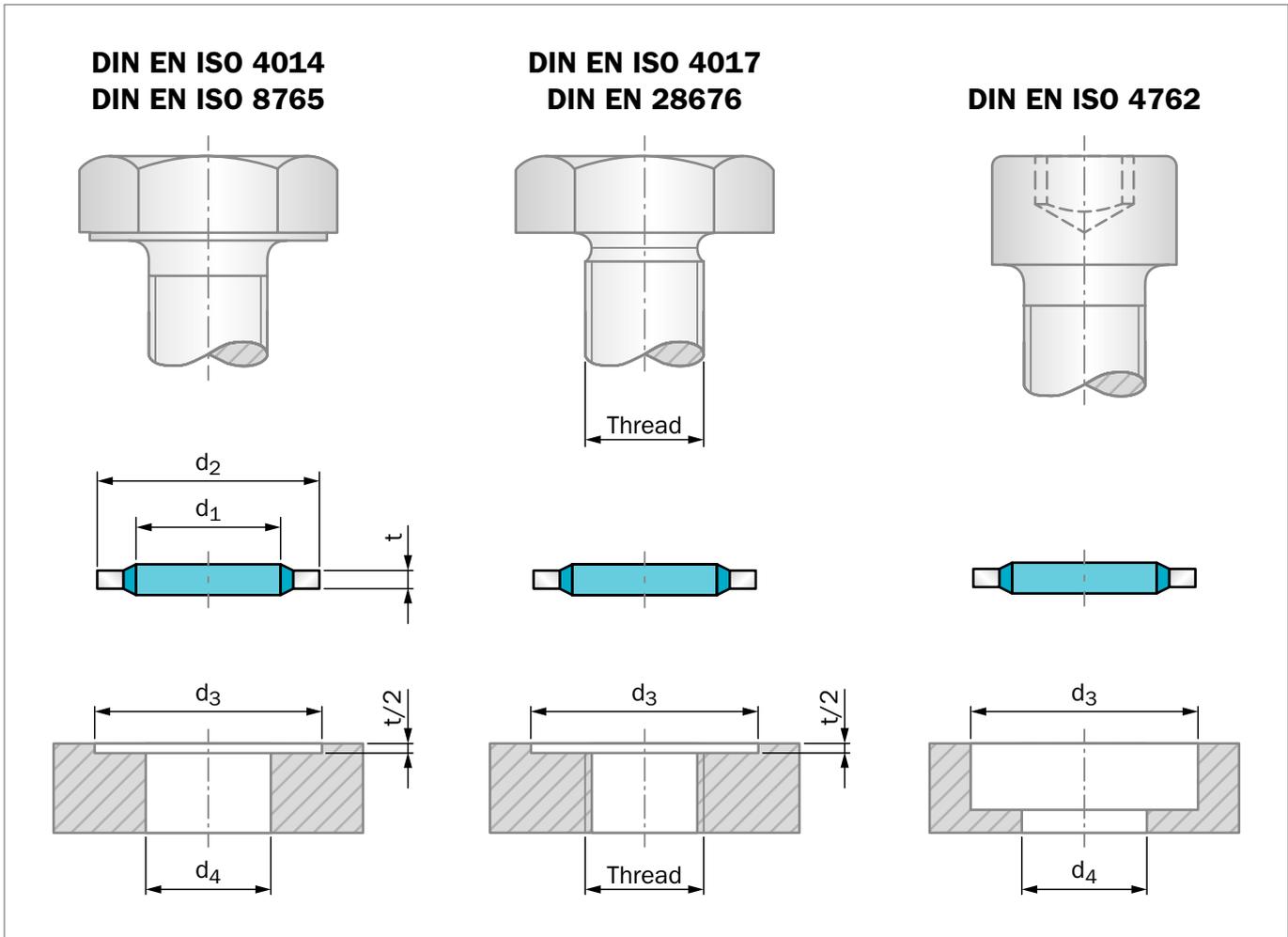


Figure 20: Installation drawings in accordance with ISO standards

Thread and through holes (d_4) in accordance with DIN EN 20273, quality grade fine is preferred. Hollow (d_3) in accordance with DIN 974-1 series 4/5/6



Table 11: Maximum preload and torque loading

Metric Thread	Bonded Seal Steel 1.0540 Tensile Strength N/mm ²	Preload KN	Max. Permissible Torque Nm	Burst Pressure bar	Metric Thread	Bonded Seal Steel SUS316L Tensile Strength N/mm ²	Preload KN	Max. Permissible Torque Nm	Burst Pressure bar
M4	540	0.7	1	2212	M4	485	0.5	0.9	1886
M5	540	0.9	2	1592	M5	485	0.6	1	1773
M6	540	5	12	1299	M6	485	3.5	8	1446
M8	540	10	32	1381	M8	485	7	23	1385
M10	540	18	72	1358	M10	485	13	51	1512
M12	540	21	98	1194	M12	485	15	70	1185
M14	540	29	159	1260	M14	485	20	114	1231
M16	540	45	284	1358	M16	485	32	203	1402
M18	540	58	416	1154	M18	485	42	298	1285
M20	540	72	570	1127	M20	485	51	408	1162
M22	540	44	384	1103	M22	485	31	275	1100
M24	540	83	793	1029	M24	485	60	568	1026
M30	540	109	1307	889	M30	485	78	935	894
M33	540	128	1683	834	M33	485	92	1204	855
M36	540	138	1978	818	M36	485	99	1415	910
M42	540	170	2830	935	M42	485	121	2025	946

For the force calculation, Trelleborg Sealing Solutions uses screws in accordance with DIN ISO 4014 Grade A. The figures given are only indicative values. Tensile strength refers to the material chosen for the Bonded Seal. See Table 7 on page 55 for more information.

Further burst pressure calculations for different materials on request.



GM500 Installation Recommendation - Metric

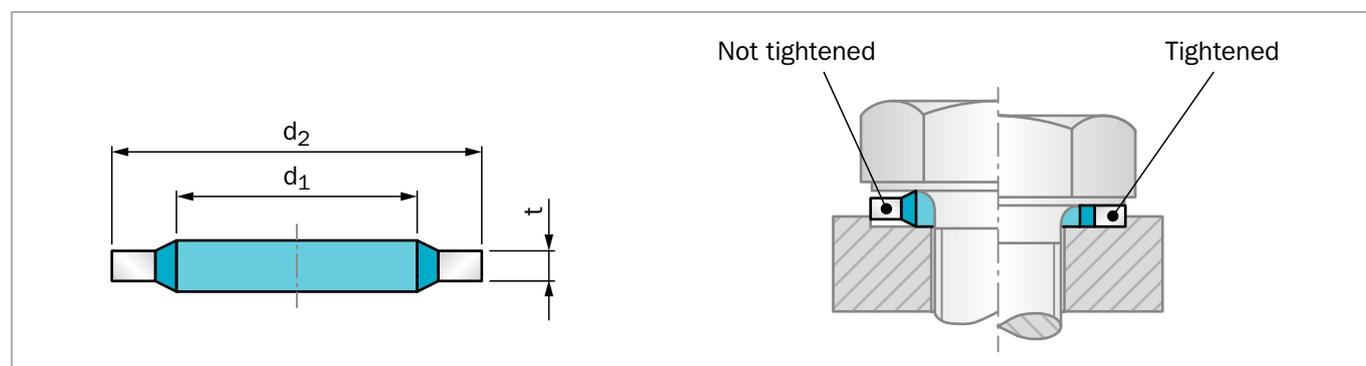


Figure 21: Installation drawing

ORDERING EXAMPLE

GM500 for hexagon head cap screw M4

Dimensions:	Inside diameter	$d_1 = 4.5 \text{ mm}$
	Outside diameter	$d_2 = 7.0 \text{ mm}$
	Thickness	$t = 1.0 \text{ mm}$

Materials:	Sealing lip of NBR 90 Shore A (N9M_H)
	Flat ring of steel (1.0540)
	Plating: Fe//Zn8//An//TO (metal code J)

TSS Article No. **DDM000045 - N9MJH**
 TSS Part No. _____
 Quality Index (Standard) _____
 Material Code (Standard)* _____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 12: GM500/Usit ring recommended metric dimensions

Metric Thread	d_1 ± 0.15	d_2 $-0/+0.15$	t ± 0.1	TSS Part No.	Ref No. GM500	Metric Thread	d_1 ± 0.15	d_2 $-0/+0.15$	t ± 0.1	TSS Part No.	Ref No. GM500
M4	4.1	7.2	1	DDM100041	201	M13	13.7	22	1.5	DDM200137	225
M4	4.5	7	1	DDM000045	202	M13.5	14	18.7	1.5	DDM000140	226
M5	5.7	9	1	DDM000057	203	M14	14.7	22	1.5	DDM000147	227
M5	5.7	10	1	DDM200057	204	M15	16	22.7	1.5	DDM000160	228
M5.5	6.2	9.2	1	DDM000062	205	M16	16.7	24	1.5	DDM000167	229
M6	6.7	10	1	DDM000067	206	M17	17.4	24	1.5	DDM000174	230
M6	6.7	11	1	DDM100067	207	M18	18.7	26	1.5	DDM000187	232
M6	7.3	10.2	1	DDM000073	210	M20	20.7	28	1.5	DDM000207	233
M6	8.5	13.4	1	DDM000085	211	M21	21.5	28.7	2.5	DDM000215	234
M8	8.7	13	1	DDM000087	212	M22	22.5	28	1.5	DDM000225	235
M8	8.7	14	1	DDM100087	213	M22	22.7	30	2	DDM000227	236
M8	8.7	16	1	DDM300087	214	M22	22.7	30	3	DDM100227	237
M8.5	9.3	13.3	1	DDM000093	215	M24	24.7	32	2	DDM000247	238
M10	10.35	16	2	DDM000103	216	-	26.7	35	2	DDM000267	239
M10	10.7	16	1.5	DDM000107	217	M30	31	39	2	DDM000310	242
M10	10.7	18	1.5	DDM100107	218	M33	33.7	42	2	DDM000337	243
M11	11.8	18.5	1.5	DDM000118	220	M36	36.7	46	2	DDM000367	245
M12	12.7	18	1.5	DDM000127	222	M42	42.7	53	3	DDM000427	247
M12	12.7	20	1.5	DDM100127	223	M52	53.3	64.5	3	DDM000533	250
M13	13.7	20	1.5	DDM000137	224						

Given values are maximum tolerances for standard Bonded Seals



GM500 Installation Recommendation According to French sizes - Metric

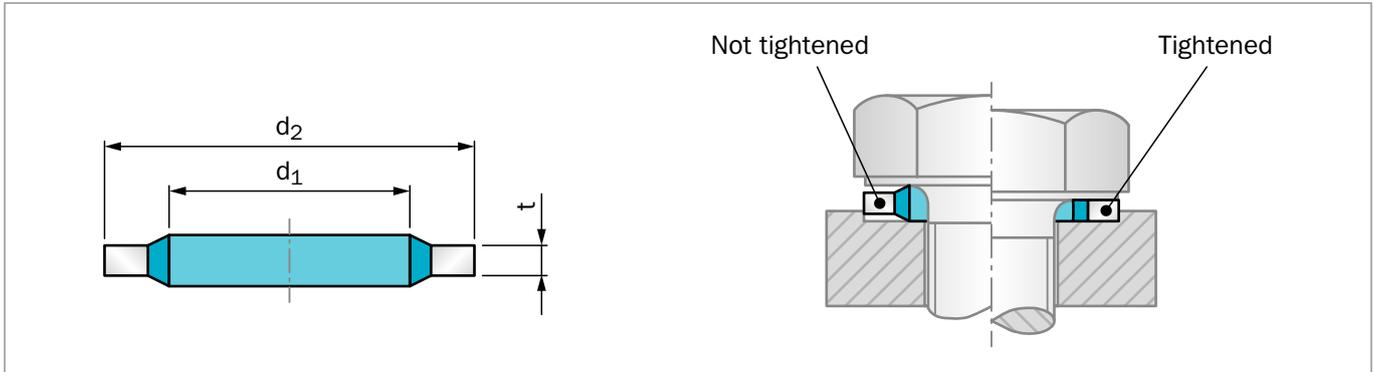


Figure 22: Installation drawing

ORDERING EXAMPLE

GM500 for hexagon head cap screw M4 according to French standard

Dimensions:	Inside diameter	$d_1 = 4.6 \text{ mm}$
	Outside diameter	$d_2 = 9.0 \text{ mm}$
	Thickness	$t = 1.0 \text{ mm}$

Materials:	Sealing lip of NBR 90 Shore A (N9M_H)
	Flat ring of steel (1.0540)
	Plating: Fe//Zn8//An//TO (metal code J)

TSS Article No. **DDM000046 - N9MJH**

TSS Part No. _____

Quality Index (Standard) _____

Material Code (Standard)* _____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 13: GM500/Usit ring recommended French metric dimensions

Metric Thread	d_1 ±0.15	d_2 -0/+0.15	t ±0.1	TSS Part No.	Ref No. GM500	Metric Thread	d_1 ±0.15	d_2 -0/+0.15	t ±0.1	TSS Part No.	Ref No. GM500
M3	3.6	7.5	1	DDM000036	301	M20	20.7	29	2	DDM100207	321
M4	4.6	9	1	DDM000046	302	M21	21.7	30	2	DDM000217	323
M5	5.6	10	1	DDM000056	303	M22	22.7	31	2	DDM200227	324
M6	6.6	11	1	DDM000066	304	M24	24.7	33	2	DDM100247	326
M6	7	11.4	1	DDM100070	306	M26	27	35.3	2	DDM100270	327
M8	8.6	13	1	DDM000086	307	M27	27.7	36	2	DDM000277	328
M10	10.7	17	1.5	DDM200107	310	M28	28.6	36	2	DDM000286	329
M12	12.7	19	1.5	DDM200127	313	M30	30.7	39	2	DDM000307	331
M13	13.8	20.1	1.5	DDM000138	315	M36	37	48	2.5	DDM000370	333
M17	17.4	23.7	1.5	DDM200174	318	M48	49	60	2.5	DDM000490	337
M18	18.7	27	2	DDM100187	320						

Given values are maximum tolerances for standard Bonded Seals



GM500 Installation Recommendation - Inch

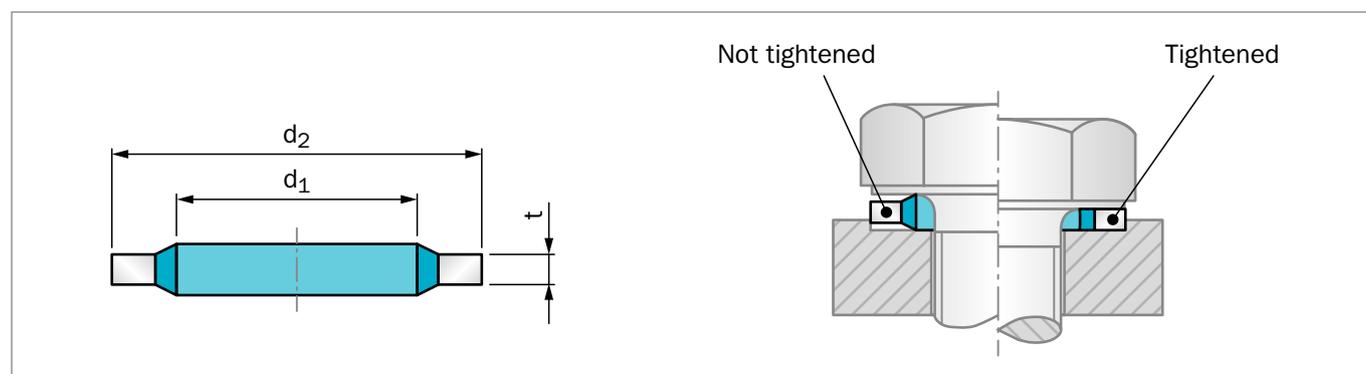


Figure 23: Installation drawing

ORDERING EXAMPLE

GM500 for hexagon head cap screw BSP 1/8

Dimensions:	Inside diameter	$d_1 = 10.37$ mm
	Outside diameter	$d_2 = 15.88$ mm
	Thickness	$t = 2.0$ mm
Materials:	Sealing lip of NBR 90 Shore A (N9M_H)	
	Flat ring of steel (1.0540)	
	Plating: Fe//Zn8//An//TO (metal code J)	

TSS Article No.	DDW400020 - N9MJH
TSS Part No.	DDW400020
Quality Index (Standard)	N9MJH
Material Code (Standard)*	N9MJH

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 14: GM500/Usit ring recommended inch dimensions

Bolt Size	BSP*	d_1	d_2	t	TSS Part No.	Ref No. GM500
	nominal size d_1 tube					
6BA	-	3.05	6.35	1.20	DDW400001	001
4BA	-	4.12	7.26	1.20	DDW400002	002
2BA	-	5.21	8.38	1.20	DDW400003	003
0.25	-	6.86	13.21	1.20	DDW400004	004
0.25	-	6.99	13.34	1.20	DDW400005	005
5/16	-	8.31	13.34	1.20	DDW400006	006
5/16	-	8.64	14.22	1.20	DDW400007	007
3/8	1/8	10.37	15.88	2.00	DDW400020	020
0.40	-	11.26	18.36	2.00	DDW400008	008
7/16	-	11.69	19.05	2.00	DDW400009	009
1/2	1/4	13.74	20.57	2.00	DDW400021	021
9/16	-	14.86	22.23	2.00	DDW400010	010
0.60	-	15.83	22.23	2.00	DDW400022	022
5/8	-	16.51	25.40	2.00	DDW400011	011
-	3/8	17.28	23.80	2.00	DDW400023	023
11/16	-	18.16	25.40	2.30	DDW400012	012
3/4	-	19.69	26.92	2.30	DDW400024	024
13/16	-	21.54	28.58	2.50	DDW400025	025

Table continues on next page.



Bolt Size	BSP*	d ₁	d ₂	t	TSS Part No.	Ref No. GM500
	nominal size d ₁ tube	±0.15	-0/+0.13	±0.10		
7/8	5/8	23.49	31.75	2.30	DDW400026	-
15/16	-	24.26	33.27	2.30	DDW400013	-
1	3/4	27.05	34.93	2.50	DDW400027	027
1 1/16	-	27.82	38.61	2.30	DDW400028	028
1 1/8	-	29.33	36.58	2.30	DDW400014	014
1 3/16	7/8	30.81	38.10	2.30	DDW400029	029
1 1/4	-	32.64	41.40	3.20	DDW400015	015
1 5/16	1	33.89	42.80	3.20	DDW400030	-
1 5/16	1	33.89	42.80	2.30	DDW400031	031
1 3/8	-	35.94	44.45	3.20	DDW400016	-
1 1/2	-	38.96	47.75	3.20	DDW400017	017
1 5/8	1 1/4	42.93	52.38	3.20	DDW400032	-
1 3/4	-	45.34	57.15	3.20	DDW400018	-
1 7/8	1 1/2	48.44	58.60	3.20	DDW400033	-
2	-	51.69	63.50	3.20	DDW400019	-
2 1/8	1 3/4	54.89	69.85	3.20	DDW400034	034
2 1/4	-	58.04	70.36	3.20	DDW400035	035
-	2	60.58	73.03	3.20	DDW400036	036
2 1/2	-	64.39	77.72	3.20	DDW400037	037
-	2 1/4	66.68	79.50	3.20	DDW400038	038
-	2 1/2	76.08	90.17	3.20	DDW400039	-

Given values are maximum tolerances for standard Bonded Seals

* BSP - British Standard Pipe



GM500 Installation Recommendation for Pipe Connections and Couplings

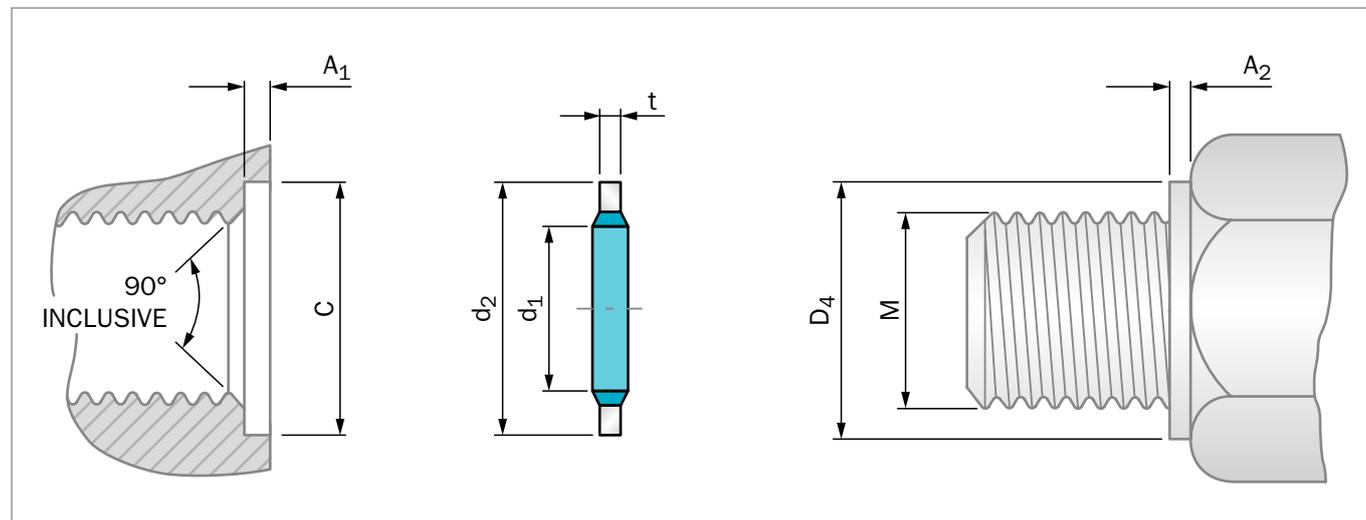


Figure 24: Installation drawing

ORDERING EXAMPLE

GM500 for hexagon head cap screw BSP 1/16

Dimensions:	Inside diameter	$d_1 = 8.3 \text{ mm}$
	Outside diameter	$d_2 = 12.7 \text{ mm}$
	Thickness	$t = 1.2 \text{ mm}$

Materials:	Sealing lip of NBR 90 Shore A (N9M_H)
	Flat ring of steel (1.0540)
	Plating: Fe//Zn8//An//TO (metal code J)

TSS Article No. **DDW400519 - N9MJH**
TSS Part No. _____
Quality Index (Standard) _____
Material Code (Standard)* _____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 15: GM500 dimensions for pipe connections and couplings in accordance with ISO 1179

Thread dia. M in BSP	d_1 -0/+0.2	d_2 -0/+0.2	t ± 0.15	TSS Part No.	Ref No. GM500	C	D ₄	A
						+0.4		(A ₁ max./A ₂ min.)
1/16	8.3	12.7	1.2	DDW400519	519	13	12	1
1/8	10.4	14.7	1.2	DDW400510	510	15	14	1
1/4	13.85	18.7	1.2	DDW400511	511	19	18	1.5
3/8	17.35	22.7	1.2	DDW400512	512	23	22	2
1/2	21.65	26.7	1.2	DDW400513	513	27	26	2.5
3/4	27.3	32.5	1.2	DDW400514	514	33	32	2.5
1	34.2	39.5	2	DDW400515	515	40	39	2.5
1 1/4	42.8	49.5	2	DDW400516	516	50	49	2.5
1 1/2	48.7	55.5	2	DDW400517	517	56	55	2.5
2	60.5	68.5	2	DDW400518	518	69	68	3

Given values are maximum tolerances for standard Bonded Seals



GM500 Self-centering Installation Recommendation - Metric

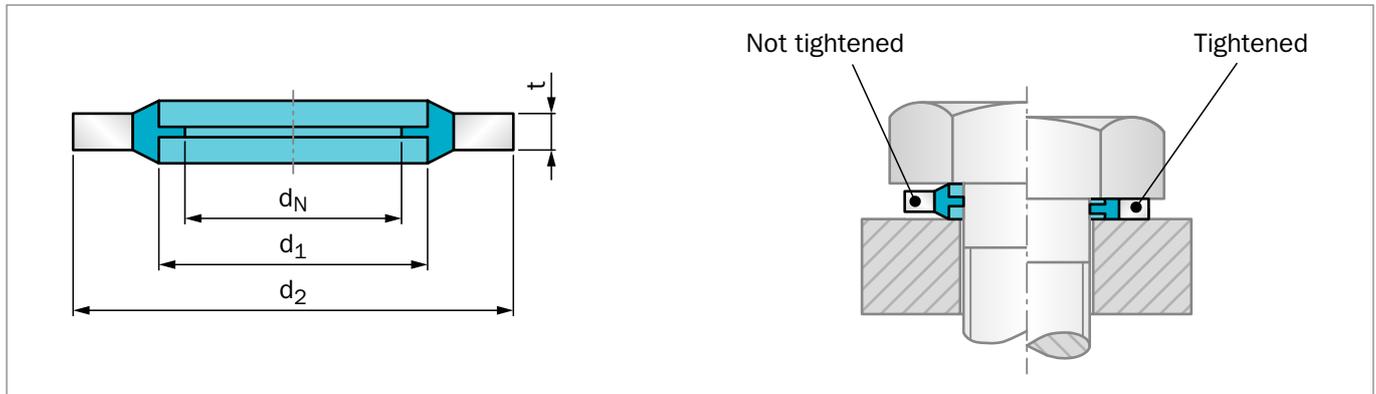


Figure 25: Installation drawing

ORDERING EXAMPLE

GM500 Self-centering for hexagon head cap screw M8

Dimensions:	Inside diameter	$d_1 = 8.7 \text{ mm}$
	Outside diameter	$d_2 = 14.0 \text{ mm}$
	Thickness	$t = 1.0 \text{ mm}$

Material:	Sealing lip of NBR 90 Shore A (N9M_H)
	Flat ring of steel (1.0540)
	Plating: Fe//Zn8//An//TO (metal code J)

TSS Article No.	DDMOC0087 - N9MJH
TSS Part No.	_____
Quality Index (Standard)	_____
Material Code (Standard)*	_____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 16: GM500 Self-centering recommended metric dimensions

Metric Thread	d_N	d_1	d_2	t	TSS Part No.	Ref No. GM500
		± 0.15	$-0/+0.15$				$\pm 0.10$
M4	3.4	4.5	7	1.00	DDMOC0045	947
M5	4.4	5.6	10	1.00	DDMOC0057	946
M6	4.7	6.7	10	1.00	DDMOC0067	898
M8	6.4	8.7	14	1.00	DDMOC0087	866
M10	8.05	10.7	16	1.50	DDMOC0107	708
M12	9.73	12.7	19	1.50	DDMOC0127	867
M14	11.38	14.7	22	1.50	DDMOC0147	868
M16	13.41	16.7	24	1.50	DDMOC0167	870
M18	14.76	18.7	26	1.50	DDMOC0187	872
M20	16.76	20.7	28	1.50	DDMOC0207	873
M22	18.74	22.7	30	2.00	DDMOC0227	874
M24	23.3	27.7	36	2.00	DDMOC0247	875

Given values are maximum tolerances for standard Bonded Seals



GM500 Self-centering Installation Recommendation - Inch

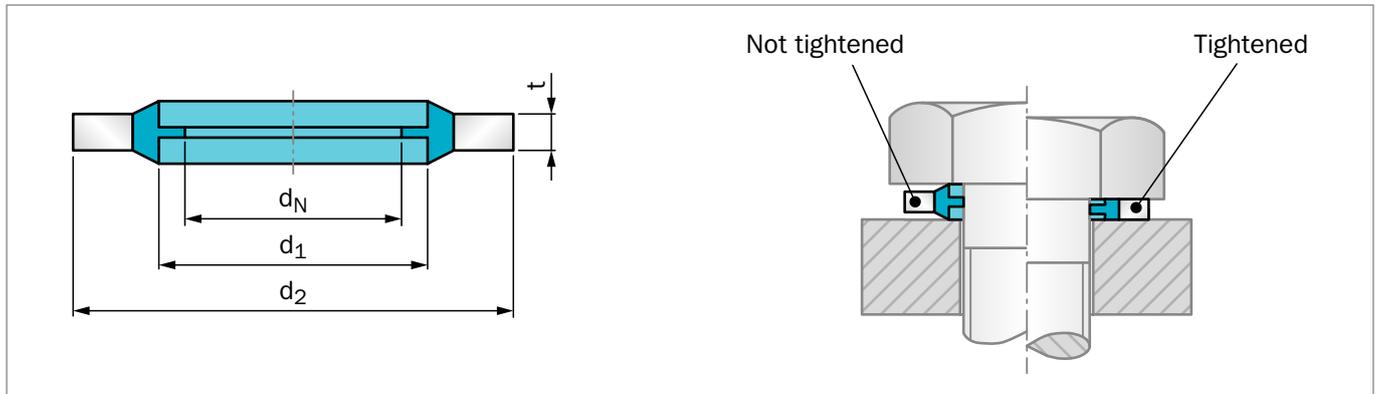


Figure 26: Installation drawing

ORDERING EXAMPLE

GM500 Self-centering for hexagon head cap screw BSP 3/8

Dimensions:	Inside diameter	$d_1 = 17.28$ mm
	Outside diameter	$d_2 = 23.80$ mm
	Thickness	$t = 2.0$ mm
Material:	Sealing lip of NBR 90 Shore A (N9M_H)	
	Flat ring of steel (1.0540)	
	Plating: Fe//Zn8//An//TO (metal code J)	

TSS Article No.	DDW4C0823 - N9MJH
TSS Part No.	_____
Quality Index (Standard)	_____
Material Code (Standard)*	_____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 17: GM500 Self-centering recommended inch dimensions, BSP*

Metric Thread	BSP nominal size ID tube	d_N	d_1 ±0.10	d_2 -0/+0.15	t ±0.10	TSS Part No.	Ref No. GM500
3/8	BSP1/8	8.26	10.37	15.88	2.00	DDW4C0820	820
1/2	BSP1/4	11.18	13.74	20.57	2.00	DDW4C0821	821
-	BSP 3/8	14.96	17.28	23.80	2.00	DDW4C0823	823
13/16	BSP 1/2	18.64	21.54	28.58	2.50	DDW4C0825	825
1.0	BSP 3/4	24.13	27.05	34.93	2.50	DDW4C0827	827
1.3/16	BSP7/8	27.51	30.81	38.10	2.50	DDW4C0829	829
1.5/16	BSP 1	29.92	33.89	42.80	3.20	DDW4C0830	830
1.5/16	BSP 1	30.30	33.89	42.80	2.50	DDW5C0830	830
1.5/8	BSP 1 1/4	38.45	42.93	52.38	3.20	DDW4C0832	832
1.5/8	BSP1/1/4	38.45	42.93	52.38	2.50	DDW5C0832	832
1.7/8	BSP 1 1/2	44.45	48.44	58.60	3.20	DDW4C0833	833
1.7/8	BSP 1 1/2	44.45	48.44	58.60	2.50	DDW5C0833	833
2.1/8	BSP 1 3/4	50.42	54.89	69.85	3.20	DDW4C0834	834
-	BSP 2	56.26	60.58	73.03	3.20	DDW4C0836	836
-	BSP 2	56.26	60.58	73.03	2.50	DDW5C0836	836
-	BSP 2 1/4	62.36	66.68	79.50	3.20	DDW4C0838	838
-	BSP 2 1/2	71.50	76.08	90.17	3.20	DDW4C0839	839

Given values are maximum tolerances for standard Bonded Seals
 * BSP - British Standard Pipe



GM1000 Installation Recommendation - Metric

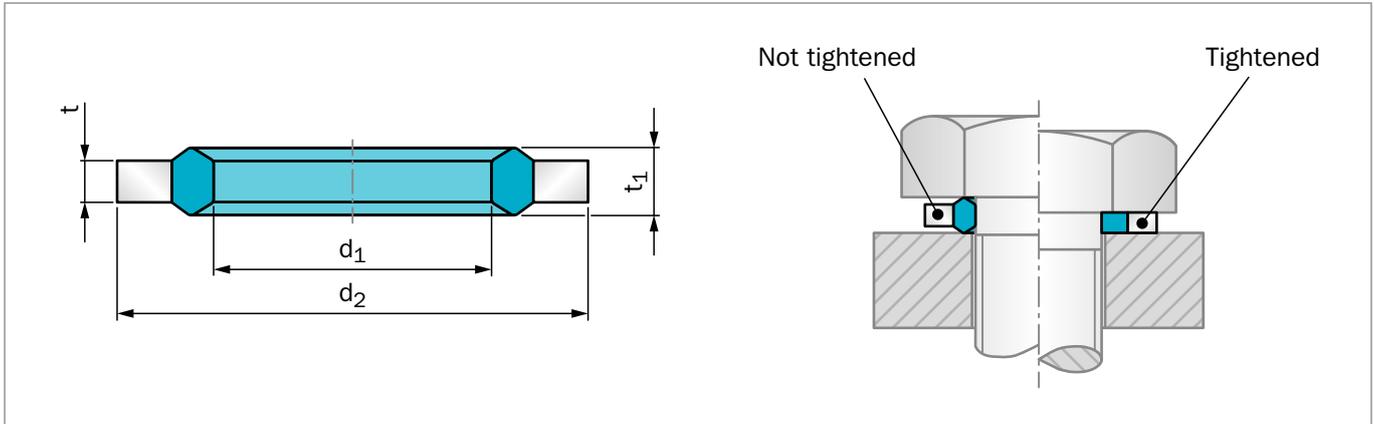


Figure 27: Installation drawing

ORDERING EXAMPLE

GM1000 for hexagon head cap screw M12

Dimensions:	Inside diameter	$d_1 = 12.0 \text{ mm}$
	Outside diameter	$d_2 = 18.9 \text{ mm}$
	Thickness	$t = 1.5 \text{ mm}$

Material:	Sealing lip of NBR 90 Shore A (N9M_H)
	Flat ring of steel (1.0540)
	Plating: Fe//Zn8//An//TO (metal code J)

TSS Article No.	DDG100M12 - N9MJH
TSS Part No.	_____
Quality Index (Standard)	_____
Material Code (Standard)*	_____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 18: GM1000 recommended metric dimensions

Metric Thread	d_1	Tolerance	d_2 ± 0.20	t_1 ± 0.20	t ± 0.20	TSS Part No.
M4	4	± 0.20	7.9	1.30	1.00	DDG100M4
M5	5	± 0.20	8.9	1.50	1.00	DDG100M5
M8	8	± 0.20	13.9	2.00	1.00	DDG100M8
M10	10	± 0.25	16.9	2.50	1.50	DDG100M10
M12	12	± 0.25	18.9	2.50	1.50	DDG100M12
M14	14	± 0.25	21.9	2.50	1.50	DDG100M14

Metric Thread	d_1	Tolerance	d_2 ± 0.20	t_1 ± 0.20	t ± 0.20	TSS Part No.
M16	16	± 0.25	23.9	2.50	1.50	DDG100M16
M18	18	± 0.25	26.9	3.00	2.00	DDG100M18
M20	20	± 0.35	29.9	3.00	2.00	DDG100M20
M22	22	± 0.35	31.9	3.00	2.00	DDG100M22
M24	24	± 0.35	35.9	3.00	2.00	DDG100M24
M30	30	± 0.35	45.9	3.00	2.00	DDG100M30

Given tolerances are maximum tolerances for standard Bonded Seals



GM2000 Installation Recommendation - Metric

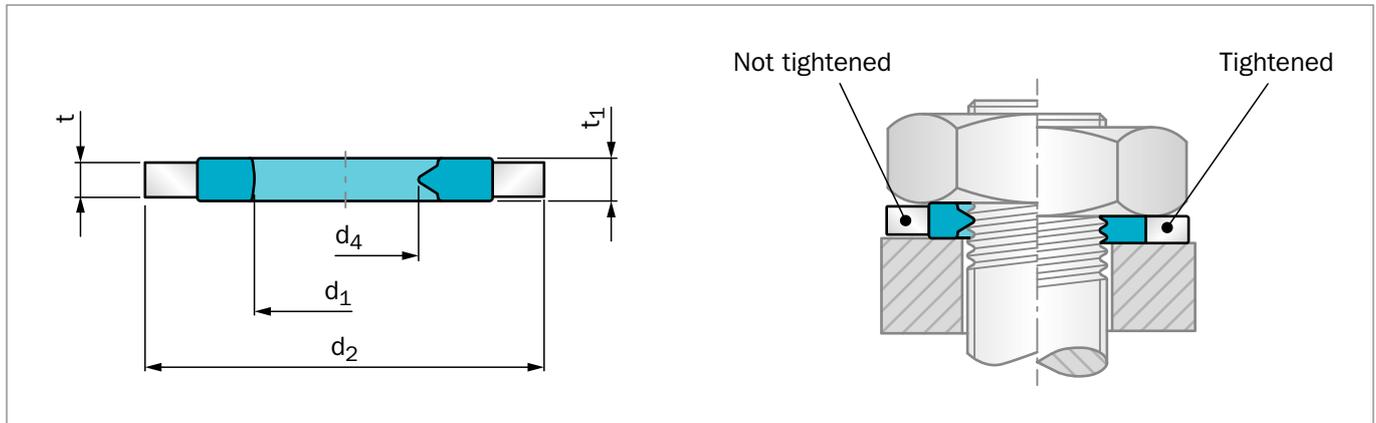


Figure 28: Installation drawing

ORDERING EXAMPLE

GM2000 for hexagon head cap screw M6

Dimensions:	Inside diameter	$d_1 = 6.2 \text{ mm}$
	Outside diameter	$d_2 = 9.9 \text{ mm}$
	Thickness	$t = 1.00 \text{ mm}$
Material:	Sealing lip of NBR 90 Shore A (N9M_H)	
	Flat ring of steel (1.0540)	
	Plating: Fe//Zn8//An//T0 (metal code J)	

TSS Article No. **DDG2000M6 - N9MJH**

TSS Part No. _____

Quality Index (Standard) _____

Material Code (Standard)* _____

* The material code is a combination of compound and metal code. For compound code (digits 1, 2, 3 and 5), see page 55, Table 5 and Table 6. For metal code (digit 4), see page 55, Table 7.

Table 19: GM2000 recommended metric dimensions

Metric thread	d_4	Tolerance	d_1	Tolerance	d_2	t_1	t	TSS Part No.
					± 0.15	± 0.30	± 0.20	
M4	3.1	± 0.15	4.2	± 0.2	7.9	1.80	1.00	DDG2000M4
M5	4.0	± 0.20	5.2	± 0.2	8.9	1.80	1.00	DDG2000M5
M6	4.7	± 0.20	6.2	± 0.2	9.9	1.80	1.00	DDG2000M6
M8	6.4	± 0.20	8.2	± 0.2	13.9	2.50	1.50	DDG2000M8
M10	8.1	± 0.20	10.2	± 0.2	16.9	2.50	1.50	DDG2000M10
M12	9.8	± 0.20	12.2	± 0.2	18.9	2.50	1.50	DDG2000M12
M14	11.5	± 0.25	14.2	± 0.2	21.9	3.00	2.00	DDG2000M14
M16	13.5	± 0.25	16.2	± 0.25	23.9	3.50	2.50	DDG2000M16
M18	14.8	± 0.25	18.2	± 0.25	26.9	3.50	2.50	DDG2000M18
M20	16.8	± 0.35	20.2	± 0.25	29.9	3.70	2.50	DDG2000M20
M22	18.8	± 0.35	22.2	± 0.25	31.9	3.70	2.50	DDG2000M22
M24	20.2	± 0.35	24.2	± 0.25	35.9	4.20	3.00	DDG2000M24
M30	25.5	± 0.35	30.2	± 0.35	45.9	4.20	3.00	DDG2000M30
M36	31	± 0.40	36.2	± 0.35	54.9	4.20	3.00	DDG2000M36

Given tolerances are maximum tolerances for standard Bonded Seals

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Dualseal

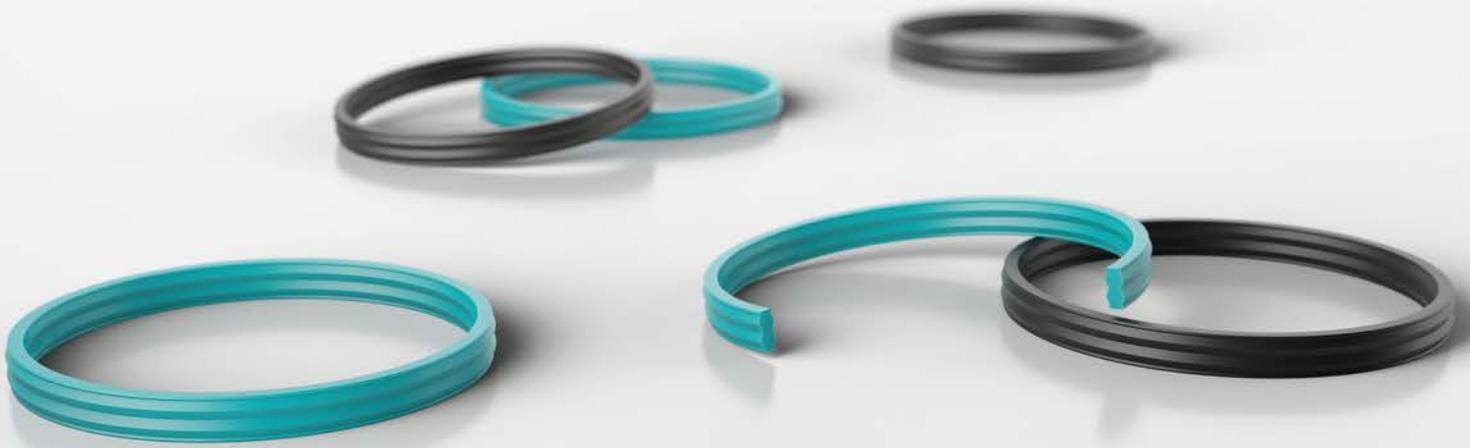


Single-acting/Double-acting

Radial sealing, for O-Ring grooves

Material:

Zurcon® and Elastomers



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■ Zurcon® Dualseal



DESCRIPTION

Current hydraulic cylinder designs mainly use O-Rings or O-Ring/Back-up Ring combinations as static seals. In applications with pressure pulses or where ingress of dirt is a concern,

Dualseal is the preferred solution. The single piece geometry is resistant to twisting during installation and operation and is an ideal solution for automatic assembly processes. High-specification Zurcon® material, combined with an innovative design, extends service life and increases reliability in fluid power applications.

FEATURES AND BENEFITS

- Single component with easy assembly
- No twisting in the groove
- Long service life
- High extrusion and abrasion resistance
- Wide temperature range and low compression set
- Stability under pulsating pressures
- Tighter fit within the groove

APPLICATION EXAMPLES

Dualseal is ideal for general use in hydraulic cylinders within:

- Forklifts
- Mobile hydraulics
- Industrial hydraulics
- Machine tools
- Injection molding machines
- Hydraulic presses
- Cartridge valves

OPERATING CONDITIONS

Pressure:	Max. 50 MPa / 7,250 psi
Temperature:	-35 °C to +110 °C -31 °F to +230 °F

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving these values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.



Table 20: Surface finish

Type of load	Surface	Rt µm	Rz µm	Ra µm
Axial-static	Mating surface	≤ 10.0	≤ 6.3	≤ 1.6
	Groove surface (groove bottom, groove flanks)	≤ 16.0	≤ 6.3	≤ 1.6
Under pulsating pressures	Mating surface	≤ 6.3	≤ 6.3	≤ 0.8
	Groove surface (groove bottom, groove flanks)	≤ 10.0	≤ 6.3	≤ 1.6

TESTING DATA

Dualseal operated without leakage and was highly extrusion resistant under the test conditions given in Table 21.

Table 21: Dualseal test conditions

	High pressure test	Pressure pulsation test
Pressure	40/52 MPa	30 MPa
Temperature	+100 °C / +80 °C	+60 °C (max. tank temperature)
Media	Hydraulic oil HLP 46	Hydraulic oil HLP 46
Test duration	72 h	500,000 Pressure pulsations

DESIGN INSTRUCTIONS

Correct design can help to eliminate possible sources of damage and seal failure from the outset.

Lead-in chamfers

Because Dualseal are squeezed during installation, lead-in chamfers and rounded edges are necessary.

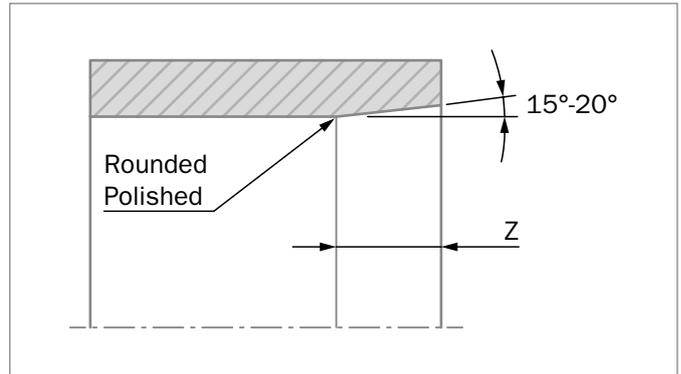


Figure 29: Lead-in chamfers

The minimum length of the lead-in chamfer is listed below as a function of groove depth:

Z = 3 mm for groove depth < 2.7 mm

Z = 5 mm for groove depth > 2.7 mm and ≤ 5.8 mm

Z = 6 mm for groove depth > 5.8 mm

Radial Clearance

Cylinder bore/gland fit H8/g6 is recommended.

Due to the high extrusion resistance of Zurcon® materials, a larger radial clearance can be used, depending on the maximum pressure and temperature in the application.

MATERIALS

Zurcon® Polyurethane has high abrasion resistance, a low compression set, high extrusion resistance and a wide temperature range.

Zurcon® Z20 Standard Polyurethane 93 Shore A

Temperature: -35 °C to +110 °C

Colour: Turquoise

Zurcon® Z22 Premium Polyurethane 93 Shore A

Temperature: -50 °C to +110 °C

Colour: Dark petrol

Other premium Zurcon® material grades that are able to extend temperature range or increase hydrolysis resistance are available on request.



Installation Recommendation Dualseal

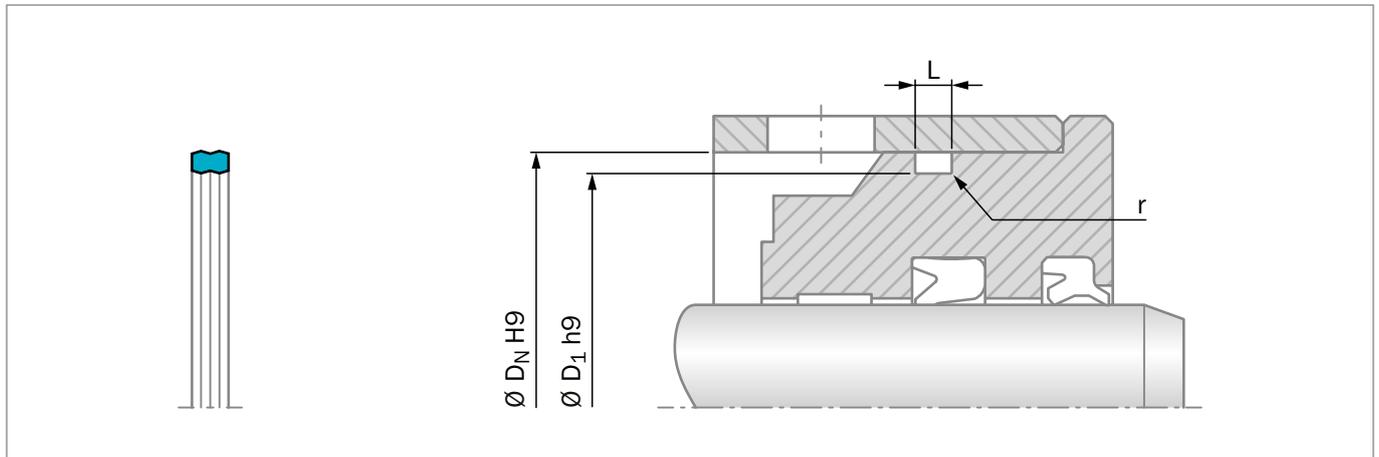


Figure 30: Installation drawing

Table 22: Installation Dimensions / TSS Part Numbers

Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.	Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.
D _N H8	D ₁ H9	L +0.2	R +0.1		D _N H8	D ₁ H9	L +0.2	R +0.1	
10.0	7.6	3.6	0.3	DU0000100	21.5	18.1	4.4	0.3	DU0000215
11.0	8.6	2.6	0.3	DU0000110	22.0	19.6	3.6	0.3	DU0000220
12.0	9.6	2.2	0.3	DU0100120	23.0	20.6	3.6	0.3	DU0000230
12.0	9.6	3.6	0.3	DU0000120	23.0	19.6	4.4	0.3	DU0100230
14.0	10.9	2.5	0.3	DU0000141	24.0	21.6	3.6	0.3	DU0100240
15.0	12.6	3.6	0.3	DU0000150	24.0	20.0	4.8	0.3	DU0000240
15.5	13.1	3.6	0.3	DU0000155	26.0	22.0	4.4	0.3	DU0000260
16.0	13.6	3.6	0.3	DU0000160	26.8	22.0	5.4	0.3	DU0000268
16.6	12.0	3.1	0.3	DU0000166	28.0	23.4	6.0	0.3	DU0100280
17.0	14.6	2.6	0.3	DU0000170	28.0	23.0	5.3	0.3	DU0000280
17.0	14.6	3.4	0.3	DU0100170	28.6	25.6	3.6	0.3	DU0000286
17.5	15.1	3.4	0.3	DU0100175	30.0	25.1	4.4	0.3	DU0000300
18.0	15.6	3.6	0.3	DU0000180	31.0	26.4	5.0	0.3	DU0000310
18.0	14.0	5.8	0.3	DU0100180	32.0	27.4	5.4	0.3	DU0000320
19.0	16.6	2.6	0.3	DU0200190	34.0	31.1	3.6	0.3	DU0100340
19.0	16.6	3.6	0.3	DU0300190	34.0	28.4	5.3	0.3	DU0000340
19.0	15.8	3.6	0.3	DU0400190	35.0	30.4	5.0	0.3	DU0000350
19.0	15.6	3.6	0.3	DU0000190	35.5	30.9	5.0	0.3	DU0000355
19.0	15.6	4.4	0.3	DU0100190	36.0	32.0	6.2	0.3	DU0000360
20.0	17.6	3.6	0.3	DU0400200	38.0	35.2	4.8	0.3	DU0100380
20.0	16.6	4.4	0.3	DU0100200	38.0	32.4	5.3	0.3	DU0000380
20.0	16.0	5.8	0.3	DU0000200	38.6	34.0	4.0	0.3	DU0000386
21.0	18.6	3.6	0.3	DU0100210	40.0	35.4	5.4	0.3	DU0100400
21.0	17.6	4.4	0.3	DU0000210	40.0	35.2	5.4	0.3	DU0000400



Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.	Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.
D _N H8	D ₁ H9	L +0.2	R +0.1		D _N H8	D ₁ H9	L +0.2	R +0.1	
42.0	36.4	4.8	0.3	DU0000420	80.0	75.4	5.4	0.3	DU0500800
43.4	37.8	6.2	0.3	DU0000434	80.0	74.4	5.3	0.3	DU0300800
45.0	40.0	5.4	0.3	DU0000450	80.0	74.3	5.3	0.3	DU0900800
45.6	41.0	4.0	0.3	DU0000456	80.0	73.8	6.9	0.3	DU0200800
48.0	44.4	4.5	0.3	DU0100480	80.0	73.6	6.4	0.3	DU0100800
50.0	45.4	3.9	0.3	DU0400500	80.0	70.8	9.0	0.6	DU0400800
50.0	45.4	5.4	0.3	DU0200500	80.6	76.0	4.0	0.3	DU0000806
50.0	44.6	6.2	0.3	DU0100500	85.0	79.4	5.3	0.3	DU0000850
50.0	44.4	5.3	0.3	DU0600500	85.1	80.5	3.9	0.3	DU0000851
50.0	44.3	5.3	0.3	DU0700500	86.4	80.0	5.5	0.3	DU0000864
50.0	43.8	5.6	0.3	DU0300500	90.0	84.4	4.8	0.3	DU0200900
52.0	47.9	3.6	0.3	DU0000520	90.0	83.0	6.5	0.3	DU0100900
55.0	51.0	3.6	0.3	DU0200550	90.0	81.4	9.0	0.6	DU0000900
55.0	49.9	5.3	0.3	DU0100550	93.0	87.4	5.3	0.3	DU0000930
55.0	49.6	6.2	0.3	DU0000550	94.0	89.5	3.8	0.3	DU0000940
57.0	52.2	4.1	0.3	DU0000570	95.0	89.4	6.2	0.3	DU0000950
60.0	55.0	5.3	0.3	DU0400600	100.0	94.3	5.3	0.3	DU0401000
60.0	54.6	6.2	0.3	DU0200600	100.0	93.8	6.9	0.3	DU0301000
60.0	54.4	5.8	0.3	DU0100600	100.0	91.6	8.6	0.3	DU0201000
63.0	58.4	5.4	0.3	DU0400630	100.0	91.4	9.0	0.6	DU0101000
63.0	57.6	6.2	0.3	DU0300630	100.0	90.8	9.7	0.6	DU0001000
63.0	57.4	4.8	0.3	DU0200630	101.0	96.0	5.0	0.3	DU0001010
63.0	57.3	5.3	0.3	DU0500630	101.0	94.6	6.7	0.3	DU0201010
63.0	56.6	6.4	0.3	DU0100630	102.0	95.8	6.2	0.3	DU0001020
65.0	60.4	5.0	0.3	DU0200650	104.0	99.5	3.8	0.3	DU0001040
65.0	59.6	6.2	0.3	DU0100650	108.0	98.9	7.2	0.6	DU0000988
65.0	59.4	5.0	0.3	DU0000650	110.0	104.5	4.5	0.3	DU0201100
68.0	62.7	5.0	0.3	DU0000680	110.0	101.4	9.0	0.6	DU0001100
69.6	65.0	3.9	0.3	DU0000696	111.4	105.0	5.5	0.3	DU0001114
70.0	65.0	5.0	0.3	DU0100700	112.0	105.8	6.2	0.3	DU0001120
70.0	64.6	6.2	0.3	DU0000700	113.0	107.4	5.3	0.3	DU0001130
70.0	61.3	8.0	0.6	DU0200700	115.0	107.0	6.5	0.3	DU0101150
72.0	66.4	5.0	0.3	DU0000720	115.0	106.6	8.6	0.3	DU0001150
72.6	68.0	3.8	0.3	DU0000726	117.0	108.4	9.0	0.6	DU0001170
73.5	70.0	5.0	0.3	DU0000735	120.0	113.0	6.0	0.3	DU0001200
74.6	70.0	3.8	0.3	DU0000746	120.0	111.6	8.6	0.3	DU0201200
75.0	69.6	6.2	0.3	DU0100750	125.0	119.8	6.8	0.3	DU0401250
75.0	69.4	5.3	0.3	DU0000750	125.0	119.3	5.3	0.3	DU0301250
76.4	70.0	5.5	0.3	DU0000764	125.0	116.6	8.6	0.3	DU0201250
77.0	70.8	6.2	0.3	DU0000770	125.0	116.4	9.0	0.6	DU0101250
78.0	73.0	5.0	0.3	DU0000780	125.0	115.8	9.7	0.6	DU0001250
80.0	76.0	3.6	0.3	DU0600800	127.7	122.0	5.4	0.3	DU0001277



Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.	Bore Dia.	Groove Dia.	Groove Width	Groove Radius	TSS Part No.
D_N H8	D_1 H9	L +0.2	R +0.1		D_N H8	D_1 H9	L +0.2	R +0.1	
128.0	119.6	8.6	0.3	DU0101280	165.0	155.8	9.7	0.6	DU0201650
133.0	124.6	8.6	0.3	DU0001330	170.0	160.8	9.7	0.6	DU0101700
133.4	125.0	7.0	0.3	DU0001334	170.0	158.4	12.3	0.6	DU0001700
137.0	128.6	8.6	0.3	DU0101370	180.0	171.6	8.6	0.3	DU0101800
140.0	134.6	8.6	0.3	DU0101400	180.0	168.4	12.3	0.6	DU0001800
140.0	130.8	9.7	0.6	DU0201400	188.2	180.0	7.0	0.3	DU0001882
140.0	128.4	12.3	0.6	DU0001400	188.6	180.0	9.0	0.6	DU0001886
148.4	140.0	7.0	0.3	DU0001484	190.0	178.4	12.3	0.6	DU0001900
150.0	141.6	8.6	0.3	DU0101500	200.0	194.3	5.3	0.3	DU0302000
150.0	140.8	9.7	0.6	DU0201500	200.0	191.6	8.6	0.3	DU0102000
150.0	138.4	12.3	0.6	DU0001500	200.0	188.4	12.3	0.6	DU0002000
158.4	150.0	7.0	0.3	DU0001584	208.6	200.0	9.0	0.6	DU0002086
160.0	154.3	5.3	0.3	DU0201600	225.0	213.0	10.9	0.6	DU0002250
160.0	150.8	9.7	0.6	DU0101600	228.6	220.0	9.0	0.6	DU0102286
160.0	148.4	12.3	0.6	DU0001600	250.0	238.0	10.9	0.6	DU0002500
165.0	156.6	8.6	0.3	DU0101650					

Other sizes available on request.

This table shows the possible range of available Dualseal dimensions. Not all sizes will always be available in stock. Contact your local Customer Solution Center for recommendations specific to your application.

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■ Elastomeric Dualseal



DESCRIPTION

Developed to address a need in the fluid power industry, the Elastomeric Dualseal is a one-piece alternative to O-Rings and Back-up Rings for static sealing. As a single component, it can easily retrofit existing standard ISO 3601-1/AS 568 O-Ring groove sizes and provides the advantage of improved performance in most applications.

As an addition to Trelleborg Sealing Solutions wide range of technically superior time-saving products for the fluid power industry, Elastomeric Dualseal is recommended for heavy-duty applications in cylinders and valves. Easy to install, the seal's features and benefits contribute to a long service life and ultimately increase reliability in applications.

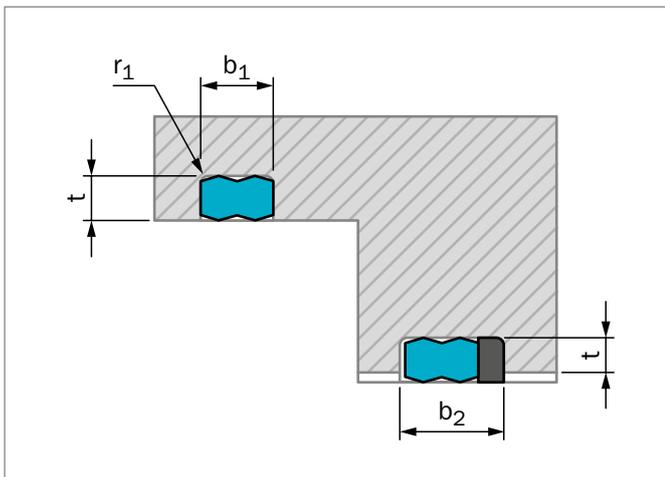


Figure 31: Elastomeric Dualseal installation drawing

FEATURES AND BENEFITS

- One-piece design ideal for automated assembly eliminates the risk of installing the wrong size
- Excellent sealing performance
- Compatible with the latest hydraulic fluids
- Extended service life
- Cost optimization
- Resistant to twisting post-installation
- Stability at pulsating pressures
- Low contamination

APPLICATION EXAMPLES

- Fork Lifts
- Industrial Hydraulics
- Mobile Hydraulics
- Machine Tools
- Cartridge Valves
- Hydraulic Presses
- Injection Molding Presses

OPERATING CONDITIONS

Pressure:	Up to 21 MPa / 3,000 psi
Temperature:	-30 °C to +100 °C -22 °F to +212 °F
Extrusion Gap:	0.15 mm / 0.005 inch max. radial
Media/ compatibility:	Petroleum-based Hydraulic Fluids (Refer to the Chemical Compatibility Guide to verify material applicability)

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.



TECHNICAL DATA

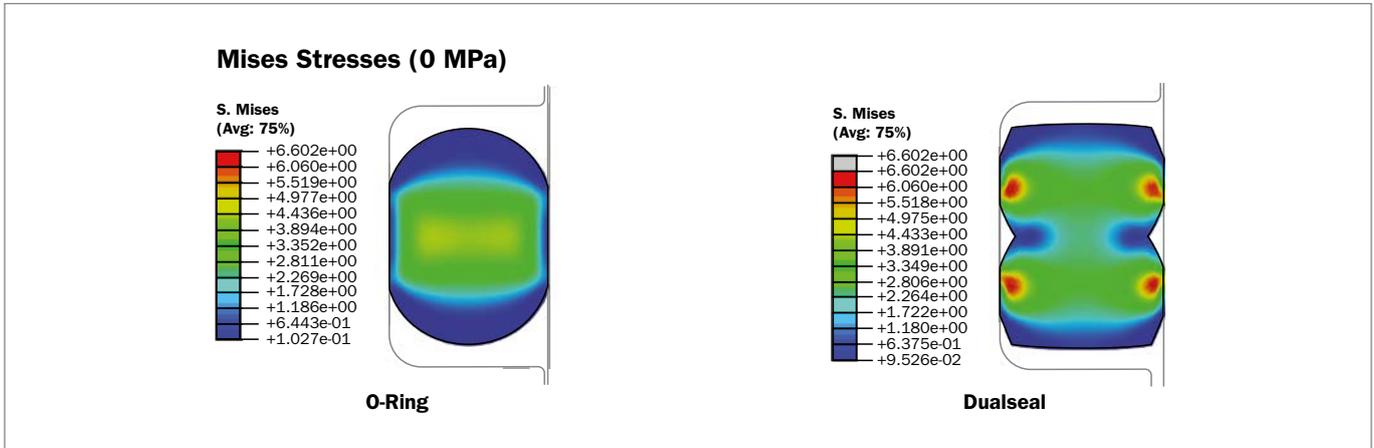


Figure 32: Elastomeric Dualseal, Mises Stresses

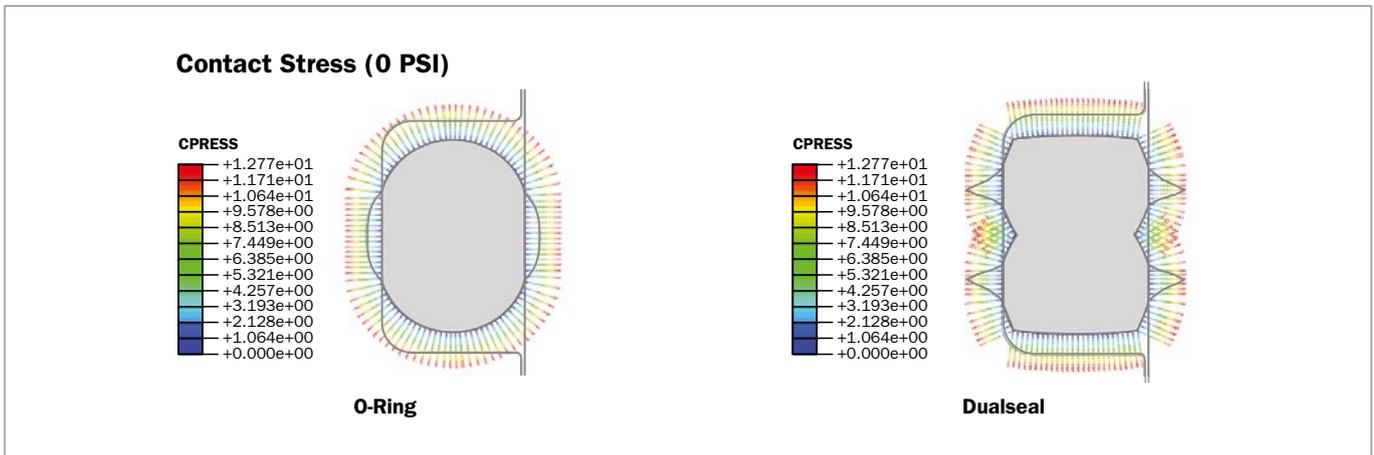


Figure 33: Elastomeric Dualseal, Contact Stress

HARDWARE GUIDELINES

- Zero Back-up Ring Dualseal (DUR00B***) is designed to replace an O-Ring (ISO 3601-1/AS568***) in industry standard grooves.
- Custom grooves can be utilized with the same design considerations for squeeze and occupancy as standard O-Rings.
- Take into consideration that the Zero Back-up Ring Dualseal has a volume approximately 7.5% larger than the O-Ring it replaces.
- In applications with groove occupancy calculated over 85% for the O-Ring, or expectations of high swell or high temperature, additional care should be taken during groove design.

- One Back-up Ring Dualseal (DUR10B***) is designed to replace an O-Ring (ISO 3601-1/AS568***) and a concave Back-up Ring made of NBR 90 Shore A in industry standard grooves.
- Standard surface quality specifications: TSS TBS-00051, AQL 1.0 ISO 2859-1, general inspection level II, normal.

Custom grooves can be utilized following the squeeze and area guidelines in Table 23.

**Table 23: Groove Dimensions**

ISO3601-1/AS568 Sizes	Cross-Section mm inch	Groove Depth (t) mm inch		0 Back-up Groove Area Minimum (t x b ₁)	1 Back-up Groove Area Minimum (t x b ₂)
		Minimum	Maximum	mm ² inch ²	mm ² inch ²
004 through 050	1.78	1.25	1.58	3.00	4.45
	0.070	0.049	0.062	0.0047	0.0069
102 through 178	2.62	1.97	2.42	7.32	8.94
	0.103	0.078	0.095	0.0113	0.0139
201 through 284	3.53	2.65	3.33	13.39	14.90
	0.139	0.104	0.131	0.0208	0.0231
309 through 395	5.33	4.00	5.13	30.82	34.11
	0.210	0.157	0.202	0.0478	0.0529
425 through 475	6.99	5.24	6.79	54.68	59.49
	0.275	0.206	0.267	0.0848	0.0922

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

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Seals for SAE J518 and ISO 6162-1 Flanges



Single-acting

Axial hydraulic sealing

Material:

Elastomers and polyurethane



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■ Seals for SAE J518 and ISO 6162-1 Flanges

DESCRIPTION

Flanges to the SAE J518 and ISO 6162-1 standards are among the most widely used static connections for high volume flows. They are functionally reliable and simple to assemble and dismantle. The individual elements for sealing these flanges can be Nitrile O-Rings, Nitrile rectangular rings, or Zurcon® Z20 polyurethane compact sealing rings (Type DRV5), specially developed for mobile hydraulic systems.

APPLICATION EXAMPLES

- Mobile hydraulics
- Injection molding machines
- Machine tools
- Presses
- Excavators
- Agricultural machines

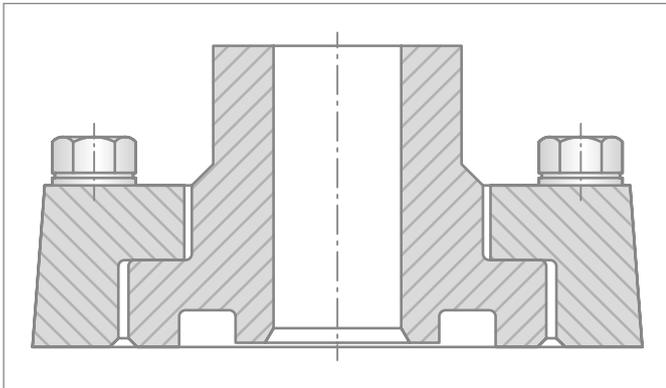


Figure 34: Flange in accordance with SAE J518



Table 24: Imperial dimensions of flange heads according to SAE J518 (see Figure 35)

Nominal Flange Size	D_N Max.	D_1 (Min. - Max.)	H (Min. - Max.)	L (Min. - Max.)
1/2"	0.5"	1" - 1.005"	0.155" - 0.175"	0.11" - 0.115"
3/4"	0.75"	1.25" - 1.255"	0.155" - 0.175"	0.11" - 0.115"
1"	1"	1.561" - 1.565"	0.155" - 0.175"	0.11" - 0.115"
1.25"	1.25"	1.75" - 1.755"	0.155" - 0.175"	0.11" - 0.115"
1.5"	1.5"	2.115" - 2.125"	0.155" - 0.175"	0.11" - 0.115"
2"	2"	2.49" - 2.5"	0.155" - 0.175"	0.11" - 0.115"

Table 25: Metric dimensions of flange heads according to ISO 6162-1 (see Figure 36)

Nominal Flange Size	d_2 Max.	d_{11} (Min. - Max.)	H (Min. - Max.)	L (Min. - Max.)
13	13.0 mm	25.40 - 25.53 mm	4.1 - 4.5 mm	2.8 - 2.9 mm
19	19.2 mm	31.75 - 31.88 mm	4.1 - 4.5 mm	2.8 - 2.9 mm
25	25.6 mm	39.62 - 39.75 mm	4.1 - 4.5 mm	2.8 - 2.9 mm
32	32.0 mm	44.45 - 44.58 mm	4.1 - 4.5 mm	2.8 - 2.9 mm
38	38.2 mm	53.72 - 53.98 mm	4.1 - 4.5 mm	2.8 - 2.9 mm
51	51.0 mm	63.25 - 63.50 mm	4.1 - 4.5 mm	2.8 - 2.9 mm

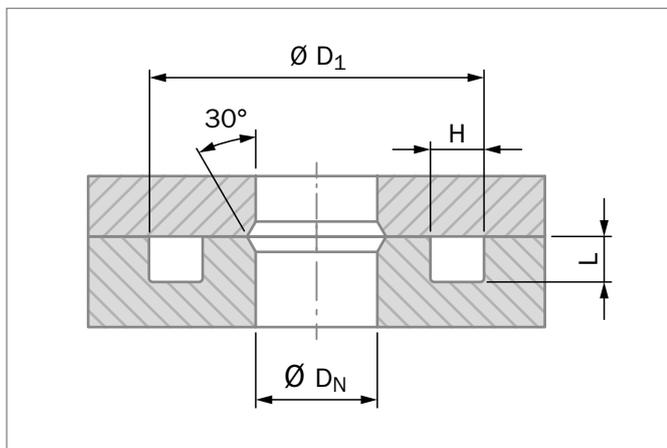


Figure 35: Flanged head according to SAE J518

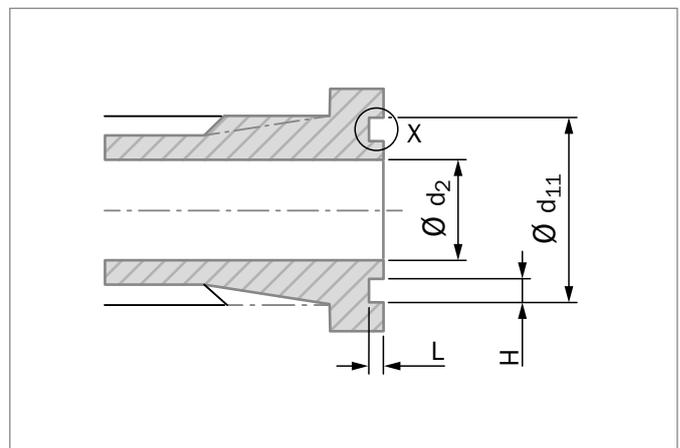


Figure 36: Flanged head according to ISO 6162-1



O-Ring

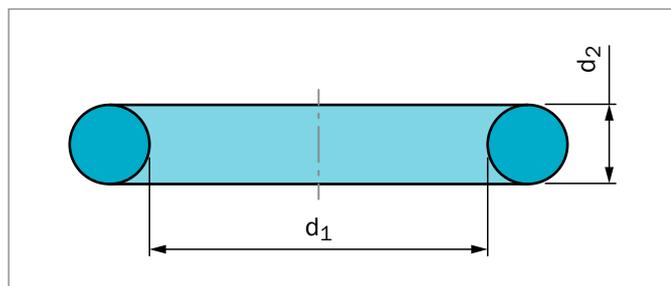


Figure 37: O-Ring in accordance with SAE J518

FEATURES AND BENEFITS

- Simple design
- Economical sealing
- Ex-stock availability

OPERATING CONDITIONS

Pressure:	Up to 21 MPa / 3,000 psi
Standard	NBR 90 Shore A
Material:	
Temperature:	-25 °C to +100 °C -13 °F to +212 °F
Media/ compatibility:	HL, HLP, HETG, HEPG, HEES and HFC hydraulic fluids

For more information on O-Ring tolerances and surface quality, see the Trelleborg Sealing Solutions O-Rings and Back-up Rings Catalog.

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.

ORDERING EXAMPLE

Type:	O-Ring, ISO 3601 / AS568, ref. 214
Dimensions:	Inside diameter $d_1 = 30.0 \text{ mm} / 1.181 \text{ inch}$ Cross section $d_2 = 3.0 \text{ mm} / 0.118 \text{ inch}$
Material:	NBR 90 Shore A

TSS Article No.	OR AR 00214 - N90
TSS Article - Group	OR
Standard ISO 3601-1/AS568	AR
Size Code (Dash-No.)	00214
Quality Index (Standard)	-
Material Code	N90

For O-Ring dimensions and TSS Part No. see Table 26.

For installation dimensions, see Table 24 and Table 25, page 84.

Ordering numbers can also be made using the O-Ring dimensions and material.

Table 26: Dimensions / TSS Part No.

Nominal flange size	d_1	d_2	TSS Part No.
1/2" / 13 mm	0.734" / 18.64 mm	0.139" / 3.53 mm	ORAR00210
3/4" / 19 mm	0.984" / 24.99 mm	0.139" / 3.53 mm	ORAR00214
1" / 25 mm	1.296" / 32.92 mm	0.139" / 3.53 mm	ORAR00219
1 1/4" / 32 mm	1.484" / 37.69 mm	0.139" / 3.53 mm	ORAR00222
1 1/2" / 38 mm	1.859" / 47.22 mm	0.139" / 3.53 mm	ORAR00225
2" / 51 mm	2.234" / 56.74 mm	0.139" / 3.53 mm	ORAR00228



■ Rectangular Seal

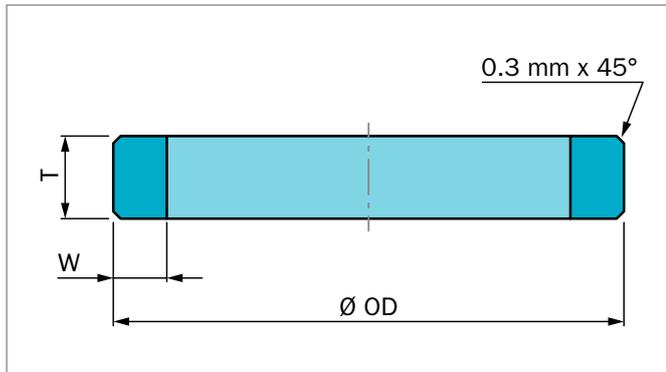


Figure 38: Rectangular Seal

FEATURES AND BENEFITS

- Minimal mechanical deformation of the cross-section
- Outstanding sealing behavior over long periods
- No twisting in the groove due to its rectangular profile
- Less sensitive to gap extrusion
- No relative movements during pressure cycles
- Dimensionally stable under pressure
- High leak-tightness
- Fits at the outer diameter due to its interference with the groove

OPERATING CONDITIONS

Pressure:	Up to 42 MPa / 6,000 psi
Standard	NBR 90 Shore A
Material:	
Temperature:	-25 °C to +100 °C -13 °F to +212 °F
Media/ compatibility:	HL, HLP, HETG, HEPG, HEES and HFC hydraulic fluids

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

For Rectangular Seal dimensions and TSS Part No. see Table 27.

For installation dimensions, see Table 24 and Table 25, page 84.

Ordering numbers can also be made using the O-Ring dimensions and material.

Table 27: Dimensions / TSS Article No.

Nominal flange size	OD	W	T	TSS Article No.
1/2" / 13 mm	1.018" / 25.85 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001482N90
3/4" / 19 mm	1.272" / 32.30 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001481N90
1" / 25 mm	1.581" / 40.15 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001480N90
1 1/4" / 32 mm	1.774" / 45.05 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001479N90
1 1/2" / 38 mm	2.142" / 54.40 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001484N90
2" / 51 mm	2.516" / 63.90 mm	0.110" / 2.8 mm	0.134" / 3.4 mm	DRYD001483N90



Zurcon® DRV5 Flange Seal

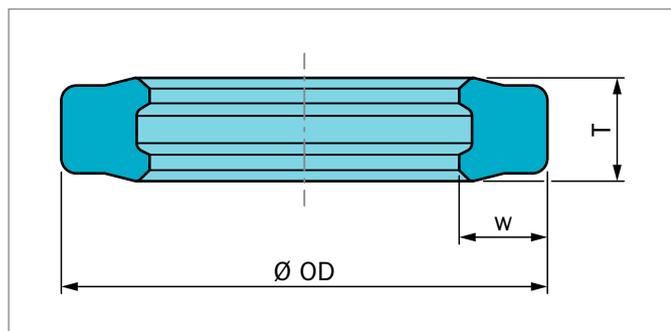


Figure 39: Zurcon® DRV5 Flange Seal

FEATURES AND BENEFITS

- Good abrasion resistance
- Usable with rough surface finishes
- Sealing edge offers improved sealing
- Very high resistance to extrusion
- Low compression set
- Prevents extrusion and nibbling
- Eliminates micro-pumping leakage
- Offers easy assembly – outside diameter interference and a symmetrical profile eliminate potential for errors on the assembly line
- Increases duty cycles

OPERATING CONDITIONS

Pressure:	Up to 42 MPa / 6,000 psi
Standard	Zurcon® Z20
Material:	polyurethane 93 Shore A
Temperature:	Zurcon® Z20 -35 °C to +110 °C -31 °F to +230 °F Zurcon® Z22 (Low temp.) -50 °C to +110 °C -58 °F to +230 °F
Media/ compatibility:	HL and HLP hydraulic fluids

IMPORTANT NOTE

The application limits for pressure and temperature given in this catalog are maximum values. Achieving the maximum values in the field may not be possible due to the interaction of operating parameters and media. Contact your local Customer Solution Center for more information.

ORDERING EXAMPLE

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

For DRV5 Flange Seal dimensions and TSS Part No. see Table 28.

For installation dimensions, see Table 24 and Table 25, page 84.

Ordering numbers can also be made using the O-Ring dimensions and material.

**Table 28: Dimensions / TSS Part No.**

TSS Part No.	Nominal flange size	OD	W	T
DRV500130	1/2" / 13 mm	1.018" / 25.85 mm	0.114" / 2.9 mm	0.134" / 3.4 mm
DRV500190	3/4" / 19 mm	1.266" / 32.15 mm	0.114" / 2.9 mm	0.134" / 3.4 mm
DRV500250	1" / 25 mm	1.575" / 40.00 mm	0.114" / 2.9 mm	0.134" / 3.4 mm
DRV500320	1.25" / 32 mm	1.768" / 44.90 mm	0.114" / 2.9 mm	0.134" / 3.4 mm
DRV500380	1.5" / 38 mm	2.142" / 54.40 mm	0.114" / 2.9 mm	0.134" / 3.4 mm
DRV500510	2" / 51 mm	2.516" / 63.90 mm	0.114" / 2.9 mm	0.134" / 3.4 mm

APPLICATION PARAMETERS OF ELASTOMERS

Elastomers, as all other organic chemicals, have limited use. External influences such as media, oxygen or ozone, as well as pressure and temperature, will affect the material properties and therefore their sealing capability.

Elastomers can swell, shrink or harden and develop cracks or even tears. Figure 3 and Figure 4 on pages 32 and 33, illustrate the performance of various elastomers under different application parameters.

Fluid Connector Seal DRV1

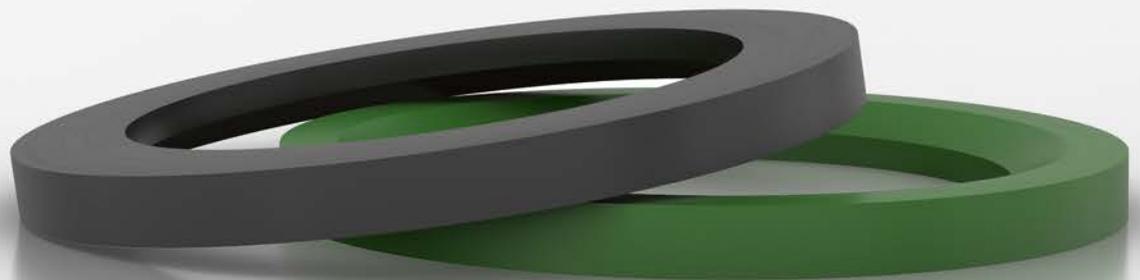


Single-acting

Axial hydraulic sealing

Material:

Elastomers



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■ Fluid Connector Seal DRV1



DESCRIPTION

In fluid power systems, power is transmitted and controlled through a pressurized fluid, either liquid or gas. Connections are made through the threaded ports on fluid conductor fittings to tubes and pipes or to hose fittings and hoses.

These ports, which are an integral part of fluid power components, such as pumps, motors, valves, cylinders, require a secondary seal to prevent metal-to-metal contact that potentially can cause leakage.

These secondary seals must withstand working pressures up to 63 MPa/ 9,137 psi, be compatible with lubricants and operate in a wide temperature range. Fluid Connector Seal DRV1 is an elastomer axial static seal for threaded ports and stud ends in hydraulic fluid power applications in accordance with ISO 1179 and ISO 9974. The seal is available in Nitrile rubber for good low temperature performance and fluoroelastomer for superior high temperature operation and media compatibility.

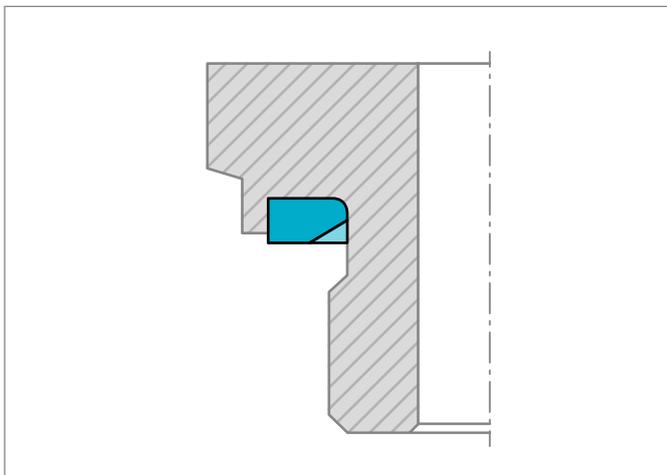


Figure 40: Fluid Connector Seal DRV1

FEATURES AND BENEFITS

- Prevents metal-to-metal contact
- Withstands working pressures up to 63 MPa/ 9,137 psi
- No relative movements during pressure cycles
- Cross-section remains virtually constant even under high pressure
- Minimal mechanical deformation of the cross-section
- No twisting in the groove

- Wide operating temperature range
- Good compatibility with lubricants
- Meets ISO 1179 and ISO 9974 specifications
- Secondary sealing function inhibits leakage
- High leak tightness compared to metal to metal sealing
- Outstanding sealing behavior
- Dimensionally stable under pressure
- Extended seal life
- Minimizes maintenance

APPLICATION EXAMPLES

- Injection molding machines
- Machine tools
- Presses
- Excavators
- Agricultural machines
- Valves for hydraulic circuits

OPERATING CONDITIONS

Pressure:	Up to 63 MPa / 9,137 psi
Temperature:	NBR 85 Shore A (black) -25 °C to +100 °C -13 °F to +212 °F
	FKM 80 Shore A (green) -18 °C to +200 °C 0 °F to +392 °F

IMPORTANT NOTE

The performance and operational reliability of this seal is related to the assembly techniques used. The application limits for pressure and temperature given in this leaflet are maximum values. During practical applications, it should be remembered that due to the interaction of operating parameters, the maximum values must be set correspondingly lower.



Installation Recommendation

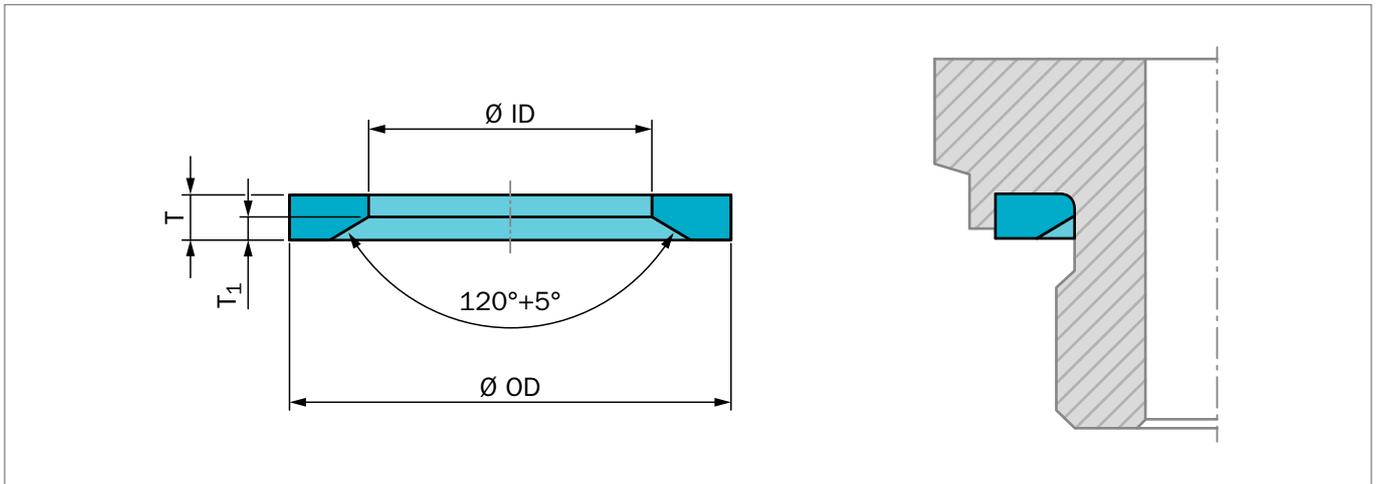


Figure 41: Installation drawing

Table 29: Installation Dimensions – Standard Recommendations

Thread metric	Thread inch	ØID mm	ØOD mm	T mm	T ₁ mm	TSS Part Number
M 10 x 1	G 1/8 A	8.4	11.9	1.0	0.5	DRV100084
M 12 x 1.5	-	9.8	14.4	1.5	0.8	DRV100098
M 14 x 1.5	G 1/4 A	11.6	16.5	1.5	0.8	DRV100116
M 16 x 1.5	-	13.8	18.9	1.5	0.8	DRV100138
-	G 3/8 A	14.7	18.9	1.5	0.8	DRV100147
M 18 x 1.5	-	15.7	20.9	1.5	0.8	DRV100157
M 20 x 1.5	-	17.8	22.9	1.5	0.8	DRV100178
-	G 1/2 A	18.5	23.9	1.5	0.8	DRV110185
M 22 x 1.5	-	19.6	24.3	1.5	0.8	DRV100196
M 27 x 2	G 3/4 A	23.9	29.2	1.5	0.8	DRV100239
M 33 x 2	G 1 A	29.7	35.7	2.0	1.0	DRV100297
M 42 x 2	G 1 1/4 A	38.8	45.8	2.0	1.0	DRV100388
M 48 x 2	G 1 1/2 A	44.7	50.7	2.0	1.0	DRV100447

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

XploR™ S-Seal and Xplor™ FS-Seal



Double-acting

Oil & gas wellhead, tubing and casing hanger

Material:

XploR™ HNBR, FKM, FFKM,
other elastomers



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■ XploR™ S-Seal and XploR™ FS-Seal



DESCRIPTION

Commonly known as spring seals, the XploR™ S-Seal and XploR™ FS-Seal from Trelleborg Sealing Solutions are custom engineered, spring-energized elastomer seals. They combine the benefits of integral support components with the flexibility of an elastomer seal, offering maximum extrusion resistance in demanding high pressure sealing environments, such as those found within oilfield casing and tubing applications.

In the XploR™ S-Seal and XploR™ FS-Seal, sealing is achieved by controlled deformation of the elastomer element. Optimal stress distribution throughout the elastomer body is modelled through Finite Element Analysis (FEA) to ensure high performance sealing coupled with long seal life. Extrusion resistance is provided by the specially designed integral steel springs that provide support to the rubber, yet are flexible to allow straightforward installation.

The seals are manufactured in the Trelleborg Sealing Solutions range of XploR™ Rapid Gas Decompression (RGD) and sour gas resistant elastomers, together with corrosion-resistant steel springs. This allows custom sealing solutions to be engineered to suit specific oil field conditions, including the requirements of high temperature, high pressure (HTHP) environments.

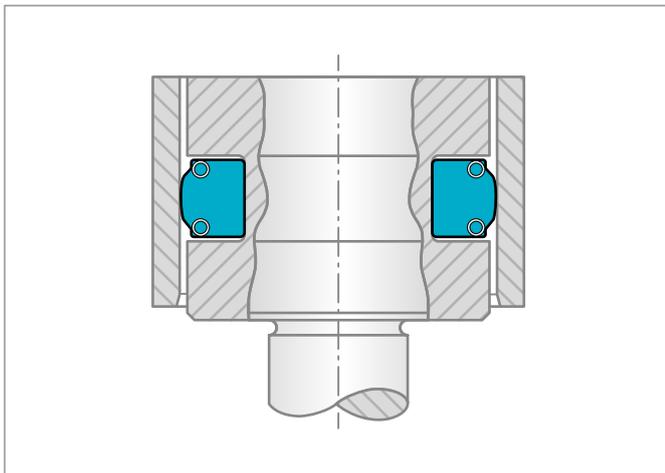


Figure 42: XploR™ S-Seal

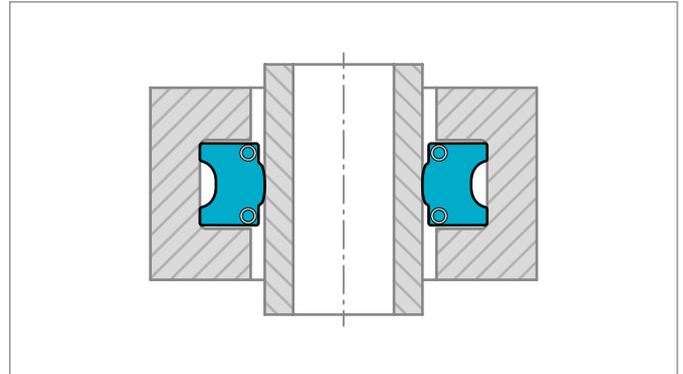


Figure 43: XploR™ FS-Seal

FEATURES AND BENEFITS

- Single piece bidirectional seal for high pressure applications
- Integrally molded helical springs provide a high level of extrusion resistance in a single piece, compact sealing element
- Flexibility given by the springs allows installation in closed grooves
- Elastomer sealing element provides leak tightness against sub-optimal tubing surface finishes
- Custom-engineered to fit existing tube sizes
- Materials certified to Norsok, API and Total standards for demanding downhole environments
- Withstand pressures up to 103.4 MPa / 15,000 psi
- Temperature resistance up to +200 °C / +392 °F

APPLICATION EXAMPLES

- High pressure wellhead sealing environments such as casing strings and tubing hangers
- Static HPHT Connections
- Downhole Tools
- Subsea Risers



OPERATING CONDITIONS

Pressure:	Up to 103.4 MPa / 15,000 psi
Temperature:	-20 °C to +200 °C / -4 °F to +392 °F (depending on elastomer material)
Media/compatibility:	Mineral oil, synthetic fluids, water-based hydraulic fluids and other media depending on elastomer material selection.

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g, the maximum operating speed depends on material type, pressure, temperature and gap value. Temperature range also depends on media.

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.

Engineered Seals, Gaskets & other Parts



ENGINEERED MOLDED PARTS (EMP) BROCHURE



For more information on custom solutions, see the Engineered Molded Parts (EMP) brochure at www.trelleborg.com/seals/literature.



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Engineered Molded Parts

MATERIALS: Elastomeric, Polyurethane, Other Polymeric

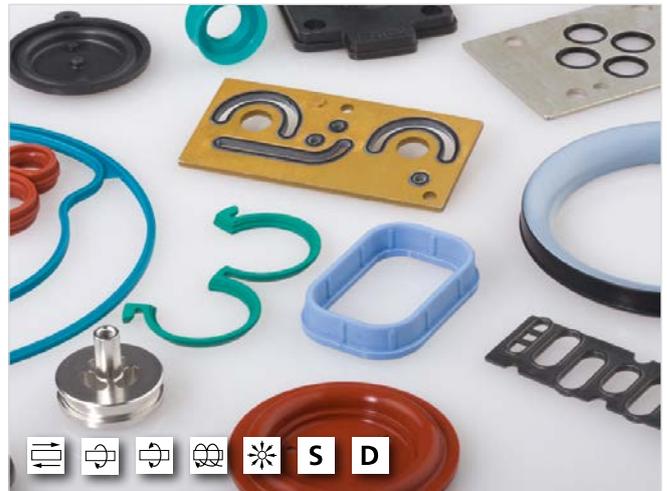
Customized seals and other components in a wide range of standard and specialized elastomers, including Isolast®, are manufactured to close tolerances for all types of industries and applications. As your development partner, Trelleborg Sealing Solutions can work with you to design, develop and supply custom engineered molded parts to suit your application requirements.

APPLICATIONS: various custom applications across all industries from a wide range of materials

Temperature Range

up to +325 °C

up to +617 °F



Engineered PTFE Components

MATERIAL: PTFE

A wide range of filled and unfilled engineered PTFE components are made available to all types of industry. They include valve seats, pump diaphragms, chevron packings, nozzles, bellows, guides, bearings and electrical insulators. These are developed in conjunction with Trelleborg Sealing Solutions to the specific requirements of the customer.

APPLICATIONS: various custom applications

Temperature Range

up to +260 °C

up to +500 °F



Engineered High Performance Plastics

MATERIAL: HiMod®

A wide range of high performance, high modulus thermoplastics are available for use as custom molded components, reinforcing rings and Back-up Rings. Grades can optimize operation on structural, chemical, electrical and high performance bearing applications.

APPLICATIONS: various custom applications across all industries from a wide range of materials

Temperature Range

up to +300 °C

up to +572 °F





HMF FlatSeal™

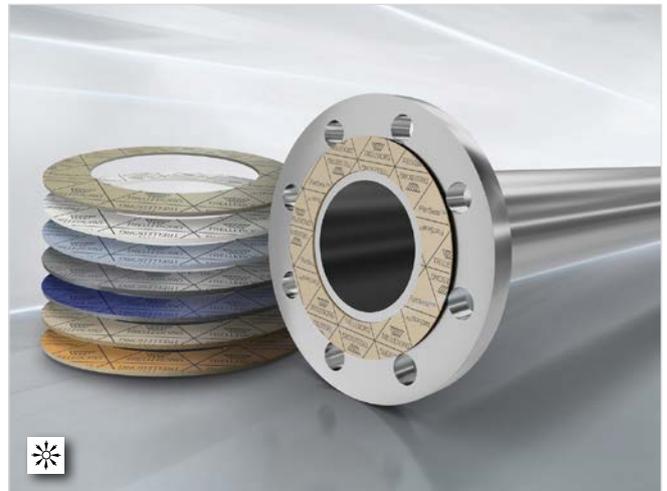
MATERIALS: Fiber, Graphite, PTFE, Mica and Elastomeric

Flat gaskets are used to seal housings, flanges in pipework, covers and lids, for example.

A wide range of material types is available to meet specific requirements and regulations for multiple industries.

APPLICATIONS: aerospace, automotive, chemical and processing, energy, oil and gas, food, beverage and pharmaceutical

Pressure Range	Temperature Range
up to 25 MPa	-270 °C +1,000 °C
up to 3,625 psi	-454 °F +1,832 °F



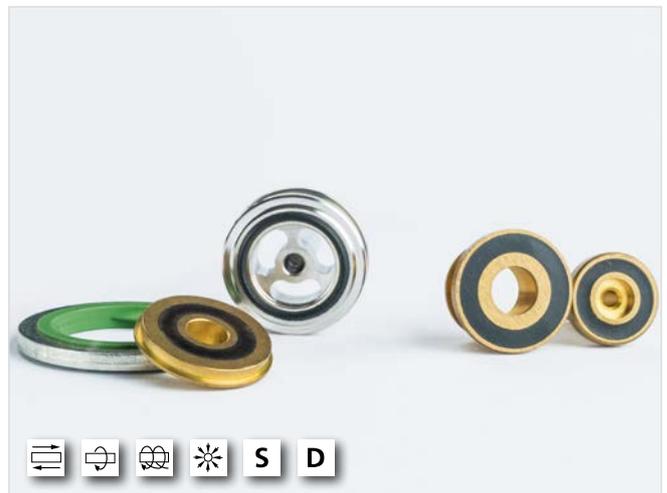
Rubber-to-Metal Bonded Parts

MATERIALS: PTFE, Elastomeric, Other Polymeric, Metal

In many applications, a composite molded part has advantages in terms of technical robustness, quality, performance and total cost of ownership. Bonding of either standard or specialized elastomers, including Isolast®, is feasible with a large variety of metals and thermoplastics. As your development partner, Trelleborg Sealing Solutions can work with you to design and develop products to suit your application requirements.

APPLICATIONS: various custom applications across all industries from a wide range of materials

Temperature Range
-60 °C +325 °C
-76 °F +617 °F



Rubber and Rubber-to-Metal Bonded Gaskets

MATERIALS: Elastomeric, Metal

Precision homogeneous or Rubber-to-Metal bonded gaskets are custom molded from a variety of elastomers for high-performance engine and other applications. Metals such as cold-rolled or stainless steel, brass or aluminum can be offered and bonded to any elastomer. As your development partner, Trelleborg Sealing Solutions can work with you to design, develop and supply gaskets to suit your application requirements.

APPLICATIONS: various custom applications across all industries from a wide range of materials

Temperature Range
-60 °C +325 °C
-76 °F +617 °F





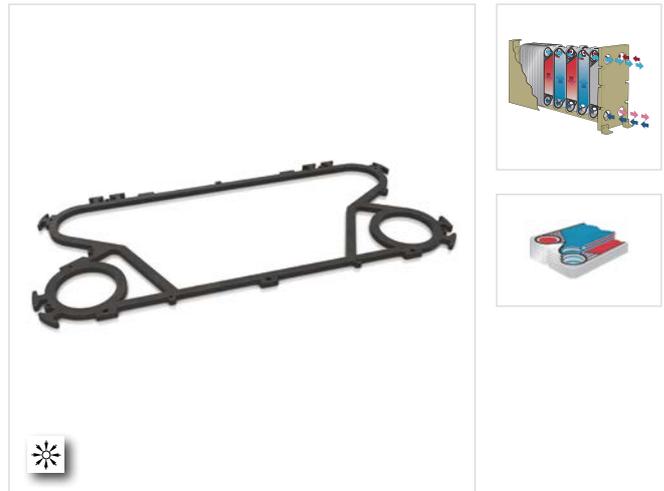
Plate Heat Exchanger Gaskets

MATERIALS: NBR, HNBR, EPDM, CR, IIR, FKM, AFLAS, VMQ

Plate heat exchangers offer a highly efficient means of heating or cooling fluid media. Plate heat exchangers employing gaskets between the heating and cooling plates are widely used in many types of industry.

APPLICATIONS: chemical processing, food and beverage, HVAC, oil and gas, refrigeration, marine

Ø Range	Pressure Range	Temperature Range
Length: up to 2900 mm or higher (by joining) Width: up to 1450 mm	0 to 50 bars	-60 °C +200 °C
Length: up to 114 in or higher (by joining) Width: up to 57 in	0 to 725 psi	-76 °F to +392 °F



Liquid Silicone Rubber (LSR) Molded Parts

MATERIAL: Elastomeric

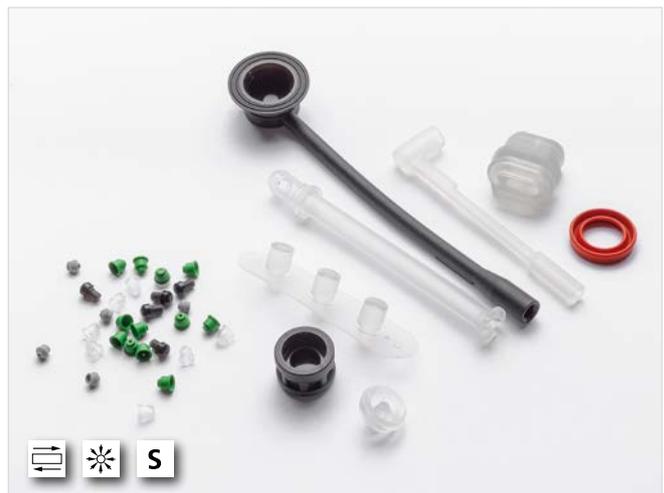
High-precision LSR parts, often delicate or micro-sized, are increasingly specified across many industrial sectors including medical and pharmaceutical, household appliances, electrical, and electronic. High-precision toolmaking and state-of-the-art fully automated liquid injection molding are the basis for custom-engineered parts into applications where consistent precision, quality and performance reliability in high quantities are critical in application.

APPLICATIONS: custom applications including life sciences, food and pharmaceutical, sanitary and automotive

Temperature Range

-40 °C +175 °C

-40 °F +347 °F



Multicomponent Solutions

MATERIALS: Elastomeric, Other Polymeric, FKM, EPDM, TPE, LSR

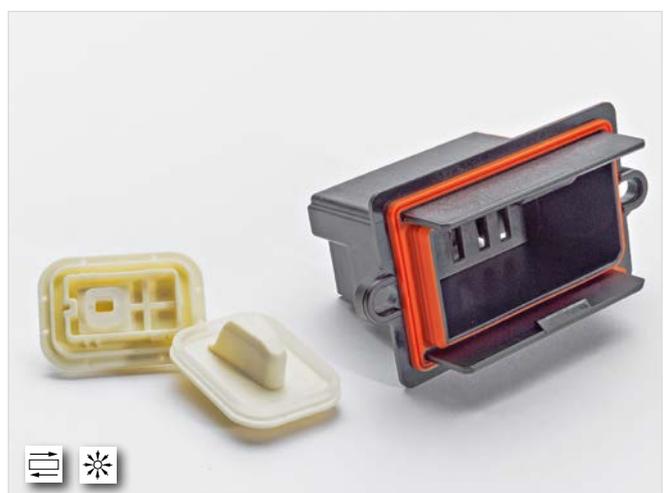
Specialized tool design and process engineering are the foundation of our advanced multicomponent injection technology, allowing the design and production of complex, high-precision hard-soft or soft-soft product solutions. Multicomponent solutions allow the integration of multiple functions into a single robust component. It increases design latitude and eliminates the need for secondary handling and assembly operations.

APPLICATIONS: various custom applications including life sciences, food and pharmaceutical and automotive

Temperature Range

-40 °C +175 °C

-40 °F +347 °F





Rubore® Seals

MATERIALS: PTFE, Elastomeric, Metal

The Rubore® process is a unique rubber-metal layering technology permitting complex seal designs that have never before been possible. Rubore® Seals provide overall cost benefits, reducing weight and frequently eliminate the need for surface finishing and after treatments. The stiffness of the product reduces handling costs and logistics requirements, and makes automated seal installation achievable.

APPLICATIONS: rubber-metal composite for custom-made applications, various possible geometries and designs

Temperature Range

-40 °C +165 °C

-40 °F +329 °F



Wills Rings®



Single-/Double-acting

Axial sealing

Material:

Metals



WILLS RINGS® CATALOG



For more information on this product, see the full Wills Rings® Catalog at www.trelleborg.com/seals/literature.



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■ Wills Rings®



DESCRIPTION

Wills Rings® are superior controlled-compression type seals used in static applications which can withstand extreme conditions that exceed the capabilities of elastomer and polymer seals. The seals are constructed from high quality metal tubing or strip in standard or thin wall thicknesses and are often coated or plated with a softer material to increase their sealing performance.

They are metallic seals and are available in two designs and five types (see Figure 44).

The designs are:

- **Wills Rings® O**
Consist of a tube formed into a circular profile.
- **Wills Rings® C**
Similar to Wills Rings® O but with an open 'C' cross section. The open slot of the Wills Rings® C faces toward the system pressure and allows the seal to be pressure activated.

FEATURES AND BENEFITS

- Temperature range from cryogenic to +850 °C / +1,550 °F
- Pressure range from ultra-high vacuum to 1,000 MPa / 145,000 psi
- Compatible with a large range of media
- Corrosion resistant and radiation tolerant
- Simple and reliable sealing
- No outgassing
- Immune to rapid gas decompression
- Wide range of sizes

APPLICATION EXAMPLES

- Nuclear power plants
- Furnaces
- Offshore and marine installations
- Cryogenic situations
- Ultra-high vacuum systems
- Fire safe valves
- Plastic processing plants
- High-performance vehicles

Wills Rings® can be customized to suit the specific requirements of a system. Contact your local Customer Solution Center for more information.

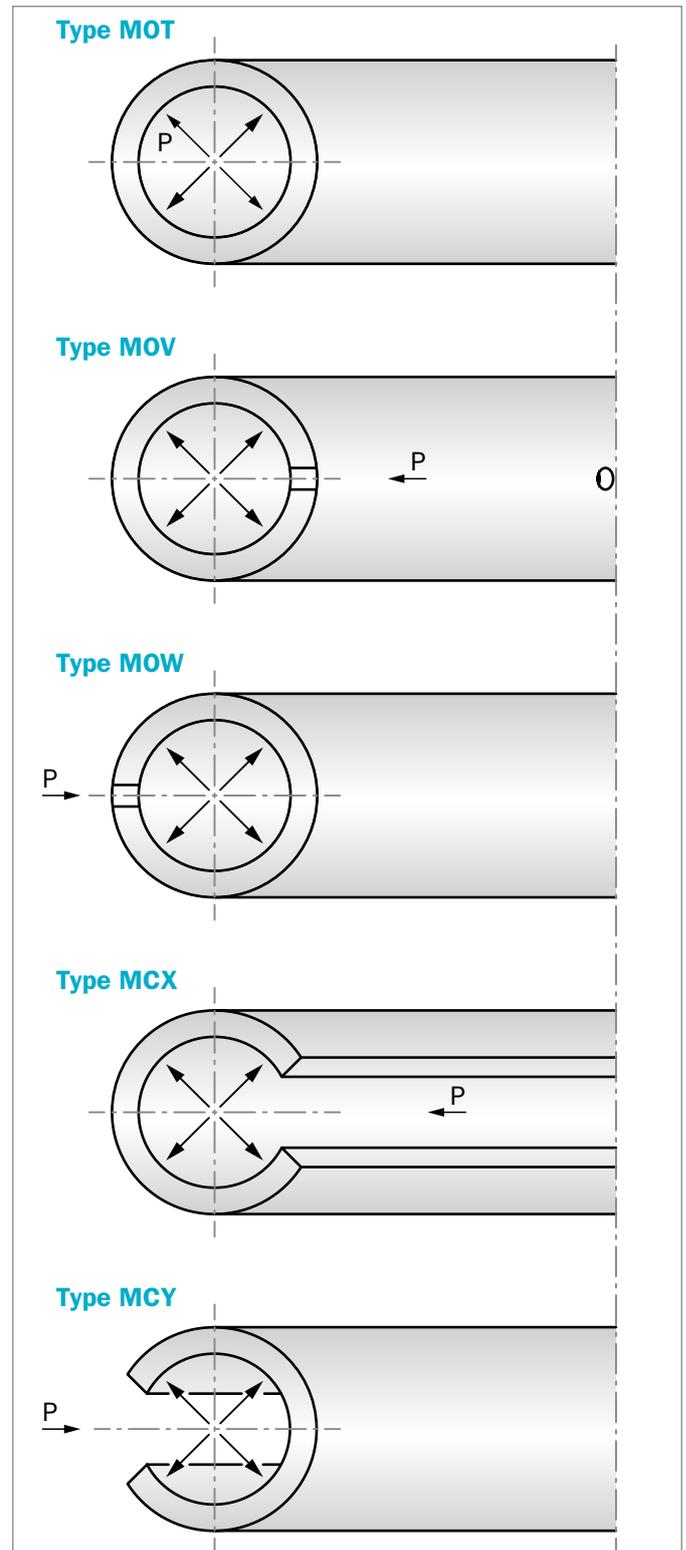


Figure 44: Wills Rings® variations



OPERATING CONDITIONS

Pressure:	Ultra-high vacuum to 1,000 MPa / 145,000 psi
Temperature:	Up to +850 °C / +1,550 °F (depending on material and design)
Materials:	Stainless steel 316 L and 321, Inconel® 600, X750 and 718, all with Silver Nickel plating

Alternative ring and plating materials can be offered. If further information on seal selection is required please contact your local Customer Solution Center. Inconel® is a trademark of INCO Alloys International, Inc.

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g. the maximum operating speed depends on material type, pressure, temperature and gap value. Temperature range also depends on media.

METHOD OF OPERATION

Because Wills Rings® are constructed from metal, their ability to handle extreme conditions exceeds that of polymeric and elastomeric seal types.

Unlike elastomer seals, Wills Rings® are not subject to outgassing, making them suitable for use on equipment sensitive to it.

Wills Rings® consist of a metal ring, often coated, which is used as a deformable seal in a static sealing situation. The ring is located between two flanges and undergoes a controlled compression.

Wills Rings® are defined by their free height, which is the cross section in the axial direction of the seal (Figure 45). The free height, d_2 , of the seal is compressed down to the groove depth, h .

The resistance of the ring to compression enables it to generate a sealing force when compressed. The resilient effect of the seal can be increased by pressurizing the internal volume of the ring (see Type MOT gas-filled Wills Rings® O).

Alternatively, if the system to be sealed is very high pressure, the pressure can be used to provide additional sealing effect. This is called system actuation and is achieved by allowing the pressure to enter the seal through vent holes (see Type MOV or the open C slot, Type MCX).

Wills Rings® have a certain degree of elasticity. This is known as springback. The springback is the elastic part of the seal deflection when it is installed in a groove. This dictates the seal's ability to absorb or compensate for hardware variations due to temperature and/or pressure loadings thus maintaining the seal integrity (Figure 45).

A softer plating or coating material can be applied to Wills Rings® to maximize sealing performance in demanding applications. The coating material yields during the ring compression and fills surface machining marks (Figure 46).

For best sealing results, Wills Rings® should be replaced each time the groove housing is dismantled as the plating material deforms from use and performance cannot be guaranteed again once the housing is dismantled.

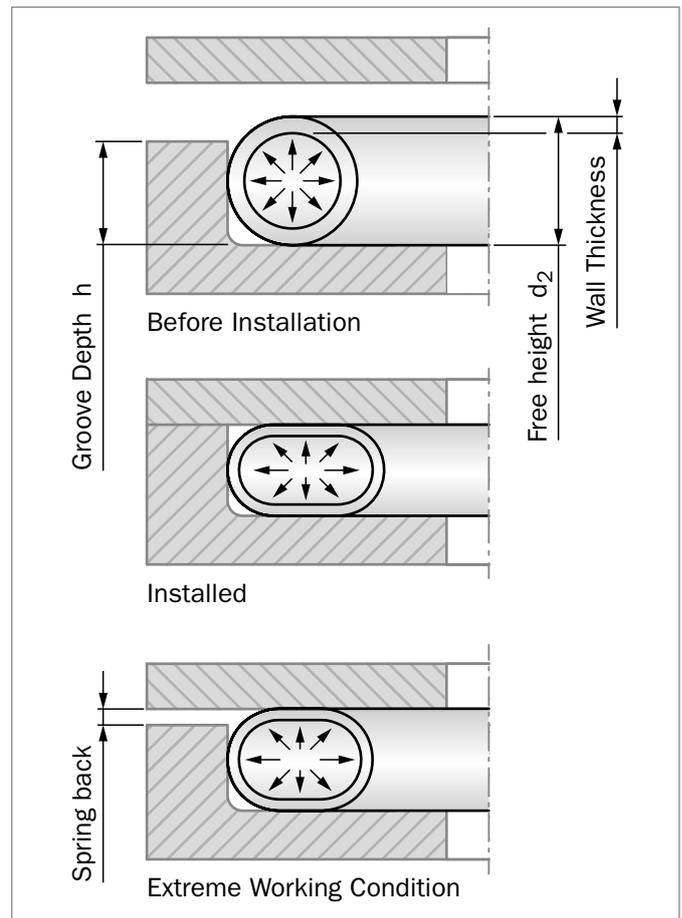


Figure 45: Method of seal operation

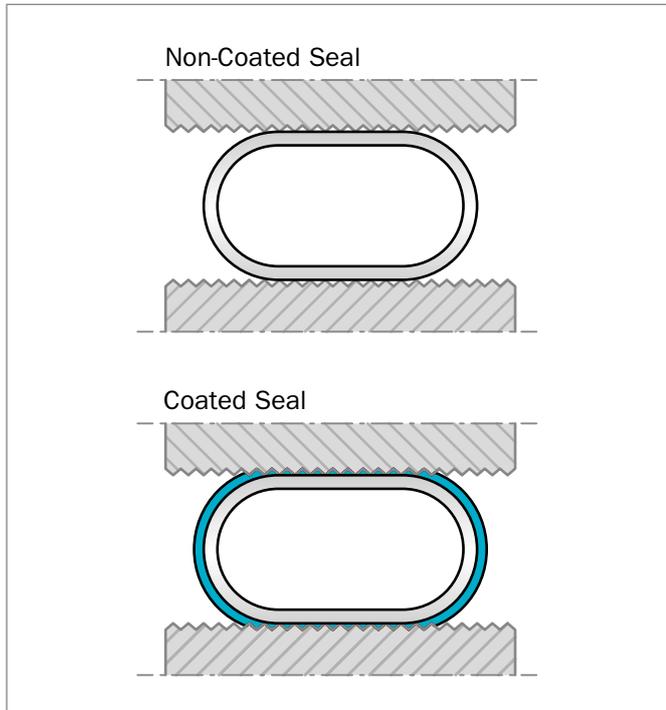


Figure 46: Contact surface for coated and non-coated Wills Rings®

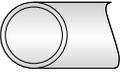
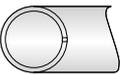
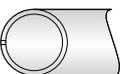
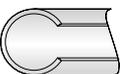


SELECTION TABLE

Use this table to select the optimum seal for an application. A, B or C indicates relative performance.

Further information can be found on the relevant pages as indicated.

Table 30: Selection Criteria

Seal		Extreme Conditions	Seating Loads	Spring-back	Vacuum Sealing	Pressure MPa/psi	Max. Working Temp. °C / °F	Standard Material	
Code								Seal	Coating
Type MOT 	Pressurized	A	C	C	1x10 ⁻⁹ mbar.l.s. ⁻¹	20 MPa 2,900 psi / 40 MPa 5,800 psi	850 °C 1,550 °F	Stainless Steel 316 L Stainless Steel 321 Inconel® 600	Silver Nickel
Type MOV 	Vented internal	B	B	C	-	1,000 MPa 145,000 psi	600 °C 1,100 °F		
Type MOW 	Vented external								
Type MCX 	Internal pressure	B	A	A	1x10 ⁻⁷ mbar.l.s. ⁻¹	200 MPa 29,000 psi	750 °C 1,375 °F	Inconel® X750 Inconel® 718	Silver Nickel
Type MCY 	External pressure								

Properties: A = Excellent B = Good C = Satisfactory

If further information on seal selection is required please contact your local Customer Solution Center. Inconel® is a trademark of INCO Alloys International, Inc.

ORDERING

For more information on this product, or for orders and enquiries, see the full Wills Rings® Catalog at www.trelleborg.com/seals/literature or contact your local Customer Solution Center.

Turcon® Variseal® H and Turcon® Variseal® HF



Single-acting

Radial and axial sealing

Material:

Turcon®



TURCON® VARISEAL® CATALOG



For more information on this product, see the full Turcon® Variseal® Catalog at www.trelleborg.com/seals/literature



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Turcon® Variseal® H



DESCRIPTION

Turcon® Variseal® H is a single-acting seal consisting of a U-shaped jacket and a helical wound corrosion-resistant spring.

The helical spring of Variseal® H has a high spring loading, which gives excellent sealing integrity at low pressure.

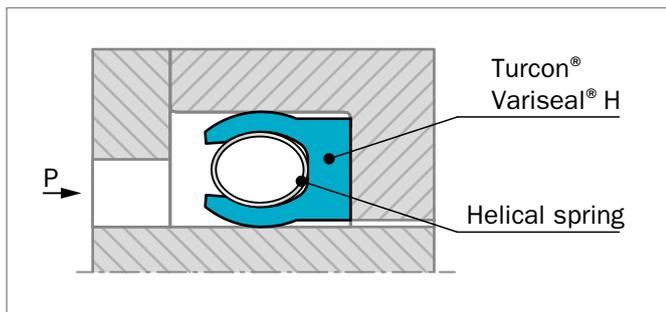


Figure 47: Turcon® Variseal® H

FEATURES AND BENEFITS

- High contact pressure
- Excellent sealing integrity in gas and fluid applications
- Withstands rapid changes in temperature
- Good sealing ability when surfaces are not ideal
- Excellent resistance to aging
- Interchangeable with O-Ring and Back-up Ring in most cases

APPLICATION EXAMPLES

- Compressors
- Ball valves
- Construction - equipment and plant
- Chemical processing
- Crude oil and natural gas installations
- Cryogenic engineering
- Nuclear power engineering
- Vacuum applications
- Pivot joints
- Gas chromatographs

OPERATING CONDITIONS

Pressure:	Maximum static load 40 MPa / 5,800 psi (207 MPa / 30,000 psi with custom designs)
Temperature:	-100 °C to +200 °C / -148 °F to +392 °F
Media/compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g. the maximum operating speed depends on material type, pressure, temperature and gap value.
Temperature range also depends on media.

ORDERING

For more information on this product, or for orders and enquiries, see the full Turcon® Variseal® Catalog at www.trelleborg.com/seals/literature or contact your local Customer Solution Center.



Installation Recommendation for Rod Seals - Turcon® Variseal® H

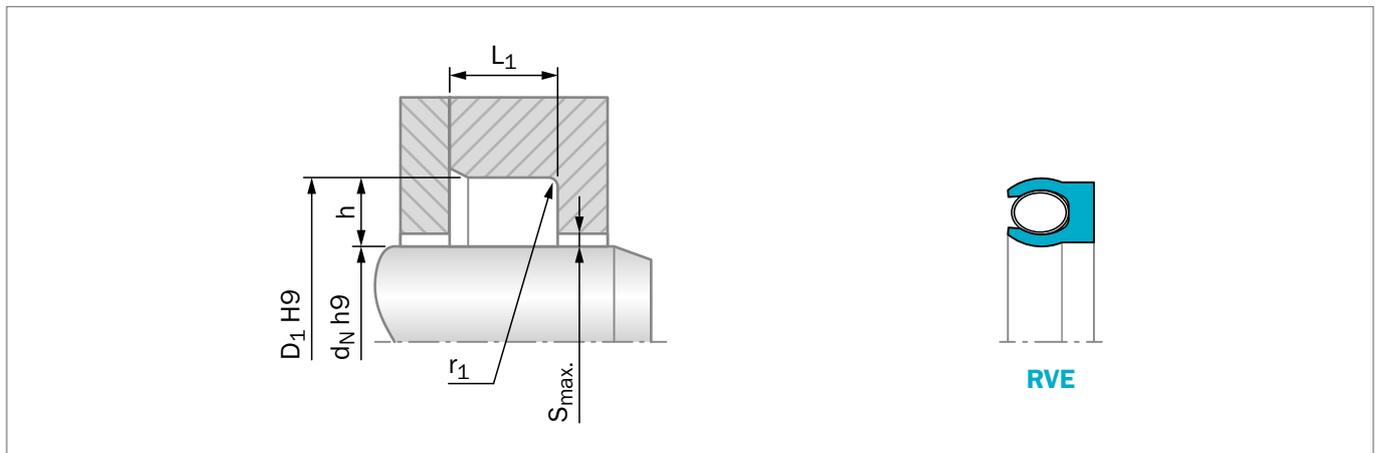


Figure 48: Installation drawing

Table 31: Installation Dimensions – Standard Recommendations – Metric

Series Number for Types	Rod Diameter d_N h9		h Groove Depth	D_1 Groove Diameter H9	L_1 Groove Width +0.2	r_1 Radius Max	Radial Clearance S_{max}			
	Standard Range	Extended Range					2 MPa	10 MPa	20 MPa	40 MPa
RVE0	3.0 - 9.9	3.0 - 40.0	1.45	$d_N + 2.9$	2.4	0.25	0.20	0.10	0.08	0.05
RVE1	10.0 - 19.9	6.0 - 200.0	2.25	$d_N + 4.5$	3.6	0.38	0.25	0.15	0.10	0.07
RVE2	20.0 - 39.9	10.0 - 400.0	3.10	$d_N + 6.2$	4.8	0.38	0.35	0.20	0.15	0.08
RVE3	40.0 - 119.9	20.0 - 700.0	4.70	$d_N + 9.4$	7.1	0.38	0.50	0.25	0.20	0.10
RVE4	120.0 - 999.9	35.0 - 1600.0	6.10	$d_N + 12.2$	9.5	0.51	0.60	0.30	0.25	0.12
RVE5	1000.0 - 2500.0	80.0 - 2500.0	9.50	$d_N + 19.0$	15.0	0.51	0.90	0.50	0.40	0.20

h_9/H_9 tolerance dimensions can be found using the ISO Fits & Tolerances App, see page 20.

Table 32: Installation Dimensions – Inch

Series Number for Types	h Groove Depth	L_1 Groove Width +0.010	r_1 Radius Max	Radial Clearance S_{max}			
				290 psi	1,450 psi	2,900 psi	5,800 psi
RVEA	0.062	0.094	0.010	0.008	0.004	0.003	0.002
RVEB	0.093	0.141	0.015	0.010	0.006	0.004	0.003
RVEC	0.125	0.188	0.015	0.014	0.008	0.006	0.003
RVED	0.187	0.281	0.015	0.020	0.010	0.008	0.004
RVEE	0.250	0.375	0.020	0.024	0.012	0.010	0.005
RVEG	0.375	0.591	0.020	0.030	0.015	0.012	0.006

For further information, refer to the full Turcon® Variseal® catalog



Installation Recommendation for Piston Seals – Turcon® Variseal® H

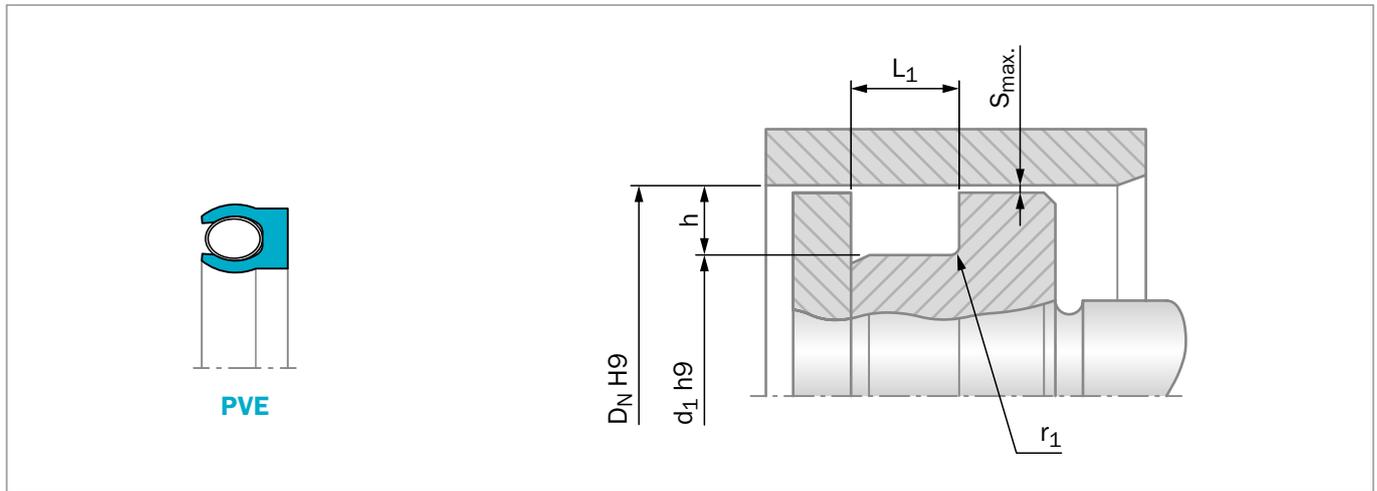


Figure 49: Installation drawing

Table 33: Installation Dimensions – Standard Recommendations – Metric

Series Number for Types	Bore Diameter D_N H9		h	d_1	L_1	r_1	Radial Clearance S_{max}				
	Standard Range	Extended Range					Groove Depth	Groove Diameter	Groove Width	Radius	2 MPa	10 MPa	20 MPa	40 MPa
H				h9	+0.2	Max					
PVE0	6.0 - 13.9	6.0 - 40.0	1.45	$D_N - 2.9$	2.4	0.25	0.20	0.10	0.08	0.05	
PVE1	14.0 - 24.9	10.0 - 200.0	2.25	$D_N - 4.5$	3.6	0.38	0.25	0.15	0.10	0.07	
PVE2	25.0 - 45.9	16.0 - 400.0	3.10	$D_N - 6.2$	4.8	0.38	0.35	0.20	0.15	0.08	
PVE3	46.0 - 124.9	28.0 - 700.0	4.70	$D_N - 9.4$	7.1	0.38	0.50	0.25	0.20	0.10	
PVE4	125.0 - 999.9	45.0 - 1600.0	6.10	$D_N - 12.2$	9.5	0.51	0.60	0.30	0.25	0.12	
PVE5	1000.0 - 2500.0	100.0 - 2500.0	9.50	$D_N - 19.0$	15.0	0.51	0.90	0.50	0.40	0.20	

h9/H9 tolerance dimensions can be found using the ISO Fits & Tolerances App, see page 20.

Table 34: Installation Dimensions – Inch

Series Number for Types	h	L_1	r_1	Radial Clearance S_{max}						
				Groove Depth	Groove Width	Radius	290 psi	1,450 psi	2,900 psi	5,800 psi
H					+0.010	Max				
PVEA	0.062	0.094	0.010	0.008	0.004	0.003	0.002			
PVEB	0.093	0.141	0.015	0.010	0.006	0.004	0.003			
PVEC	0.125	0.188	0.015	0.014	0.008	0.006	0.003			
PVED	0.187	0.281	0.015	0.020	0.010	0.008	0.004			
PVEE	0.250	0.375	0.020	0.024	0.012	0.010	0.005			
PVEG	0.375	0.591	0.020	0.030	0.015	0.012	0.006			



Turcon® Variseal® HF



DESCRIPTION

Turcon® Variseal® HF is the standard seal for axial (face) applications. It has high spring loading, which gives excellent sealing integrity at low pressure and is available for both internal and external pressure.

The heavy helical spring in Turcon® Variseal® HF makes it the best choice for vacuum, gas and low temperature flange sealing applications.

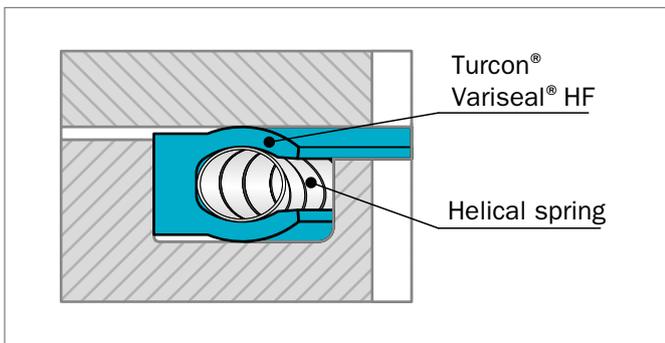


Figure 50: Turcon® Variseal® HF

FEATURES AND BENEFITS

- High contact pressure
- Excellent sealing integrity in gas and fluid applications
- Withstands rapid changes in temperature
- Good sealing ability when surfaces are not ideal
- Excellent resistance to aging
- Interchangeable with O-Ring and Back-up Ring in most cases

APPLICATION EXAMPLES

- Compressor housings
- Construction equipment and plant
- Chemical processing
- Crude oil and natural gas installations
- Cryogenic engineering
- Nuclear power
- Vacuum applications
- Pivot joints

OPERATING CONDITIONS

Pressure:	Maximum static load: 60 MPa / 8,702 psi (207 MPa / 30,000 psi with Back-up Ring)
Temperature:	-150 °C to +200 °C / -238 °F to +392 °F
Media/compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g, the maximum operating speed depends on material type, pressure, temperature and gap value.
Temperature range also depends on media.

ORDERING

For more information on this product, or for orders and enquiries, see the full Turcon® Variseal® Catalog at www.trelleborg.com/seals/literature or contact your local Customer Solution Center.



Installation Recommendation for Internal Face Seals - Turcon® Variseal® HF

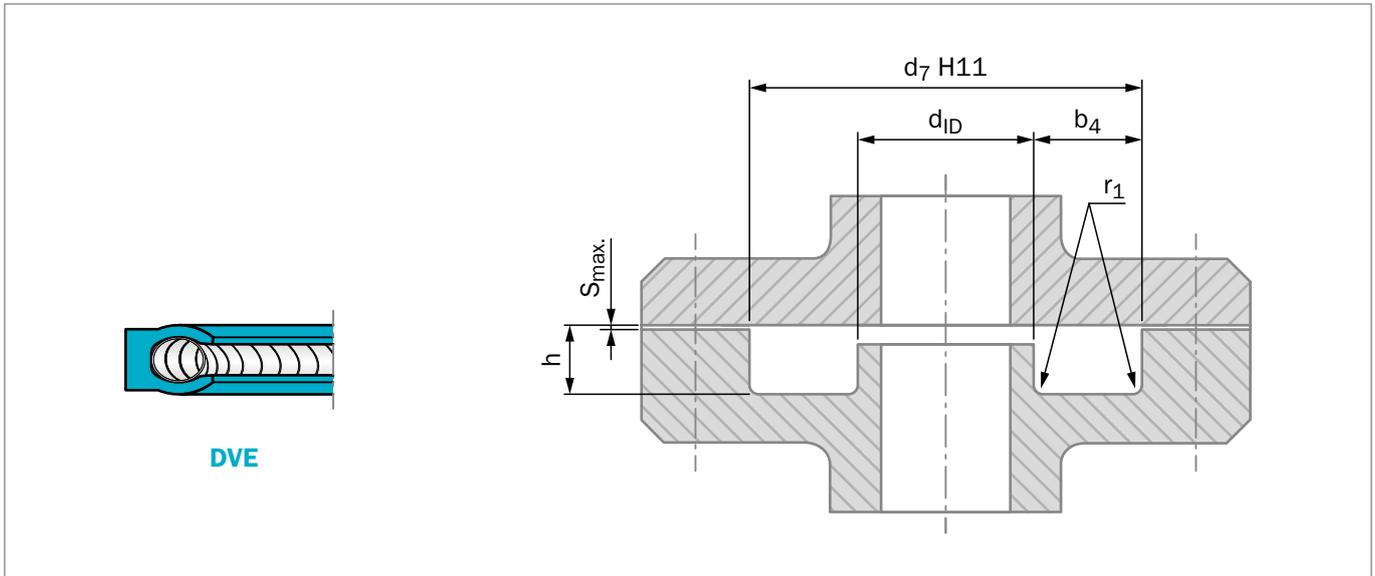


Figure 51: Installation drawing

Table 35: Installation Dimensions – Standard Recommendations – Metric

Series No.	Groove Outside Diameter d_7 H11		h		b_4 Groove Width Min	r_1 Radius Max	Axial Clearance S_{max}			
							Groove Depth	Max	2 MPa	10 MPa	20 MPa	40 MPa
	Standard Range	Extended Range ¹⁾								
DVE0	10.0 - 13.9	10.0 - 40.0	1.45	+0.03	2.40	0.25	0.20	0.10	0.08	0.05
DVE1	14.0 - 24.9	13.0 - 200.0	2.25	+0.05	3.60	0.38	0.25	0.15	0.10	0.07
DVE2	25.0 - 45.9	18.0 - 400.0	3.10	+0.08	4.80	0.38	0.35	0.20	0.15	0.08
DVE3	46.0 - 124.9	28.0 - 700.0*	4.70	+0.10	7.10*	0.38	0.50	0.25	0.20	0.10
DVE4	125.0 - 999.9**	45.0 - 1000.0**	6.10	+0.15	9.50**	0.51	0.60	0.30	0.25	0.12
DVE5	1000.0 - 2500.0***	110.0 - 2500.0***	9.50	+0.20	15.00***	0.51	0.90	0.50	0.40	0.20

* For diameters above 700 mm b_4 min. = 8.0 mm

** For diameters above 700 mm b_4 min. = 11.0 mm

*** For diameters above 1000 mm b_4 min. = 18.0 mm

¹⁾ Available on request

H11 tolerance can be found using the ISO Fits & Tolerance App, see page 20.

Table 36: Installation Dimensions – Inch

Series No.	h		b_4 Groove Width Min	r_1 Radius Max	Axial Clearance S_{max}			
					Groove Depth		290 psi	1,450 psi	2,900 psi	5,800 psi
DVE0	0.057	+ 0.002	0.094	0.010	0.008	0.004	0.003	0.002
DVE1	0.089	+ 0.002	0.141	0.015	0.010	0.006	0.004	0.003
DVE2	0.122	+ 0.002	0.188	0.015	0.014	0.008	0.006	0.003
DVE3	0.186	+ 0.002	0.281	0.015	0.020	0.010	0.008	0.004
DVE4	0.238	+ 0.002	0.375	0.020	0.024	0.012	0.010	0.005
DVE5	0.374	+ 0.004	0.591	0.020	0.030	0.015	0.012	0.006



Installation Recommendation for External Face Seals - Turcon® Variseal® HF

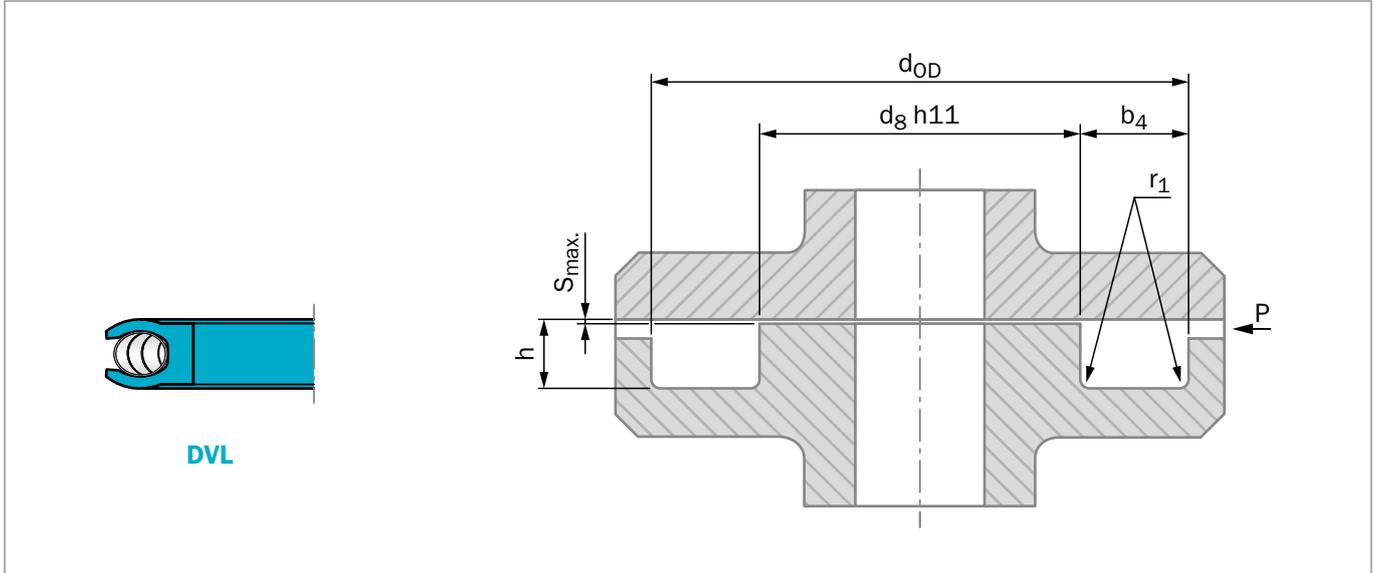


Figure 52: Installation drawing

Table 37: Installation Dimensions – Metric

Series Number	Groove Inside Diameter d_g h11		h Groove Depth	b_4 Groove Width	r_1 Radius	Axial Clearance S_{max}			
	Standard Range	Extended Range ¹⁾				2 MPa	10 MPa	20 MPa	40 MPa
DVL0	3.0 - 9.9	3.0 - 40.0	1.45 +0.03	2.40	0.25	0.20	0.10	0.08	0.05
DVL1	10.0 - 19.9	8.0 - 200.0	2.25 +0.05	3.60	0.38	0.25	0.15	0.10	0.07
DVL2	20.0 - 39.9	12.0 - 400.0	3.10 +0.08	4.80	0.38	0.35	0.20	0.15	0.08
DVL3	40.0 - 119.9	20.0 - 700.0*	4.70 +0.10	7.10*	0.38	0.50	0.25	0.20	0.10
DVL4	120.0 - 999.9**	35.0 - 1600.0**	6.10 +0.15	9.50**	0.51	0.60	0.30	0.25	0.12
DVL5	1000.0 - 2500.9***	80.0 - 2500.0***	9.50 +0.20	15.00***	0.51	0.90	0.50	0.40	0.20

* For diameters above 700 mm b_4 min. = 8.0 mm

** For diameters above 700 mm b_4 min. = 11.0 mm

*** For diameters above 1000 mm b_4 min. = 18.0 mm

¹⁾ Available on request

h11 tolerance can be found using the ISO Fits & Tolerance App, see page 20.

Table 38: Installation Dimensions – Inch

Series Number	h Groove Depth		b_4 Groove Width	r_1 Radius	Axial Clearance S_{max}			
	Min	Max			290 psi	1,450 psi	2,900 psi	5,800 psi
DVL0	0.057	+ 0.002	0.094	0.010	0.008	0.004	0.003	0.002
DVL1	0.089	+ 0.002	0.141	0.015	0.010	0.006	0.004	0.003
DVL2	0.122	+ 0.002	0.188	0.015	0.014	0.008	0.006	0.003
DVL3	0.186	+ 0.002	0.281	0.015	0.020	0.010	0.008	0.004
DVL4	0.238	+ 0.002	0.375	0.020	0.024	0.012	0.010	0.005
DVL5	0.374	+ 0.004	0.591	0.020	0.030	0.015	0.012	0.008

Turcon® Wedgpak® Face Seal



Single-acting

Internal and external static sealing
Excellent sealing in gas or fluids

Material:

Turcon® , Zurcon® and Elastomers



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Turcon® Wedgpak® Face Seal



DESCRIPTION

Turcon® Wedgpak® Face Seal is an adaptation of the Wedgpak® design. It utilizes a triangular shaped Turcon® delta ring energized by a uniquely shaped elastomer. This maximizes extrusion protection under abnormal clearance gap condition.

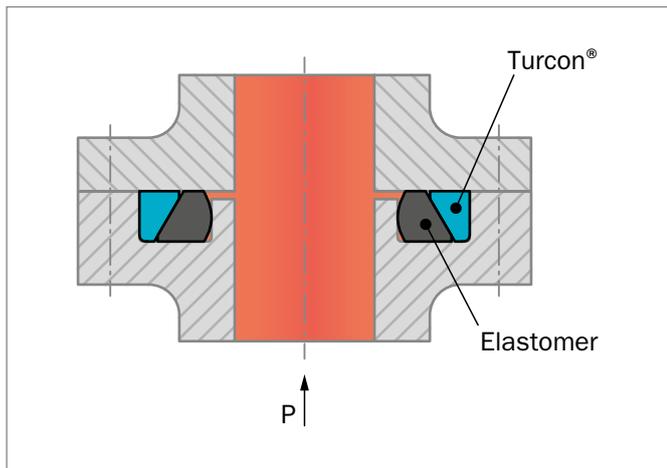


Figure 53: Turcon® Wedgpak® Face Seal (Internal pressure)

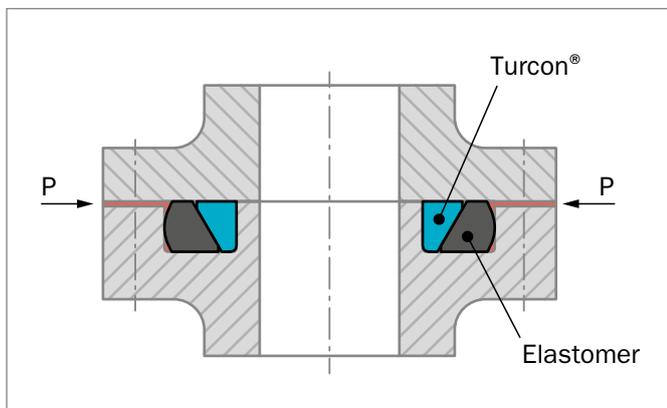


Figure 54: Turcon® Wedgpak® Face Seal (External pressure)

Typically in face seal applications there are impulse pressures. This causes high breathing conditions between the seal and mating hardware. Turcon® Wedgpak® Face Seal gives optimized sealing in these situations.

FEATURES AND BENEFITS

- Excellent static sealing effect
- Wedge profile compensates for hardware "breathing"
- Good extrusion protection
- Easy installation
- No twisting in the groove

APPLICATION EXAMPLES

- Pipe connections
- Flanges
- Valves
- Hydraulics

OPERATING CONDITIONS

Pressure:	35 MPa / 5,000 psi (greater in non-standard configurations)
Temperature:	-54°C to +200°C / -65°F to +390°F (depending on elastomer material)
Media/compatibility:	Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected
Clearance:	Can exceed recommendations of MIL-G-5514F/AS4716 dependent upon the combination of pressures and clearance gaps

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g. the maximum operating speed depends on material type, pressure, temperature and gap value. Temperature range also depends on media.

METHOD OF OPERATION

The Turcon® delta ring in Turcon® Wedgpak® Face Seal uses the full depth of the seal groove to optimize the amount of sealing material available, maximizing extrusion protection under worst case operating conditions.

The specially shaped geometry of the elastomer provides a preload under low pressure conditions, and constantly forces the Turcon® delta ring up against the clearance gap to prevent extrusion of the elastomer.



SERIES



Figure 55: Relative Size of Turcon® Wedgpak® Face Seal cross section

ORDERING

For more information on this product, or for orders and enquiries, contact your local Customer Solution Center.



Installation Recommendation Turcon® Wedgpak® Face Seal, Series No. DW00 (Old Series No. 538000), Internal

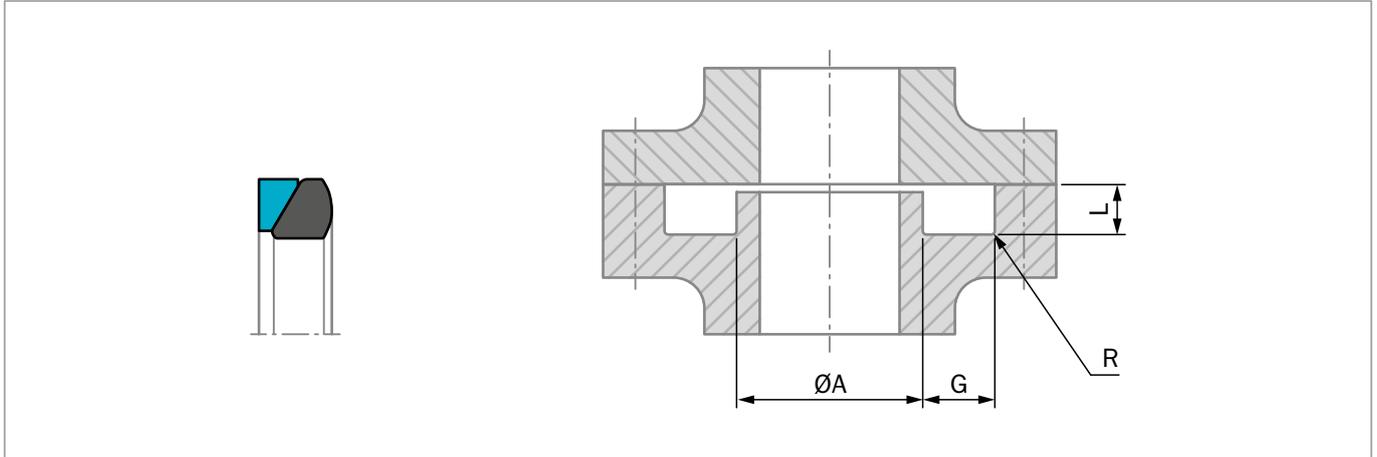


Figure 56: Installation drawing

Table 39: Installation Dimensions

Dash No.	ØA Diameter		G Groove Width		L Groove Depth		R Radius Inch / mm	Dash No.	ØA Diameter		G Groove Width		L Groove Depth		R Radius Inch / mm
	Inch	mm	Inch	mm	Inch	mm			Inch	mm	Inch	mm	Inch	mm	
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03			+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	
008	0.316	8.03						110	0.568	14.43					
009	0.348	8.94						111	0.630	16.00					
010	0.379	9.63						112	0.693	17.60					
011	0.441	11.20						113	0.755	19.18					
012	0.504	12.80						114	0.818	20.78					
013	0.566	14.38						115	0.880	22.35					
014	0.629	15.98						116	0.943	23.95					
015	0.691	17.55						117	1.005	25.53					
016	0.754	19.15						118	1.068	27.13					
017	0.816	20.73					0.005-0.015	119	1.130	28.70					0.005-0.015
018	0.879	22.33	0.094	2.39	0.057	1.45	/	120	1.193	30.30	0.141	3.58	0.090	2.29	/
019	0.941	23.90					0.13-0.38	121	1.255	31.12					0.13-0.38
020	1.004	25.50						122	1.318	33.48					
021	1.066	27.08						123	1.380	35.05					
022	1.129	28.68						124	1.443	36.65					
023	1.191	30.25						125	1.505	38.23					
024	1.254	31.85						126	1.568	39.83					
025	1.316	33.43						127	1.630	41.40					
026	1.379	35.03						128	1.693	43.00					
027	1.441	36.60						129	1.755	44.58					
028	1.504	38.20						130	1.818	46.18					



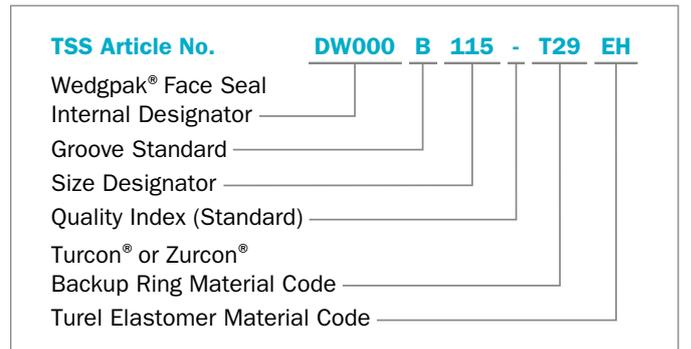
Dash No.	øA Diameter		G Groove Width		L Groove Depth		R Radius
	Inch	mm	Inch	mm	Inch	mm	Inch / mm
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	
131	1.880	47.75					0.005-
132	1.943	49.35					0.015
133	2.005	50.83	0.141	3.58	0.090	2.29	/
134	2.068	52.53					0.13-
135	2.131	54.13					0.38
210	1.012	25.70					
211	1.074	27.28					
212	1.137	28.88					
213	1.199	30.45					
214	1.262	32.05					
215	1.324	33.63					
216	1.387	35.23					
217	1.449	36.80					
218	1.512	38.40					
219	1.574	39.98					
220	1.637	41.58					
221	1.699	43.15					
222	1.762	44.75					
223	1.887	47.93					
224	2.012	51.10					
225	2.137	54.28					
226	2.262	57.45					
227	2.387	60.63					0.010-
228	2.512	63.80					0.025
229	2.637	66.98	0.188	4.78	0.122	3.10	/
230	2.762	70.15					0.25-
231	2.887	73.33					0.63
232	3.012	76.50					
233	3.137	79.68					
234	3.262	82.85					
235	3.387	86.03					
236	3.512	89.20					
237	3.637	89.84					
238	3.762	95.55					
239	3.887	98.73					
240	4.012	101.90					
241	4.137	105.08					
242	4.262	108.25					
243	4.387	111.43					
244	4.512	114.60					
245	4.637	117.78					
246	4.762	120.95					
247	4.887	124.13					

Dash No.	øA Diameter		G Groove Width		L Groove Depth		R Radius
	Inch	mm	Inch	mm	Inch	mm	Inch / mm
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	
325	1.895	48.13					
326	2.020	51.31					
327	2.145	54.48					
328	2.270	57.66					
329	2.395	60.83					
330	2.520	64.01					
331	2.645	67.18					
332	2.770	70.36					
333	2.895	73.53					
334	3.020	76.71					
335	3.145	79.88					
336	3.270	83.06					
337	3.395	86.23	0.281	7.14	0.187	4.75	0.020-
338	3.520	89.41					0.035
339	3.645	92.58					/
340	3.770	95.76					0.51-
341	3.895	98.93					0.89
342	4.020	102.11					
343	4.145	105.28					
344	4.270	108.46					
345	4.395	111.63					
346	4.520	114.31					
347	4.645	117.98					
348	4.770	121.16					
349	4.895	124.33					

ORDERING EXAMPLE

Wedgpak® Face Seal for internal use

Series:	DW00
Dash No.:	115
Material:	T29 EH





Installation Recommendation Turcon® Wedgpak® Face Seal, Series No. DW01 (Old Series No. 538001), External

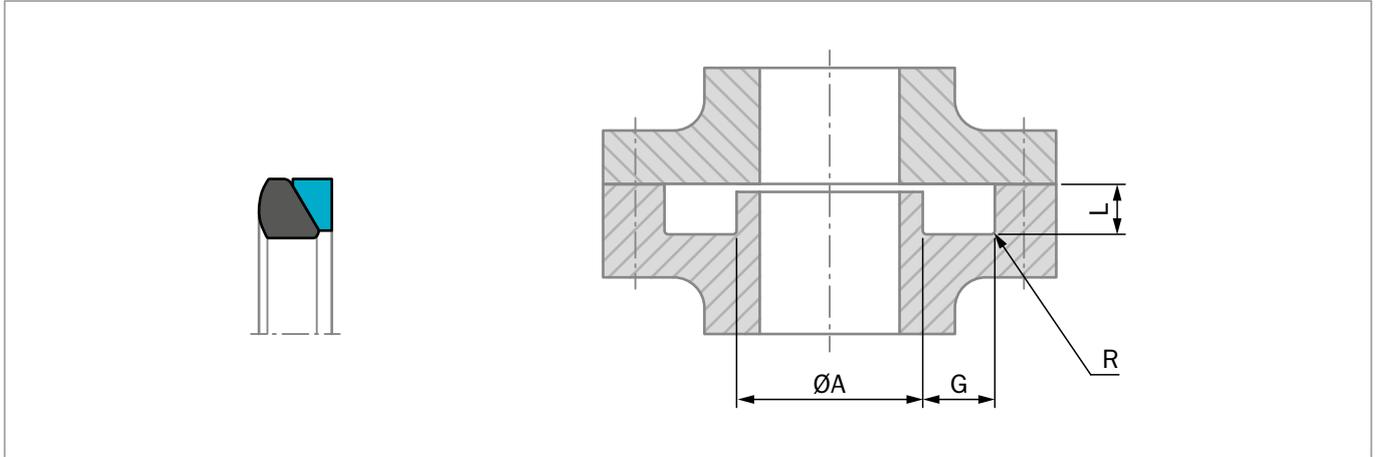


Figure 57: Installation drawing

Table 40: Installation Dimensions

Dash No.	ØA Diameter		G Groove Width		L Groove Depth		R Radius
	Inch	mm	Inch	mm	Inch	mm	Inch / mm
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	
008	0.176	4.47					
009	0.208	5.28					
010	0.239	6.07					
011	0.301	7.65					
012	0.364	9.25					
013	0.426	10.82					
014	0.489	12.42					
015	0.551	14.00					
016	0.614	15.60					
017	0.676	17.17					0.005-0.015
018	0.739	18.77	0.094	2.39	0.057	1.45	/
019	0.801	20.35					0.13-0.38
020	0.864	21.95					
021	0.926	23.52					
022	0.989	25.12					
023	1.051	26.70					
024	1.114	28.30					
025	1.176	29.87					
026	1.239	31.47					
027	1.301	33.05					
028	1.364	34.65					
110	0.362	9.19					
111	0.424	10.77					
112	0.487	12.37					
113	0.549	13.94					
114	0.612	15.54					
115	0.674	17.12					
116	0.737	18.72					
117	0.799	20.29					
118	0.862	21.89					
119	0.924	23.47					0.005-0.015
120	0.987	25.07	0.141	3.58	0.090	2.29	/
121	1.049	26.64					0.13-0.38
122	1.112	28.24					
123	1.174	29.82					
124	1.237	31.42					
125	1.299	32.99					
126	1.362	34.59					
127	1.424	36.17					
128	1.487	37.77					
129	1.549	39.34					
130	1.612	40.94					



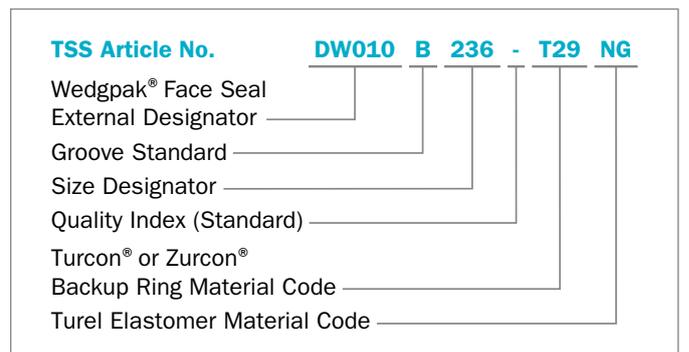
Dash No.	øA Diameter		G Groove Width		L Groove Depth		R Radius
	Inch	mm	Inch	mm	Inch	mm	Inch
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	/ mm
131	1.674	42.52					0.005-
132	1.737	44.12					0.015
133	1.799	45.69	0.141	3.58	0.090	2.29	/
134	1.862	47.29					0.13-
135	1.925	48.90					0.38
210	0.734	18.64					
211	0.796	20.22					
212	0.859	21.82					
213	0.921	23.39					
214	0.984	24.99					
215	1.046	26.57					
216	1.109	28.17					
217	1.171	29.74					
218	1.234	31.34					
219	1.296	32.92					
220	1.359	34.52					
221	1.421	36.09					
222	1.484	37.69					
223	1.609	40.87					
224	1.734	44.04					
225	1.859	47.22					
226	1.984	50.39					
227	2.109	53.57					0.010-
228	2.234	56.74					0.025
229	2.359	59.92	0.188	4.78	0.122	3.10	/
230	2.484	63.09					0.25-
231	2.609	66.27					0.63
232	2.734	69.44					
233	2.859	72.62					
234	2.984	75.79					
235	3.109	78.97					
236	3.234	82.14					
237	3.359	85.32					
238	3.484	88.49					
239	3.609	91.67					
240	3.734	94.84					
241	3.859	98.02					
242	3.984	101.19					
243	4.109	104.37					
244	4.234	107.54					
245	4.359	110.72					
246	4.484	113.89					
247	4.609	117.07					

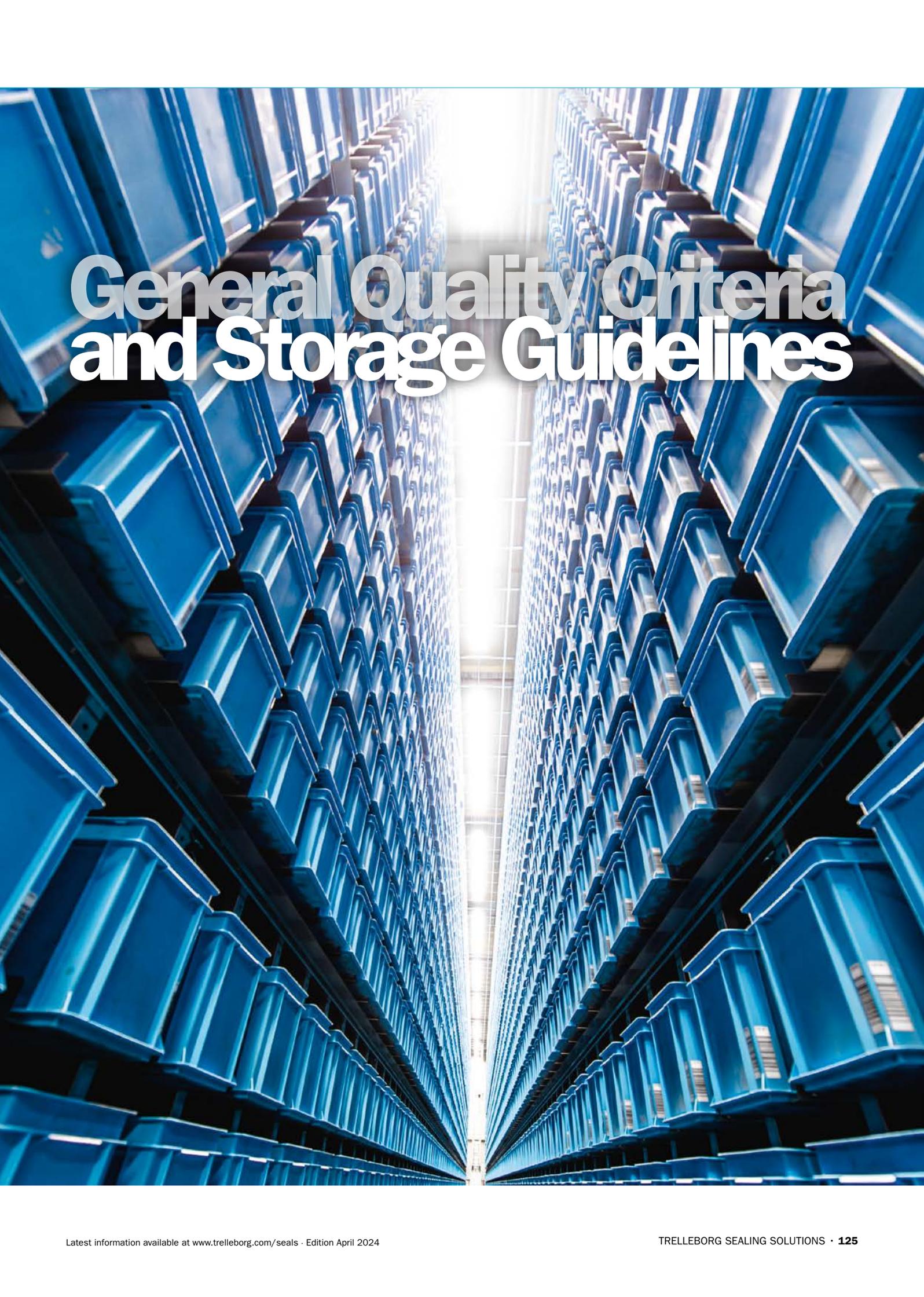
Dash No.	øA Diameter		G Groove Width		L Groove Depth		R Radius
	Inch	mm	Inch	mm	Inch	mm	Inch
	+0.000 -0.005	+0.00 -0.13	+0.010 -0.000	+0.25 -0.00	±0.001	±0.03	/ mm
325	1.475	37.47					
326	1.600	40.64					
327	1.725	43.82					
328	1.850	46.99					
329	1.975	50.17					
330	2.100	53.34					
331	2.225	56.52					
332	2.350	59.69					
333	2.475	62.87					
334	2.600	66.04					
335	2.725	69.22					
336	2.850	72.39					
337	2.975	75.57	0.281	7.14	0.187	4.75	0.020-
338	3.100	78.74					0.035
339	3.225	81.92					/
340	3.350	85.09					0.51-
341	3.475	88.27					0.89
342	3.600	91.44					
343	3.725	94.62					
344	3.850	97.79					
345	3.975	100.97					
346	4.100	104.14					
347	4.225	107.32					
348	4.350	110.49					
349	4.475	113.67					

ORDERING EXAMPLE

Wedgpak® Face Seal for external use

Series:	DW01
Dash No:	236
Material:	T29 NG





General Quality Criteria and Storage Guidelines

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■ General Quality Criteria

The cost-effective use of seals and bearings is highly influenced by the quality criteria applied in production. Seals and bearings from Trelleborg Sealing Solutions are continuously monitored according to strict quality standards from material acquisition through to delivery.

Production facilities are certified according to relevant quality management system standards. Depending on the requirements of the customer or market and in addition to the current ISO 9001, these locations may have further certifications: IATF 16949 for Automotive customers, EN/AS 9100 for Aerospace customers, ISO 13485 for Healthcare & Medical customers and ISO 29001 for Oil & Gas customers. This enables us to provide all market segments with the required quality standards.

Our quality policy is consistently controlled by strict procedures and guidelines which are implemented within all areas of the company.

All testing of materials and products is performed in accordance with accepted test standards and specifications, e.g. random sample testing in accordance with ISO 2859-1 AQL 1.0 general inspection level II, normal inspection.

Inspection specifications correspond to standards applicable to individual product groups (e.g. for O-Rings: ISO 3601).

■ Guidelines for the Storage of Polymer Products Based on ISO 2230

Many polymer products and components are stored for long periods of time before being put into service, so it is important they are stored in conditions that minimize unwanted changes in properties. Such changes may result from degradation, in which case they may include excessive hardening, softening, cracking, crazing and other surface effects. Other changes may be caused by deformation, contamination or mechanical damage.

Packaging

Unless otherwise specified in the appropriate product specification, rubber products should be enclosed in individual sealed envelopes. The packaging should be carried out in an atmosphere in which the relative humidity is less than 70%, or if polyurethanes are being packed, less than 65%. Where there is serious risk of ingress of moisture (e.g. rubber-metal-bonded parts), aluminum foil/paper/polyethylene laminate or other similar means of protection should be used to ensure protection from ingress of moisture.

Temperature

The preferred storage temperature for elastomer parts is +15 °C (+59 °F) and should not exceed +25 °C (+77 °F). The products should be stored away from direct sources of heat such as boilers, radiators and direct sunlight. If the storage temperature is below +15 °C (+59 °F), care should be exercised during handling of stored products, as they may have stiffened and have become susceptible to distortion if not handled carefully.

Humidity

The relative humidity should be such that, given in the variations of temperature in storage, condensation does not occur. In all cases, the relative humidity of the atmosphere in storage should be less than 70%, or if polyurethanes are being stored, less than 65%.

Light

Rubber should be protected from light sources, in particular direct sunlight or intense light having a high ultra-violet content. It is advisable that any windows of storage rooms be covered with a red or orange coating or screen.

Radiation

Precautions should be taken to protect stored products from all sources of ionizing radiation likely to cause damage to the products.

Ozone

Ozone has a particularly harmful effect on rubber. Storage rooms should not contain any equipment that is capable of generating ozone, such as mercury vapor lamps or high voltage electrical equipment giving rise to electric sparks or electrical discharges. Combustion gases and organic vapors should also be excluded, as they may give rise to ozone via photo-chemical processes. When equipment such as a fork-lift truck is used to handle large rubber products, care needs to be taken to ensure this equipment is not a source of pollution that may affect the rubber. Combustion gases should be considered separately. While they are responsible for generating ground-level ozone, they may also contain unburned fuel which, by condensing on rubber products, can cause additional deterioration.

Deformation

Rubber should be stored free from tension, compressive stresses or other causes of deformation. Where products are packaged in a strain-free condition, they should be stored in their original packaging. In case of doubt, the manufacturer's advice should be sought. It is advisable that rings of large internal diameter are formed into three equal loops so as to avoid creasing or twisting. It is not possible to achieve this condition by forming just two loops.

Contact with liquids and semi-liquid materials

Rubber should not be allowed to come into contact with liquid or semi-liquid materials (for example, petrol, greases, acids, disinfectants, cleaning fluids) or their vapors at any time during storage, unless these materials are by design an integral part of the product or the manufacturer's packaging. When rubber products are received coated with their operational media, they should be stored in this condition.

Contact with metals

Certain metals and their alloys (in particular, copper and manganese) are known to have harmful effects on some rubbers. Rubber should not be stored in contact with such metals except when bonded to them. They should be protected by wrapping in, or by separation with, a suitable material, e.g. paper or polyethylene.

Contact with dusting powder

Dusting powders should only be used for the packaging of rubber items in order to prevent adhesion. In such cases, the minimum quantity of powder to prevent adhesion should be used. Any powder used should be free from any constituent that would have a harmful effect on the rubber or the subsequent application of the rubber.

Contact between different products

Contact between products made from rubbers of different compositions should be avoided. This includes products of the same type but differing in color.

Rubber-to-metal bonded products

The metal part of rubber-to-metal bonded products should not come into contact with the rubber of other products. Preservative used on the metal should be of a type that it will not adversely affect the rubber or the bond to such an extent that it does not comply with the product specification.

Storage life

This is the maximum period of time that a rubber product, appropriately packaged, may be stored. After this time the product is regarded as unserviceable for the purposes for which it was originally manufactured. The storage life of a rubber product is influenced by its shape and size as well as its composition. Thick products usually undergo slower changes through degradation than thinner ones.

Initial storage period

This is the maximum period, starting from the time of manufacture, for which a rubber product, appropriately packaged, may be stored under specified conditions before a sample needs to be inspected or re-tested.

Extension storage period

This is the period for which a rubber product, appropriately packaged, may be stored after the initial storage period, before further inspection and re-testing is necessary.

Assembly

These are products or components containing more than one element, one or more of which is made of rubber. Generally it is not recommended to store elastomeric products in an assembled condition. If it is necessary to do so, the units should be checked more often. The inspection interval depends on the design and geometry of the components.

Inspection before extension storage

Before any items are to be stored for an extension period, representative samples of each type should be selected for inspection at the end of the appropriate initial storage period. Inspection should be in accordance with the relevant product specification.

Visual inspection

Inspect each of the items for the following:

1. Permanent distortions, such as creases or flats.
2. Mechanical damage, such as cuts, tears, abraded areas or delaminated plies.
3. Surface cracking when viewed under a microscope at x10 magnification.
4. Changes in surface condition, such as hardening, softening or tackiness.

Assessment at the end of the initial period

If, following the visual inspection procedure, the items are not satisfactory, they should not be stored for an extended period. If the items are satisfactory and are stored for an extended period a record should be kept of the date initial storage began as well as the date the extended storage period began. Items stored for an extended period should be inspected and tested at, or before, the expiry of the extension storage period before they are put into service or stored for a further extended period.

Material Group	Initial Storage Period	Extended Storage Period
AU, EU, NR, SBR	5 years	2 years
ACM, AEM, CR, ECO, HNBR, IIR, NBR	7 years	3 years
CSM, EPDM, FKM, VMQ, FVMQ	10 years	5 years
FFKM Isolast®	20 years	5 years
Zurcon®	10 years	5 years
PTFE	unlimited	

Note 1: If the storage temperature is over or under +25 °C (+77 °F) this will influence the storage time. Storage at +10 °C (+50 °F) higher will reduce the storage time by about 50%. Storage at +10 °C (+50 °F) lower will increase the storage time by around 100%.

Note 2: In application areas such as aerospace the storage periods can differ from this specification. These specific storage conditions have to be agreed between the supplier and the buyer.

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

Trelleborg Sealing Solutions is a leading developer, manufacturer and supplier of precision seals, bearings and custom-molded polymer components. It focuses on meeting the most demanding needs of aerospace, automotive and general industrial customers with innovative solutions.

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