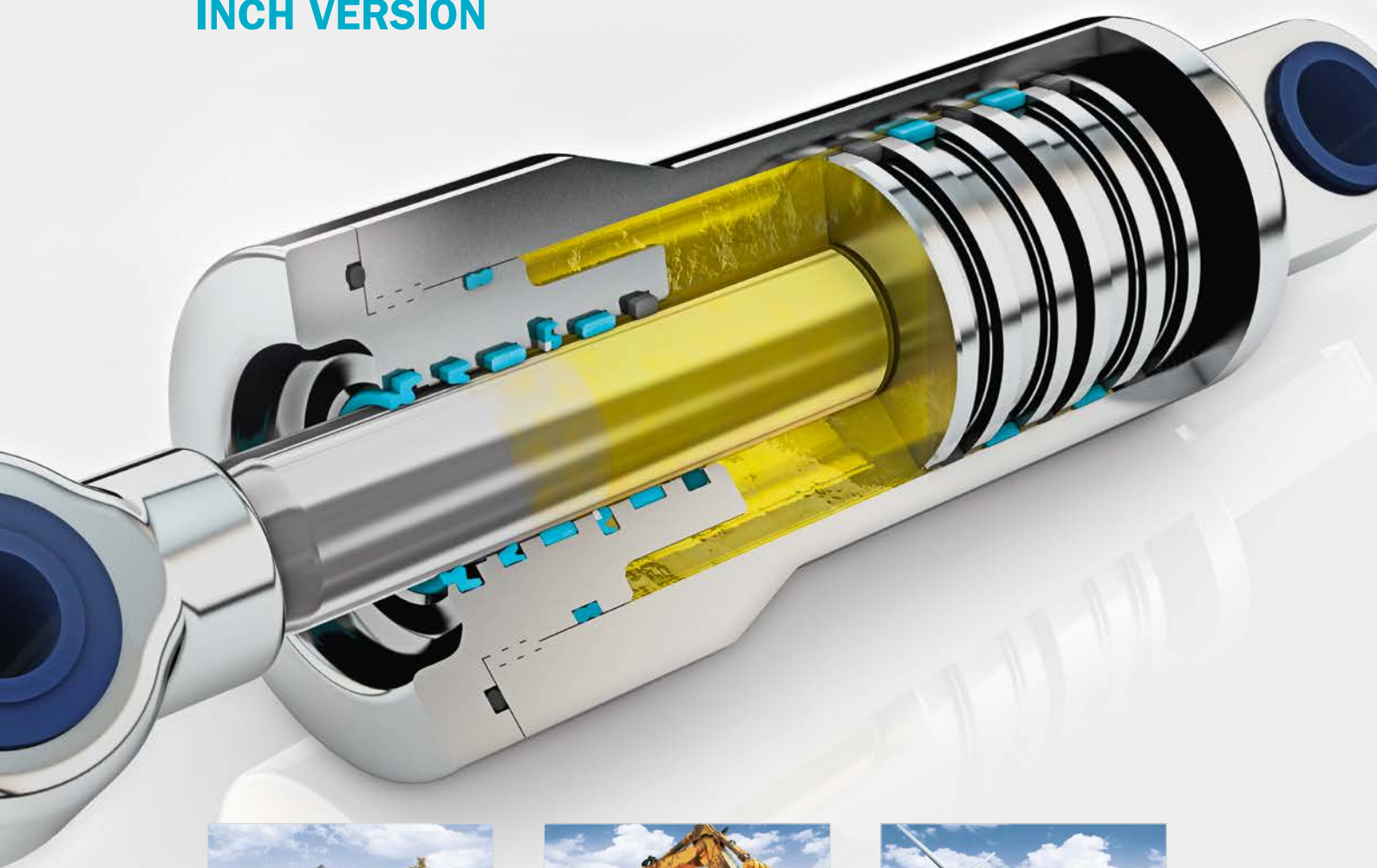


# Hydraulic seals – linear

INCH VERSION





## Your Partner for Sealing Technology

Trelleborg Sealing Solutions is a major international developer, manufacturer and supplier of seals, bearings and molded components in polymers. We are uniquely placed to offer dedicated design and development from our market-leading product and material portfolio: a one-stop-shop providing the best in elastomer, silicone, thermoplastic, PTFE and composite technologies for applications in aerospace, industrial and automotive industries.

With 50 years of experience, Trelleborg Sealing Solutions engineers support customers with design, prototyping, production, test and installation using state-of-the-art design tools. An international network of over 80 facilities worldwide includes over 20 manufacturing sites, strategically-positioned research and development centers, including materials and development laboratories and locations specializing in design and applications.

Developing and formulating materials in-house, we utilize the resource of our material database, including over 2,000

proprietary compounds and a range of unique products. Trelleborg Sealing Solutions fulfills 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.

**ISO 9001**

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.**  
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# Hydraulic Seals – linear

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**Introduction**

**Rod Seals**

**Piston Seals**

**Scrapers**

**Slydring® - Wear Rings**

**Dualseal**

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# Introduction



# 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.

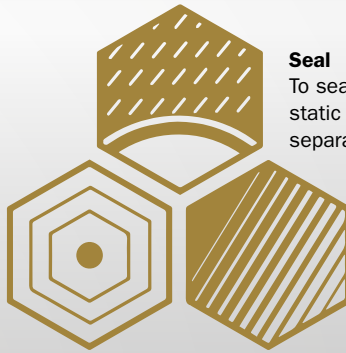


**Trelleborg Sealing Solutions -  
Your Partner for Sealing Technology**

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 Wheel Systems** is a leading global supplier of tires and complete wheels for off-highway vehicles and specialty applications.



**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, health-care & medical and general industrial customers with innovative solutions.

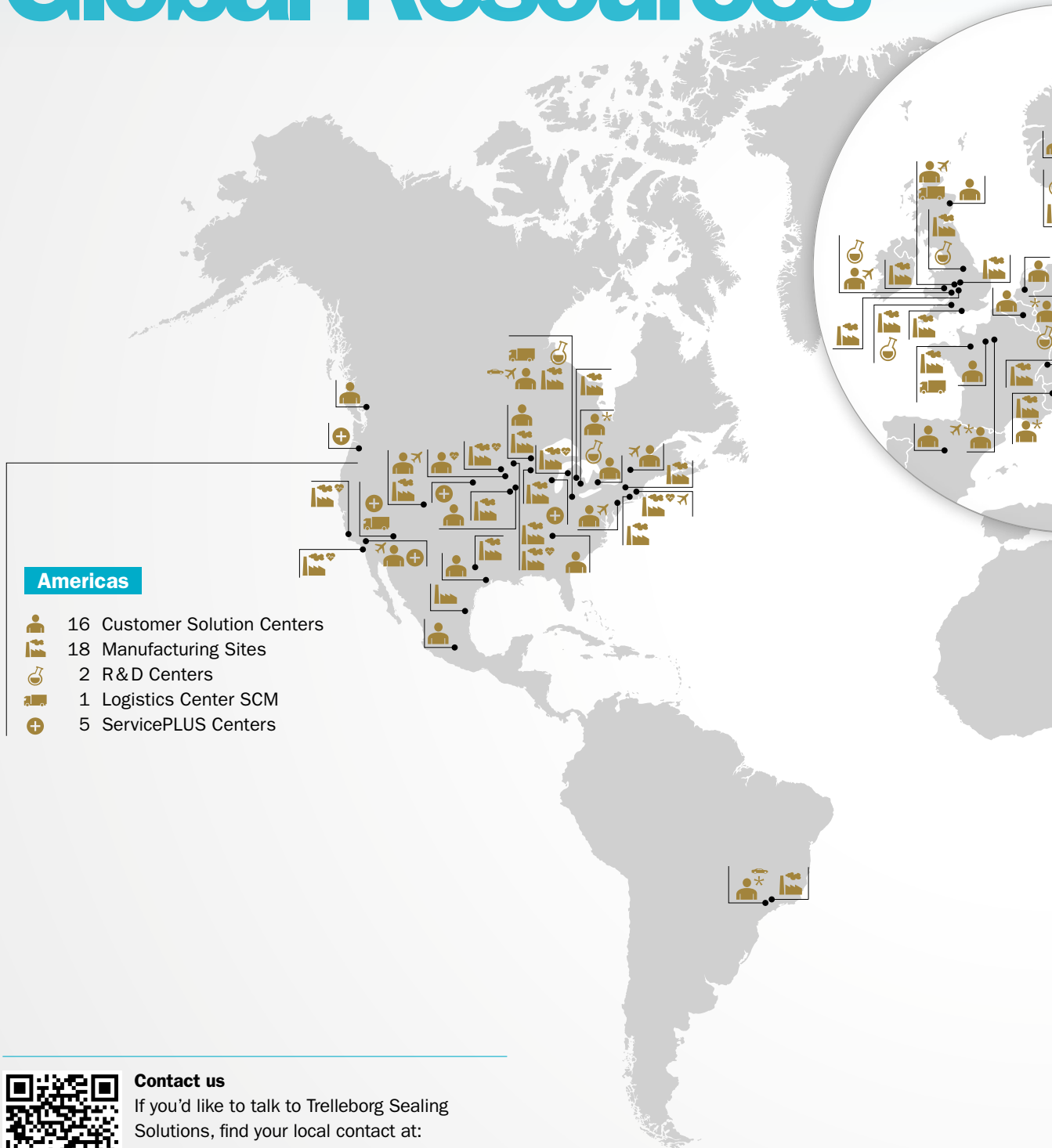
### BLUE DIMENSION™



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](http://www.trelleborg.com)**



# Our Global Resources





**7,300**  
employees

More than  
**90**  
worldwide  
locations

More than  
**2,000**  
proprietary material  
formulations



✈ Aerospace    🚗 Automotive    ✳ Damping Solutions    ❤ Healthcare & Medical

# Products, Brands & Materials

Decades of experience designing and manufacturing polymer solutions 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. Development is ongoing, ensuring that our solutions meet the changing needs of our customers, as well as the latest industry trends and regulations.

## PRODUCTS



Fluid Sealing Systems



Static Seals



O-Rings



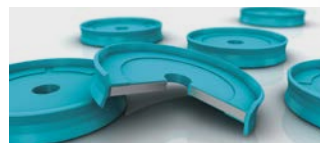
Bearings & Bushings



Rotary Seals



Mechanical Face Seals  
(Heavy Duty Seals)



Pneumatic Seals



Engineered Molded Parts



Medical Products



Customized Aerospace  
Sealing



Liquid Silicone Rubber (LSR)



Micro Parts



Brake Shims, Tuned  
Absorbers, Rubore® Seals



HMF FlatSeal™ Gaskets



Extrusion



Assembly Units

## WORLD RENOWNED NAMES UNITED

We own many of the longest established and leading names within the seal industry. 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

## PROPRIETARY MATERIALS

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

- HiMod®
- HiPlast®
- Isolast®
- Orkot®
- Turcite®
- Turcon®
- Turel®
- Zurcon®



**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](http://www.trelleborg.com/seals)**

# Your Industry



Aerospace



Agriculture



Automotive



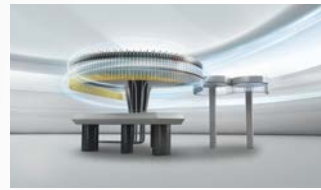
Construction & Mining Equipment



eMobility



Fluid Power – Hydraulics



Food & Beverage



Healthcare & Medical



Manufacturing & Machine Tools



Marine Equipment & Construction



Material Handling



Oil & Gas



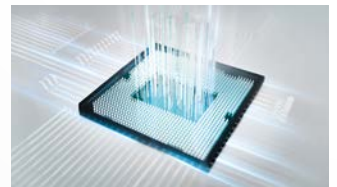
Processing Equipment



Renewable Energy & Power Generation



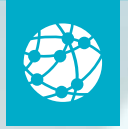
Robotics



Semiconductor



**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](http://www.trelleborg.com/seals)



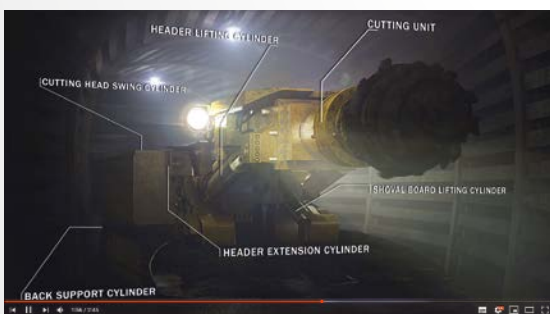
# Films & Animations

## 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)  
YouTube



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.



### 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

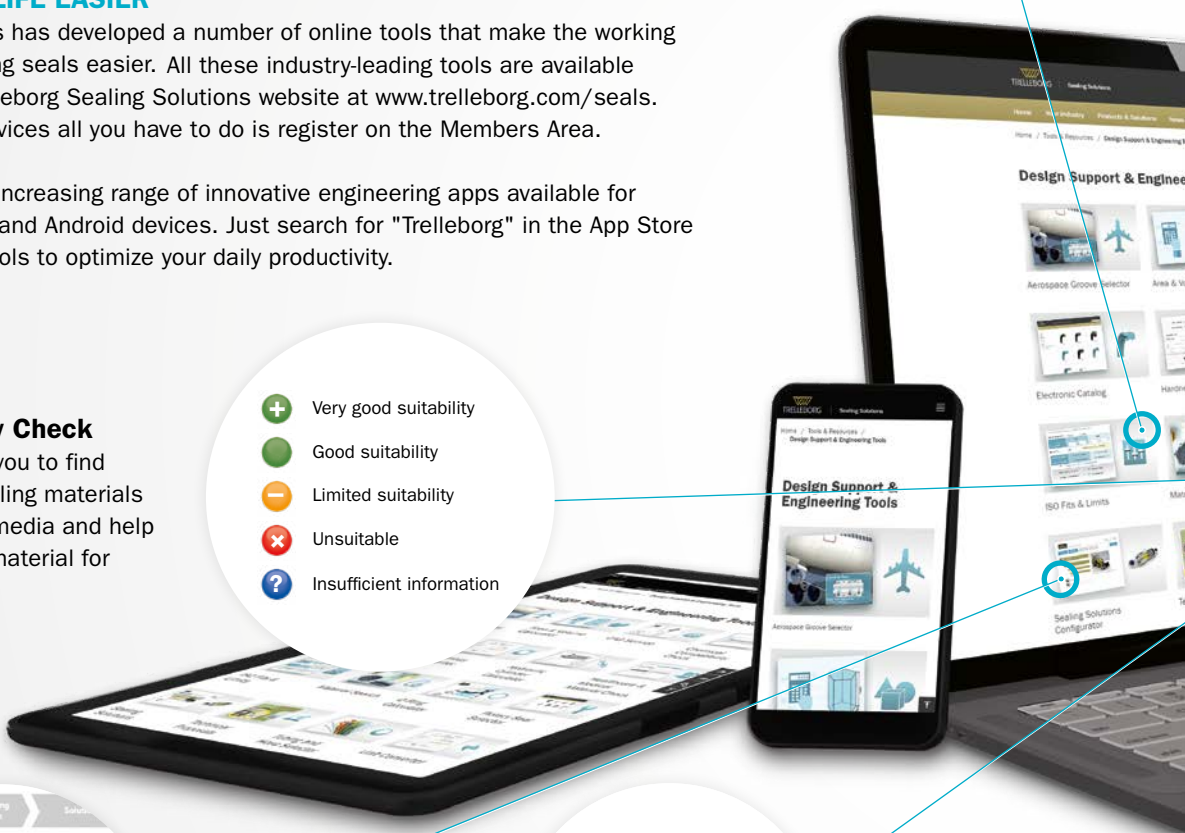
Trelleborg Sealing Solutions has developed a number of online tools that make the working life of an engineer specifying seals easier. All these industry-leading tools are available free-of-charge from the Trelleborg Sealing Solutions website at [www.trelleborg.com/seals](http://www.trelleborg.com/seals). 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

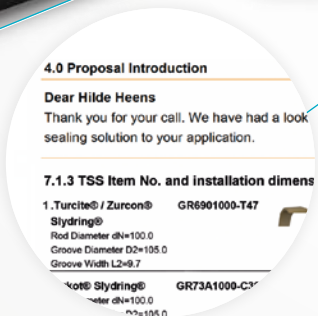
These two programs allow you to find out the compatibility of sealing materials with hundreds of different media and help identify the most suitable material for your application.

- + 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.



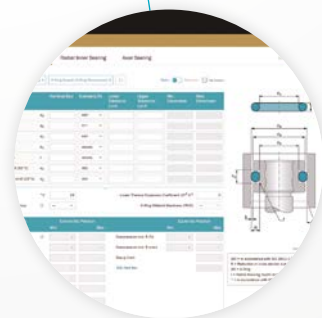
### Hydraulic System Calculator

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](http://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](http://www.trelleborg.com/seals)

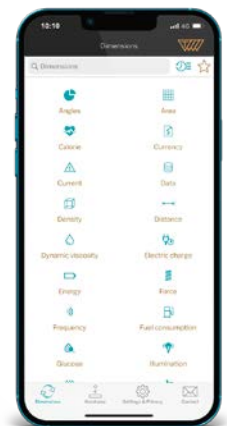
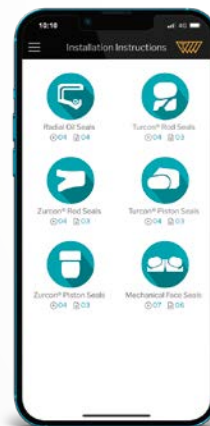
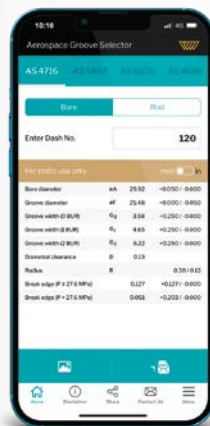
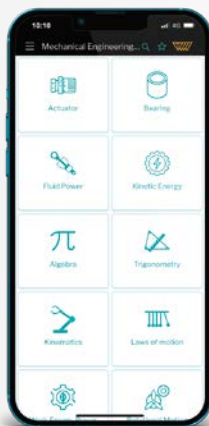


MANY MORE APPS available

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, 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 Zurcon® 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.



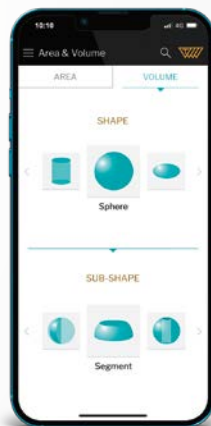
**O-Ring Selector**

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.



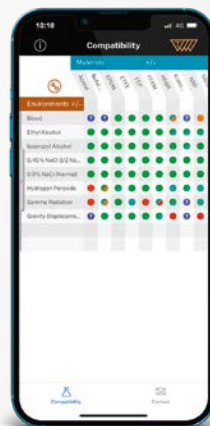
**Hydraulic System Calculator**

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.



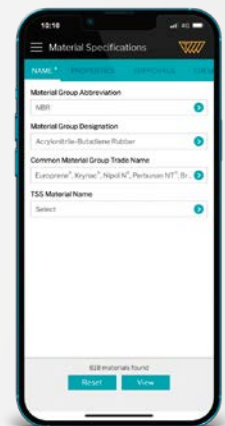
**Area and Volume Calculator**

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.

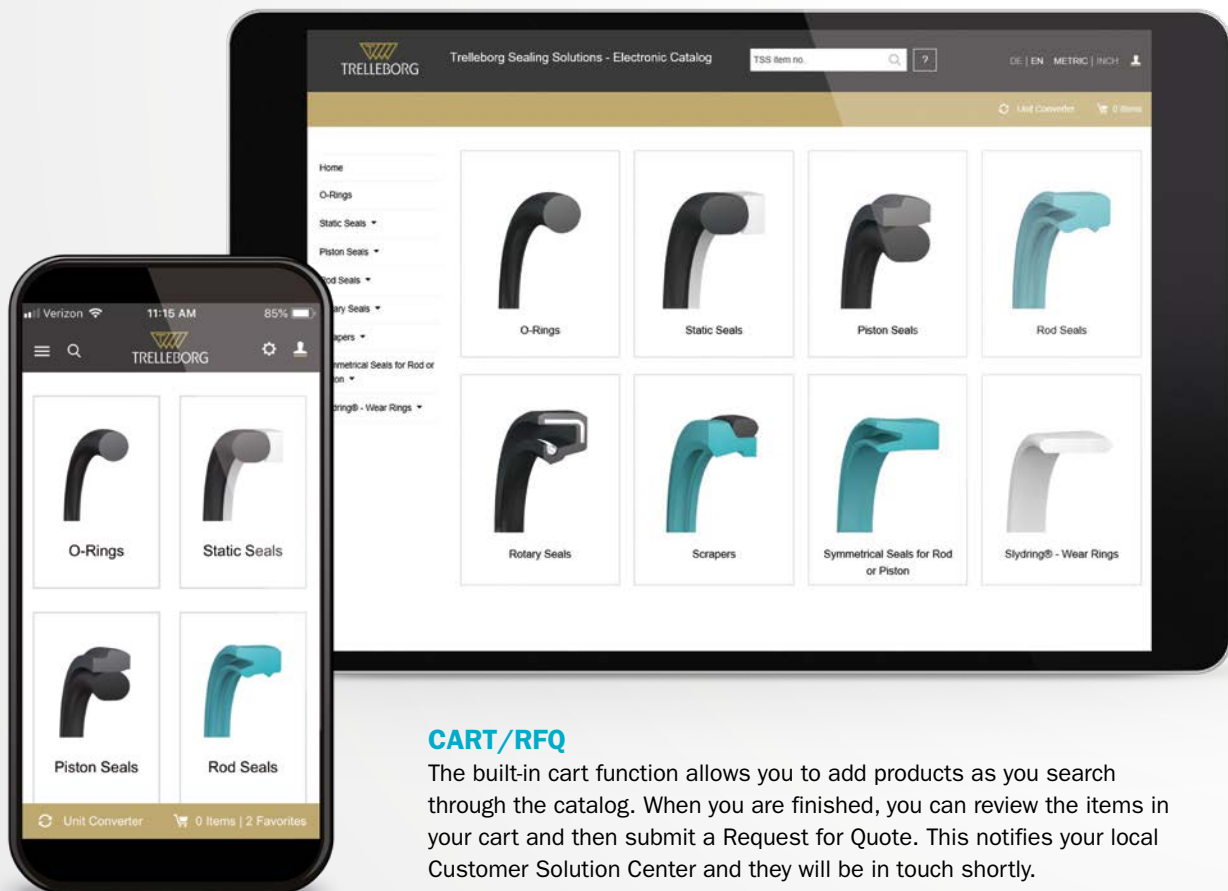
# Electronic Catalog

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



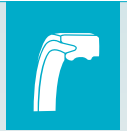
The Electronic Catalog is a user-friendly service that connects you to the broad range of products Trelleborg Sealing Solutions offers. The products are arranged based on product type and product group, making it easy to find the exact one you need.

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.



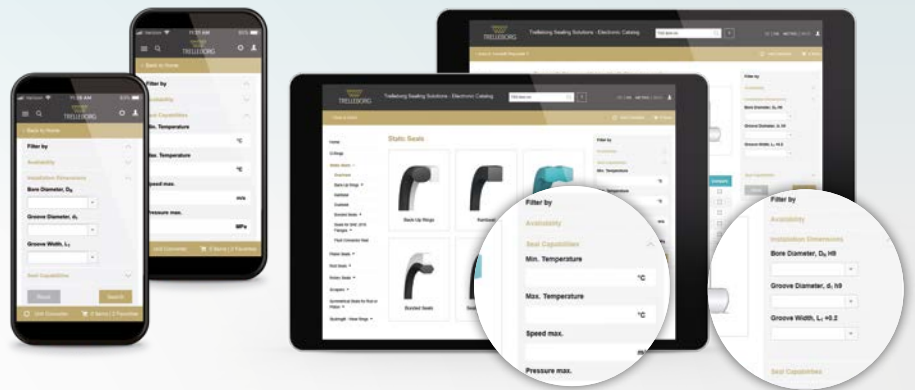
## CART/RFQ

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.



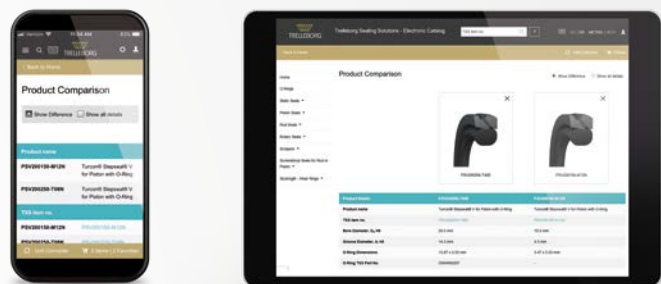
### FILTERING

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.



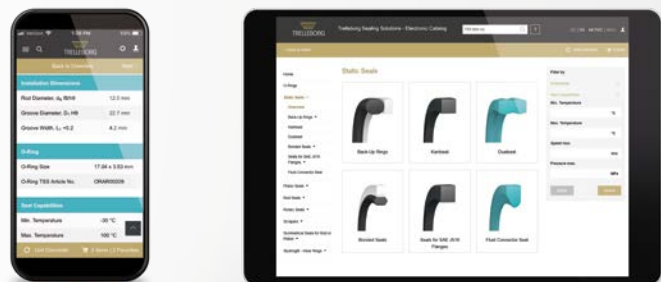
### PRODUCT COMPARISON

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.



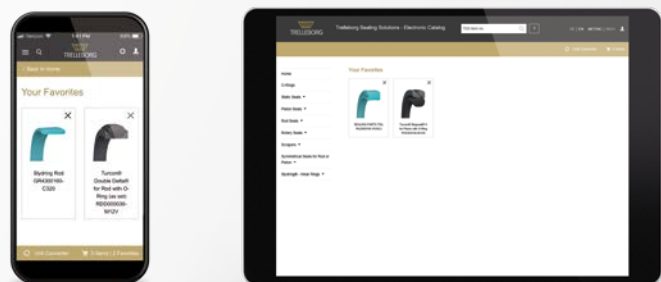
### PRODUCT INFORMATION

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.



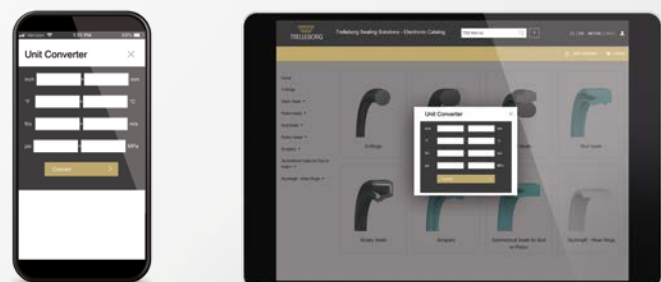
### ADD TO FAVORITES

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.

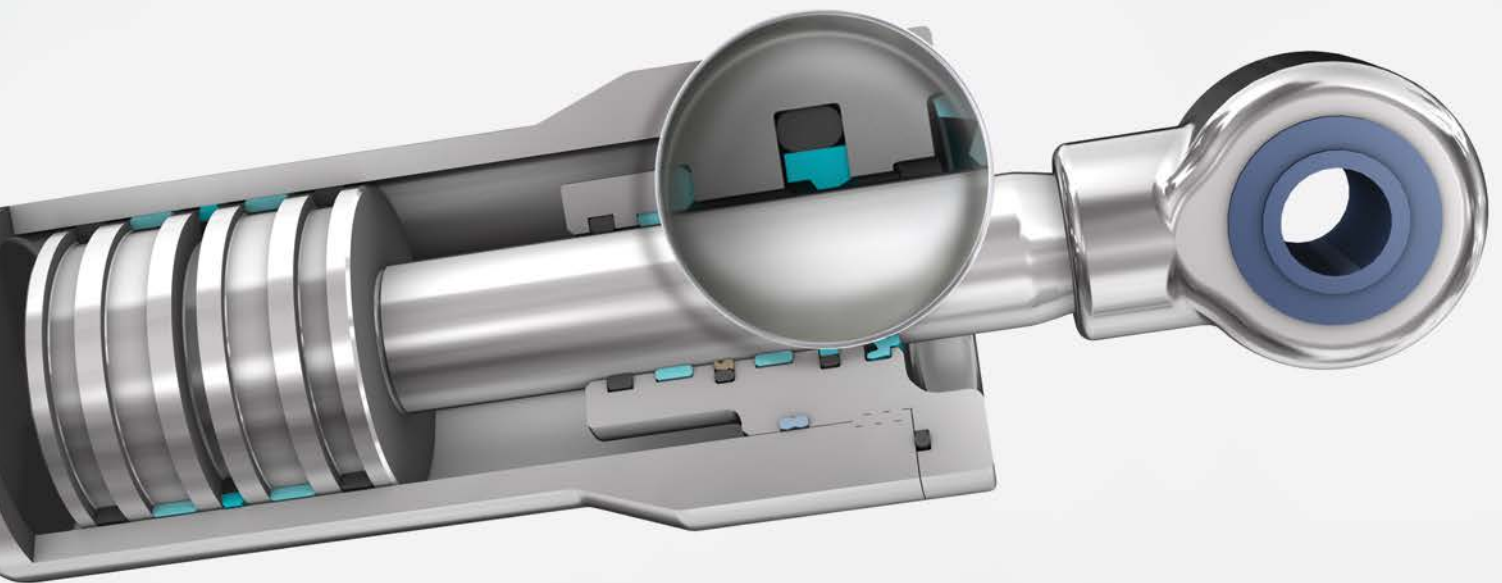


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# Rod Seals



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## Contents

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<b>32</b>	<b>Design Instructions</b>	<b>119</b>	<b>Turcon® Glyd Ring® C</b>
<b>35</b>	<b>Installation Instructions</b>	<b>127</b>	<b>Turcon® Double Delta®</b>
<b>39</b>	<b>General Quality Criteria</b>		
<b>39</b>	<b>Guidelines for the Storage of Polymer Products Based on ISO 2230</b>		
<b>43</b>	<b>Zurcon® U-Cup RU9</b>		
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<b>105</b>	<b>Turcon® Glyd Ring® T</b>		

## ■ Choice of the Sealing Element

Sealing elements have a decisive influence on the design, function and service life of hydraulic and pneumatic cylinders and systems.

This applies equally to the piston rod seals where leak tightness, resistance to wear and gap extrusion, resistance to process media, resistance to high and low temperatures, low friction, compact form and simple installation are demanded in order to meet the requirements of industry for a functional sealing solution.

The significance of these parameters and their limits generally depends on the requirements of the specific application. Trelleborg Sealing Solutions has therefore developed a complete range of seals which, due to their optimized geometries and designs and the use of high-quality materials such as Turcon® and Zurcon®, satisfy the technical and economic demands of the industry in full.

In order to be in a position to select the most appropriate seal type and material, it is necessary to first define all the desired functional parameters. Table 1 can then be used to make an initial selection of seals and materials according to the specific requirements of the application.

The second column of the table contains the number of the page on which further general information together with specific design and installation instructions on the particular seal type and materials (or material combinations with multi-element seals, e.g. Turcon® Stepseal® 2K) can be found.

Furthermore on page 33, attention is drawn to the quality of the mating surface. We recommend that the limits specified there be observed, as they have a decisive influence on the functionality and service life of the system.

The final choice of seal type and material must also take into account detailed information on the seal elements.

Please do not hesitate to contact our Technical Department for further information on specific applications and special technical questions.

This catalog is a compilation of the preferred product ranges of Trelleborg Sealing Solutions. All similar products are technically equivalent but availability and pricing may vary. For further information please contact your local Customer Solution Center.

### NOTE ON ORDERING







All multi-element standard rod seals, e.g. Turcon® Stepseal® 2K, are generally supplied as complete seal sets. The supply includes the seal and matching elastomer energizing elements. The O-Ring does not have to be ordered separately. It is also possible to use other O-Ring materials from our O-Ring catalog.

For all new applications, we recommend the use of the seal types and preferred sizes listed in this catalog.

Other combinations of materials and special designs can be developed and supplied for special applications in all intermediate sizes up to 102 inches (2,600mm) diameter, provided there is sufficient demand.







The sizes contained in this catalog are mostly available from stock or can be supplied at short notice. We reserve the right to modify our supply program.

**Table 1: Selection Criteria for Rod Seals**

Seal		Application				Size Range	Action		Technical Data*			Recommended Seal Material			
Type	Page	Field of Application			Inch	Single	Double	Temp. Range **	Velocity	Pressure					
			Light	Medium				Heavy	°F	ft/s	PSI Max.				
Zurcon® U-Cup RU9 	43	Hydraulic cylinders	•	•		.375-10	•	-30/ +230	1.65	5,800	Zurcon® Z20				
		Industrial hydraulics	•	•											
		Mobile hydraulics	•	•											
Zurcon® Buffer Seal LM 	51	Earthmoving Equipment		•	•	1.250-10.000	•	-30/ +230	3.3	8,700	Zurcon® Z20				
		Mobile hydraulics		•	•										
		Construction Machinery		•	•										
Zurcon® Loaded U-Cup 	59	Hydraulic cylinders	•	•		.125-8	•	-22/ +194	1.5	5,000	Zurcon® Z06				
		Industrial hydraulics	•	•											
		Mobile hydraulics	•	•											
Turcon® Stepseal® 2K 	65	Mobile hydraulics	•	•	•	.125-102	•	-49/ +392	50	7,250	Turcon® M12				
		Standard cylinders	•	•	•					7,250	Turcon® T46				
		Machine tools	•	•	•					2,900	Turcon® T05				
		Injection molding machines	•	•	•					.125-86	•	-49/ +230	6.5	8,700	Zurcon® Z53
		Presses	•	•	•										
		Automotive industry	•	•	•										
		Turcon® Stepseal® V 	77	Mobile hydraulics	•					•	•	.125-25.499	•	-49/ +392	50
Construction equipment	•			•	•	7,250	Turcon® T46								
Presses	•			•	•										
Injection molding machines	•			•	•										
Zurcon® Rimseal 	85	Mobile hydraulics	•	•	•	.313-86	•	-49/ +230	In tandem with Turcon® Stepseal® 2K 16 Ft/s	In tandem 8,700	Zurcon® Z54				
		Standard cylinders	•	•	•					As single seal 3,625					
		Machine tools	•	•	•										
		Injection molding machines	•	•	•										
		Presses	•	•	•										

\* The data below are maximum values and cannot be used at the same time. The maximum pressure depends on temperature and gap dimension.

\*\* Temperature range depends on choice of elastomer material and media.

Seal		Application				Size Range	Action		Technical Data*			Recommended Seal Material		
									Temp. Range **	Velocity	Pressure			
Type	Page	Field of Application			Inch	Single	Double	°F	ft/s	PSI Max.				
		Light	Medium	Heavy										
Turcon® VL Seal® 	91	Automation	•	•	•	.375-102	•	-49/ +392	50	7,250	Turcon® M12			
		Telescopic cylinders	•	•	•					7,250	Turcon® T46			
		Valve stems	•	•	•					.375-86	-49/ +230	6.5	3,625	Zurcon® Z54
		Down-hole tools	•	•	•									
Turcon® Variseal® M2 	97	High and low temperatures	•	•	.125-102	•	-94/ +572	50	5,800	Turcon® T40				
		Aggressive media	•	•					2,900	Turcon® T05				
		Food-contact	•	•										
Glyd Ring® T 	105	Special cylinders	•	•	•	.313-102	•	-49/ +392	50	7,250	Turcon® M12			
		Pumps and valves	•	•	•					7,250	Turcon® T46			
		Machine tools	•	•	•									
		Robotics/manipulators	•	•	•									
		Presses	•	•	•					.313-86	-49/ +230	6.5	8,700	Zurcon® Z53
Glyd Ring® 	111	Special cylinders	•	•	•	.313-102	•	-49/ +392	50	7,250	Turcon® M12			
		Pumps and valves	•	•	•					2,900	Turcon® T05			
		Machine tools	•	•	•									
		Servo equipment	•	•	•					.313-86	-49/ +230	6.5	8,700	Zurcon® Z53
Glyd Ring® C 	119	Special cylinders	•	•	•	.125-15	•	-49/ +392	50	7,250	Turcon® M12			
		Pumps and valves	•	•	•					2,900	Turcon® T05			
		Machine tools	•	•	•									
		Robotics/manipulators	•	•	•									
Double Delta® 	127	Valve stems	•	•	.080-40	•	-49/ +392	50	2,900	Turcon® T05				
		Mini hydraulics	•	•					5,000	Turcon® M12				
		Hydraulic tools	•	•					5,000	Turcon® T46				

\* The data below are maximum values and cannot be used at the same time. The maximum pressure depends on temperature and gap dimension.  
 \*\* Temperature range depends on choice of elastomer material and media.

### REDUNDANT SEALING SYSTEM

Sealing of environmentally harmful fluids has led Trelleborg Sealing Solutions to develop innovative sealing systems to meet the ever demanding industry specifications with regard to leak-free performance and high service life.

In heavy duty applications, leak free performance and high service life cannot be assured by a single sealing element; therefore, specially developed system seals are arranged in series, building a tandem arrangement.

Each sealing element in a system has its specific function and their interaction needs to be secured to get a redundant sealing system.

The primary seal in PTFE based proprietary Turcon® material generates low friction and has excellent wear and extrusion resistance under extreme working conditions. It allows a fine lubrication film passing this first barrier, ensuring the necessary lubrication of the secondary sealing element for long service life.

The tandem arrangement requires an outstanding backpumping ability of the primary seal and the secondary seal, if a double acting scraper is installed. A combination of different sealing materials in a system, Turcon® and Zurcon®, (PTFE and Polyurethane) ensures the best sealing performance.

Trelleborg Sealing Solutions has pioneered work in this area and continues development of redundant sealing today.

Outstanding solutions to such applications have been the Turcon® Stepseal® 2K in tandem arrangement. A tandem sealing system can also be created by using Zurcon® Rimseal or Zurcon® U-Cup RU9 as secondary sealing elements. Depending on type of secondary seal, a single- or double acting scraper completes the system, to offer the highest possible operation reliability, ensuring both adequate lubrication of the sealing system and a long service life.

Figure 1 shows an example of a redundant sealing system consisting of Turcon® Stepseal® 2K, Zurcon® Rimseal and Rod Scraper DA 22 with corresponding wear ring arrangement.

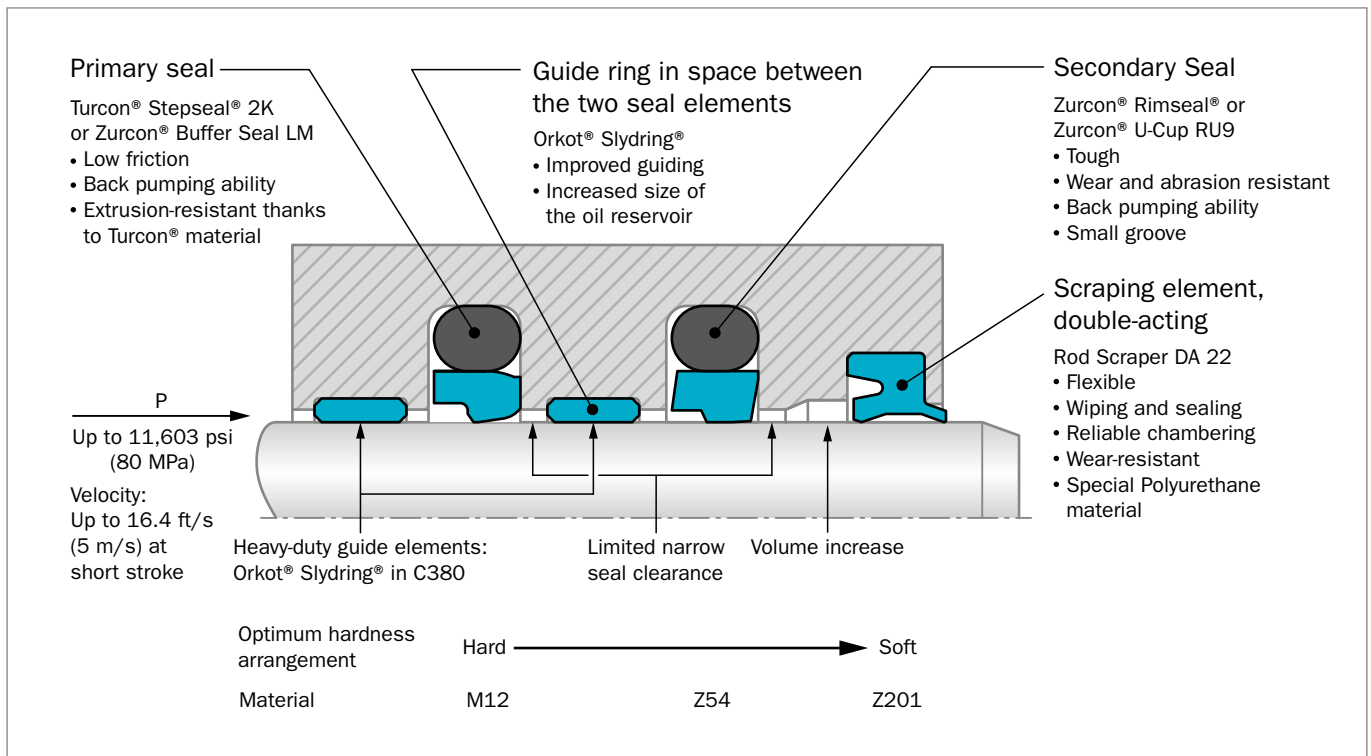


Figure 1: Example of a Redundant Modular Sealing System

## ■ Design Instructions

### LEAD-IN CHAMFERS

In order to avoid damage to the rod seal during installation, lead-in chamfers and rounded edges must be provided on the piston rods (see Figure 2). If this is not possible for design reasons, a separate installation tool must be used.

The minimum length of the lead-in chamfer  $Z_{min}$  depends on the profile size of the seal and can be seen from the following tables.

Generally, for elastomer energized seals,  $Z_{min}$  from Table 2 and Table 3 is recommended but at 15° Z must also exceed 2.5% of the rod diameter  $d_N$  (relevant for large diameter rods). At 20° Z is calculated correspondingly.

The rod should have a lead-in chamfer of 15° to 20° by Z length minimum to gently guide the seal assembly into the hardware as shown in Figure 2. The chamfer should clear the seal assembly - in a free condition - after the seal has been calibrated.

For U-Cups, the rod should have a lead-in chamfer of 20° to 30° by Z length minimum to gently guide the seal assembly into the hardware as shown in Figure 3. U-Cups typically do not require calibration after assembly.

**Table 2: Elastomer Energized Seals**

Minimum chamfer for a calibrated seal.

Groove Width $L_1^*$	Lead-in Chamfer Length $Z_{min}$	
	15°	20°
.087	.098	.079
.126	.118	.098
.165	.138	.118
.248	.197	.157
.319	.256	.197
.374	.295	.217
.543	.413	.315

\* The groove width can be found in the table Installation Dimensions for Turcon® Glyd Ring®, Glyd Ring® T, Glyd Ring® C, AQ Seal®, Stepseal® 2K, Stepseal® V, and Zurcon® Wynseal® M

**Table 3: Double Delta®**

Minimum chamfer for a calibrated seal.

O-Ring Cross Section** $d_2$	Lead-in Chamfer* Length $Z_{min}$	
	15°	20°
.070	-	.098
.094	.103	.118
.118	.139	.138
.210	.225	.197
.275	-	.256
.331	-	.295

\* Though not less than 2.5% of rod diameter.

\*\*The O-Ring cross section  $d_2$  can be found in the appropriate table "Installation Dimensions", from chapter Double Delta®.

**Table 4: U-Cups**

Minimum for a calibrated seal

U-Cup Groove Depth*	Lead-in Chamfer Length $Z_{min}$	
	20°	30°
.125 / .187	.098	.059
.250	.118	.079
.312 / .375	.177	.117
.500	.256	.236
.625	.295	.256
.750	.394	.335

\* The groove depth is calculated from:  $(d_1 - d)/2$ . The dimensions for  $d_1$  and  $d$  can be found in the tables, "Installation dimensions".

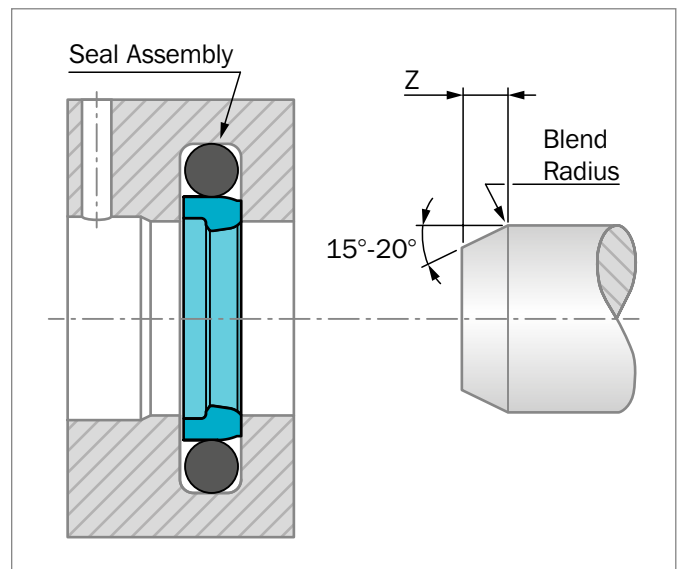


Figure 2: Lead-in chamfers Distance between Grooves



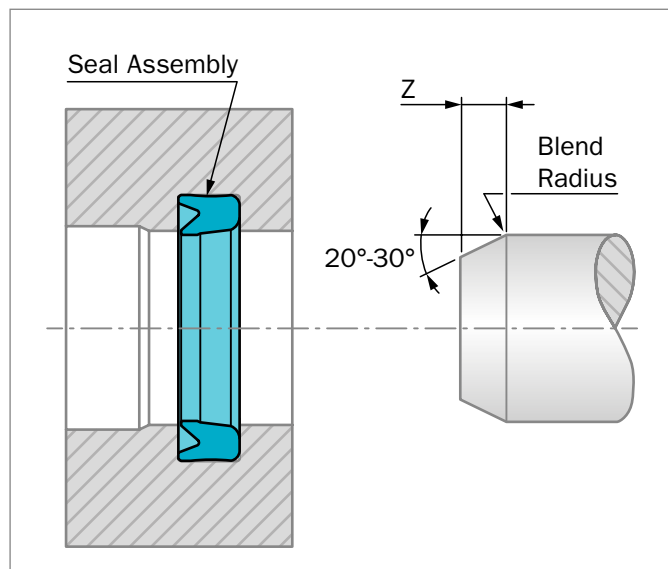


Figure 3: U-Cup lead-in chamfers

### DISTANCE BETWEEN GROOVES

When installing tandem seal arrangement or double-acting scraper seals in conjunction with rod seals with back pumping effects such as Turcon® Stepseal® 2K and Zurcon® Rimseal, we recommend the following arrangement:

- Distance between seal grooves and/or scraper seal groove  $L =$  at least groove depth  $X$
- Oil reservoir for collecting the returning oil as shown in Figure 4.

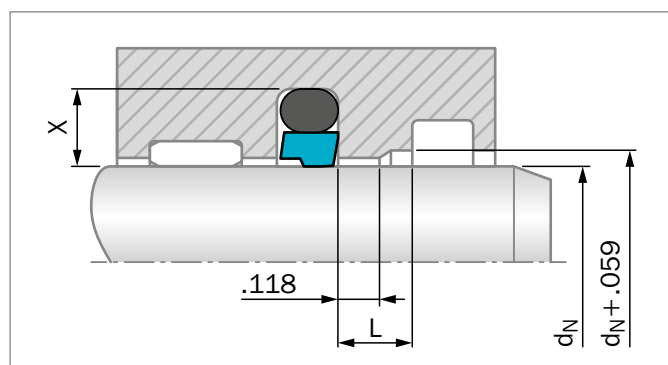


Figure 4: Recommendation for groove spacings between grooves

### SURFACE ROUGHNESS DIN EN ISO 4287

The functional reliability and service life of a seal depend to a very great extent on the quality and surface finish of the mating surface to be sealed.

Scores, scratches, pores and concentric or spiral machining marks are not permitted. Higher demands must be made on the surface finish of dynamic surfaces than of static mating surfaces.

The characteristics most frequently used to describe the surface microfinish  $R_a$ ,  $R_z$  and  $R_{max}$  are defined in DIN EN ISO 4287. These characteristics alone, however, are not sufficient for assessing the suitability in seal technology. In addition, the material contact area of the surface roughness profile  $M_r$  in accordance with DIN EN ISO 4287 should be demanded. The significance of this surface specification is illustrated in Figure 5. It shows clearly that specification of  $R_a$  and  $R_z$  alone do not describe the surface roughness profile accurately enough for the seal technology and is thus not sufficient for assessing the suitability. The material contact area  $M_r$  is essential for assessing surfaces, as this parameter is determined by the specific surface roughness profile. This in turn is directly dependent on the machining process employed.

Trelleborg Sealing Solutions recommends that the following surface finishes be observed:

Table 5: Surface Roughness

Parameter	Surface Roughness $\mu$ inch		
	Mating Surface		Groove Surface
	Turcon® Materials	Zurcon® and Rubber	
$R_{max}$	25 - 100	40 - 160	<625
$R_z$	16 - 63	25 - 100	<400
$R_a$	2 - 8	4 - 16	<63

The material contact area  $M_r$  should be approx. 50 to 70%, determined at a cut depth  $c = 0.25 \times R_z$ , relative to a reference line of  $C_{ref}$  5%.

Surface profile $\mu$ inch	$R_a$	$R_z$	$M_r$
closed profile form 	4	40	70%
open profile form 	8	40	15%

Figure 5: Profile forms of surfaces

Figure 5 shows two surface profiles, both of which exhibit nearly the same value for  $R_z$  in the test procedure. The difference becomes obvious only when the material contact area of the surface roughness profiles are compared. These show that the upper roughness profile with ( $M_r = 70\%$ ) has the better seal/mating surface ratio.

## HARDWARE

For optimum performance Trelleborg Sealing Solutions recommends a piston rod of chrome-plated steel.

Material: Preferably 42CrMo4V, purity class K3 to DIN 50602

Induction hardened min. HRC 45

Hardening depth min. 0.1 inches

Ground and hard chrome-plated, coating thickness .0008 to .0012 inch, polished

Roughness  $R_a$  4 to 12  $\mu$ inch max. corresponding to N4 DIN/ISO 1302

Material contact area  $M_r = 50$  to 70%

Cut depth  $c = 0.25 \times R_z$

For other rod materials, special coatings and treatments, please contact your local Customer Solution Center.

## ■ Installation Instructions

The following points should be observed before installation of the seals:

- Ensure the piston rod has a lead-in chamfer; if not, use an installation sleeve
- Deburr and chamfer or round sharp edges, cover the tips of screw threads
- Remove machining residues such as chips, dirt and other foreign particles and carefully clean all parts
- The seals can be installed more easily if the rod is greased or oiled. Attention must be paid to the compatibility of the seal materials with these lubricants. Use only grease without solid additives (e.g. molybdenum disulphide or zinc sulphide)
- Use no sharp-edged installation tools

### INSTALLATION IN SPLIT GROOVES

Installation in split grooves is problem-free. The sequence of installation corresponds to the configuration of the seal, whereby the individual seal elements must not be allowed to twist. During final installation (insertion of the piston rod into the seal), elastomer or spring-energized seals must be sized. The piston rod itself can be used for this purpose, provided that it has a long lead-in chamfer, or use a sizing sleeve.

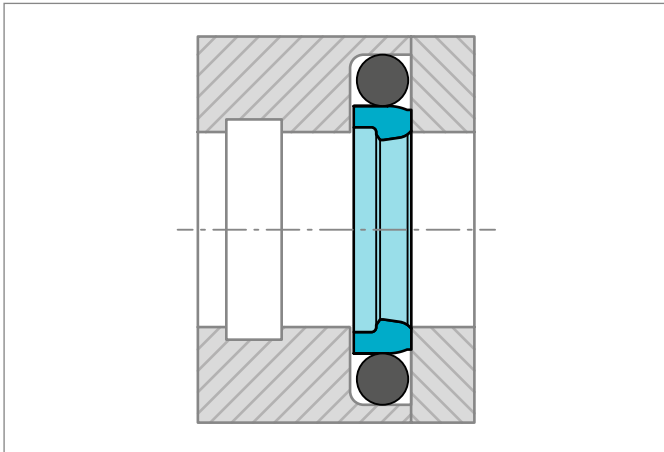


Figure 6: Installation in a split groove

### INSTALLATION IN CLOSED GROOVES

By following the instructions in each seal type description (sizes for closed or split grooves) or using the light series for Turcon® seals, it will result in a problem-free installation of our rod seal elements of small diameters.

For Zurcon® and polyurethane (not Turcon®) seals, the use of installation tools is recommended. If installation has to be performed without installation tools, the following points should be observed:

- Place the O-Ring into the groove (not necessary with U-Cups)
- Compress the Turcon® or Zurcon® seals into a kidney shape. The seal must have no sharp bends (Figure 7)!

When a rod seal with notches is folded into a kidney shape, take care to avoid bending the seal at the position of the notches as this may cause overstretch or damage to the seal material.

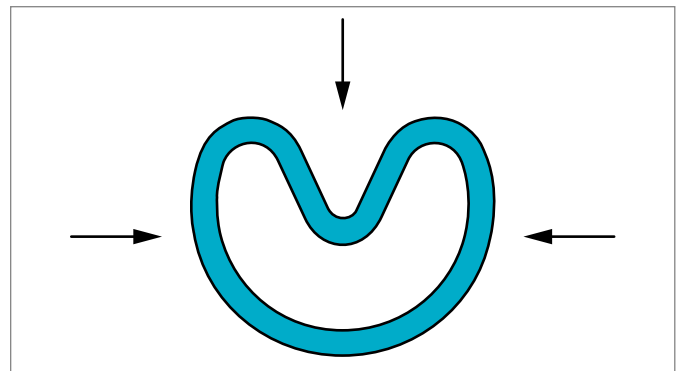


Figure 7: Kidney-shaped deformation of the seal ring

- Place the seal ring in compressed form into the groove and push against the O-Ring in the direction of the arrow (Figure 8).

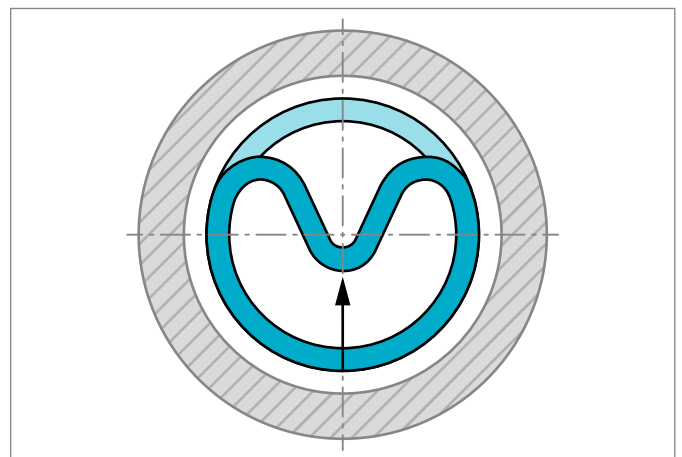


Figure 8: Inserting the seal ring into the closed groove

- After placing into the groove, form the seal into a ring again in the groove by hand.
- Finally size the seal ring using a mandrel which should have a chamfer of 15° to 20° over at least the lead-in chamfer length  $Z_{min} \times 2$  see Table 2.

The sizing mandrel should be made from a polymer material (e.g. polyamide) with good sliding characteristics and high surface quality in order to avoid damage to the seals.

The piston rod itself can also be used for calibration, provided it has a sufficiently long lead-in chamfer.

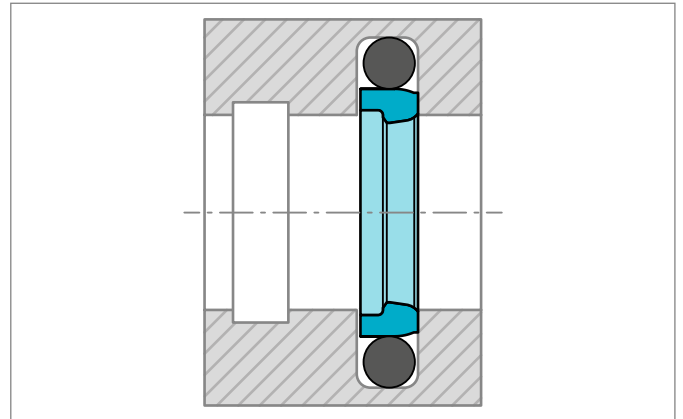


Figure 9: Installation in a closed groove

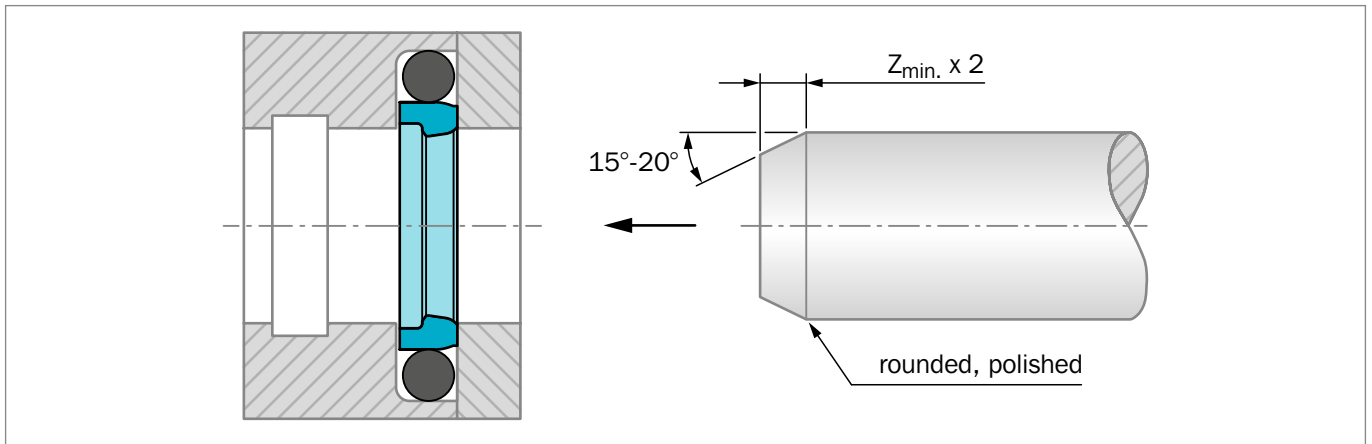


Figure 10: Calibration of the installed seal

**Table 6: Closed groove installation for Turcon® rod seals**

Glyd Ring® and seals for similar groove sizes can be installed in closed grooves above the following rod diameters\*:

O-Ring Series	Rod Diameter $\varnothing d_N$ (in)	Materials
0	$\geq .475$	Turcon® M12, T05, T08, T10, T29, T40 and T46
100	$\geq .625$	
200	$\geq .750$	
300	$\geq 1.500$	
400	$\geq 2.750$	
400 H	$\geq 7.875$	Zurcon® Z53, Z54 and Z80
.331**	$\geq 10.000$	
.472***	$\geq 25.500$	

\* For diameter  $d_N$  below 1.181 inches (30mm) and/or not very accessible grooves it is often essential to use installation tools.

\*\* O-Ring cross section according to SMS 1586.

\*\*\* The energizer can have a special shape.

### INSTALLATION OF TURCON® DOUBLE DELTA®

Installation in closed grooves is possible for diameters from .472 inches (12 mm) using the following procedure:

- Place the O-Ring into the groove.
- Compress the Turcon® seal into a kidney shape, avoid making sharp bends on the seal (Figure 11).
- Place the seal ring in compressed form into the groove and push against the O-Ring in the direction of the arrow in the groove by hand (Figure 12). For diameters smaller than 1.181 inches (30 mm) an inserter tube is recommended (Figure 13).
- Finally, size the seal ring using a mandrel (Figure 14), which should have a chamfer of 10° to 15° over a minimum length of 2 x lead-in chamfer length  $Z_{min}$  see Table 4.

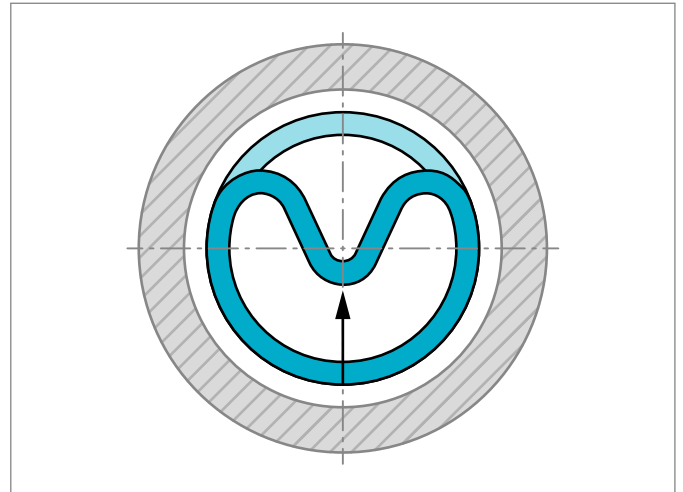


Figure 12: Inserting the seal ring into the closed groove

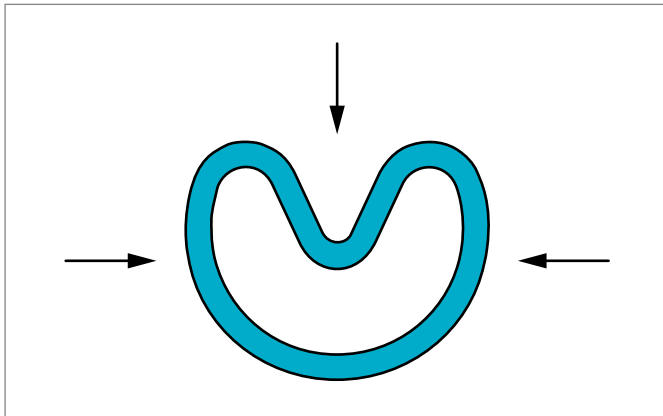


Figure 11: Kidney-shaped deformation

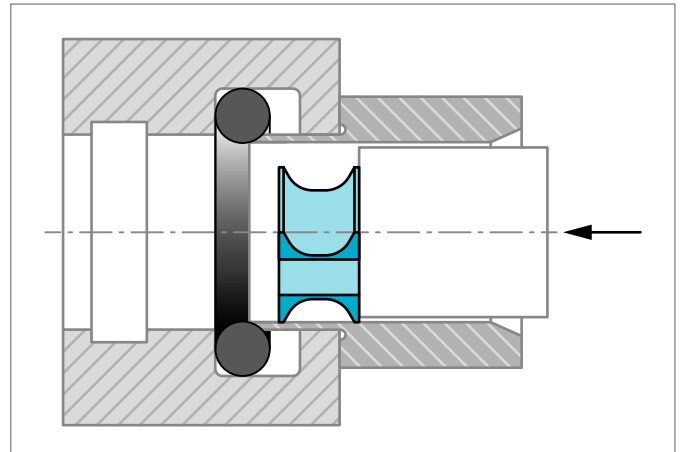


Figure 13: Insertion with an inserter tube

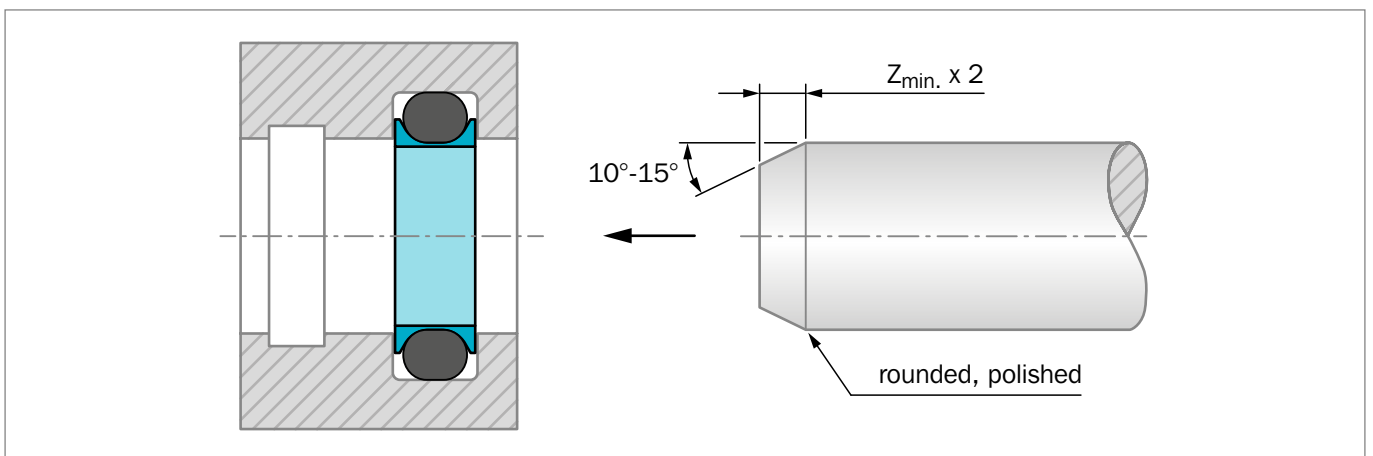


Figure 14: Calibration of the installed seal by means of a calibration mandrel

**INSTALLATION OF SPRING ENERGIZED SEALS**

Turcon® Variseal® M2 seals should preferably be installed in split grooves.

Installation in half-open grooves is possible with a snap fitting. Figure 15 shows the design of the groove.

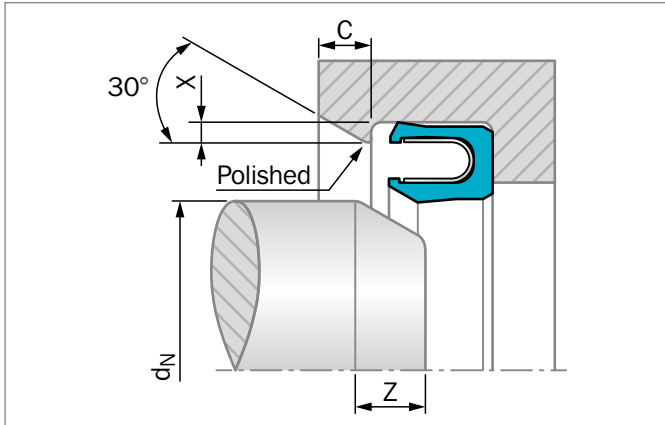


Figure 15: Installation in a half-open groove

**Table 7: Installation in Half-Open Grooves**

TSS Serial-No.	X min.	d <sub>N</sub> min.	Length Z min.	C min.
RVAA	.015	.472	.157	.098
RVAB	.023	.787	.196	.137
RVAC	.027	1.181	.196	.137
RVAD	.031	1.574	.295	.177
RVAE	.035	2.165	.472	.295
RVAG	.059	2.755	.472	.295

Further details, see Figure 47 and Table 31.

In exceptional cases or with existing designs, an installation in closed grooves is also possible. The details in Table 8 should be regarded as guide values for installation.

**Table 8: Installation in Closed Grooves**

TSS Serial-No.	d <sub>N</sub> min.
RVAA	1.181
RVAB	2.755
RVAC	4.330
RVAD	11.810
RVAE	19.684
RVAG	31.495

## ■ 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 +59 °F (+15 °C) and should not exceed +77 °F (+25 °C). The products should be stored away from direct sources of heat such as boilers, radiators and direct sunlight. If the storage temperature is below +59 °F (+15 °C), 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.

**Table 9: Initial and extension storage periods for unassembled components**

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, FMQ, 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 +77 °F (+25 °C) this will influence the storage time. Storage at +50 °F (+10 °C) higher will reduce the storage time by about 50%. Storage at +50 °F (+10 °C) 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.

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# Zurcon® U-Cup RU9



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Single-Acting

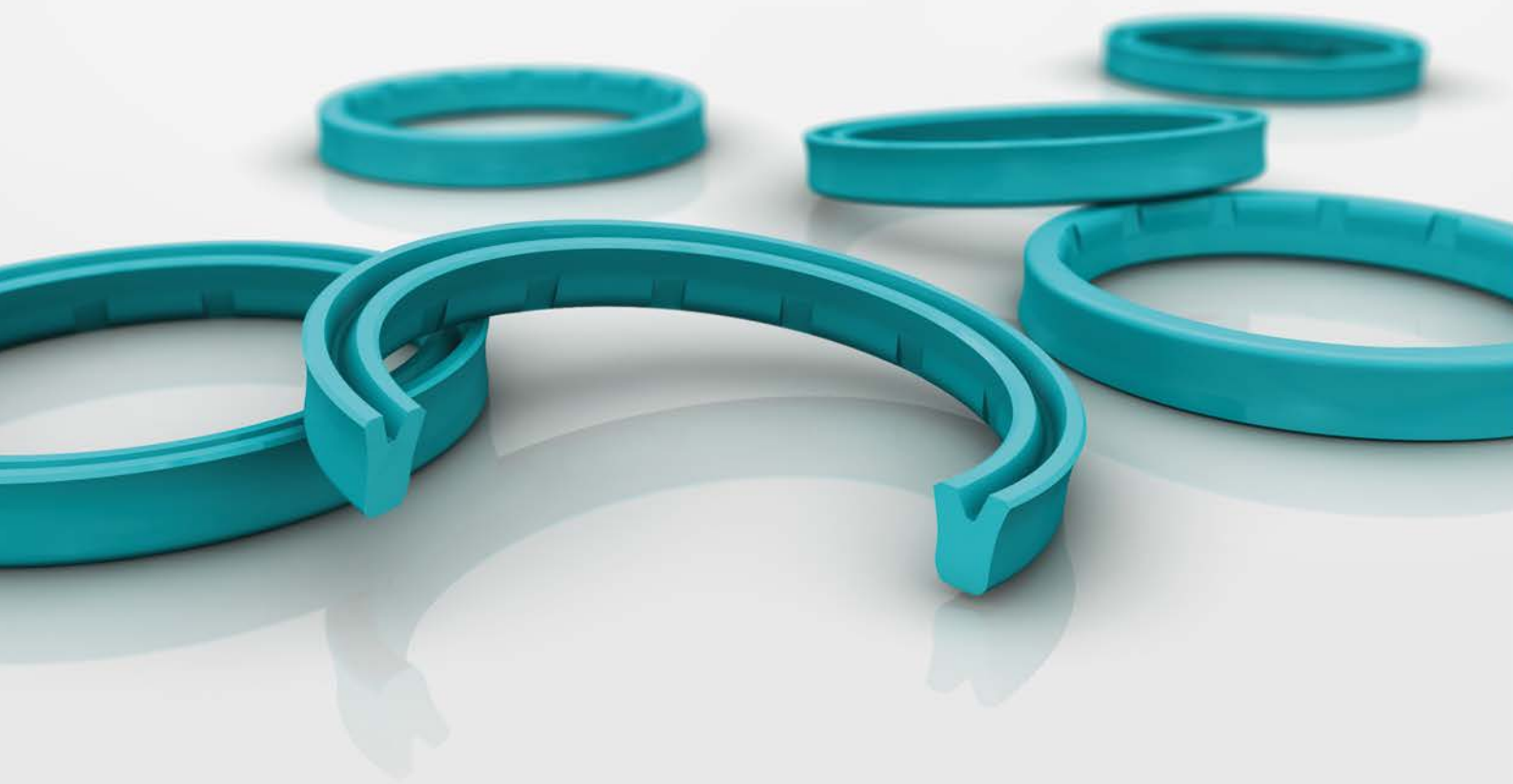
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Low-friction Zurcon® U-Cup

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**Material:**  
Zurcon®

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## ■ Zurcon® U-Cup RU9

### DESCRIPTION

Rod seals are particularly exposed to pressure and friction. A long service life is a specific requirement of piston rods. Features such as wear and extrusion resistance, media and temperature compatibility, low friction, compact installation dimensions and ease of assembly are also essential and require the introduction of new products and materials. It is against this background that we have developed the Zurcon® U-Cup RU9.

Due to its special design, behind the dynamic seal lip, the Zurcon® U-Cup RU9 with its structure of slide segments interspersed by back-pumping channels features, excellent back-pumping ability across the entire pressure range. The dynamic seal slide segments also have a micro-structure with excellent tribological and sealing characteristics. As well as increasing the sealing ability of the U-Cup RU9, this also ensures a constant lubrication film underneath the seal sliding surface, reducing breakaway force even after prolonged periods of rest, and reduces dynamic friction force.

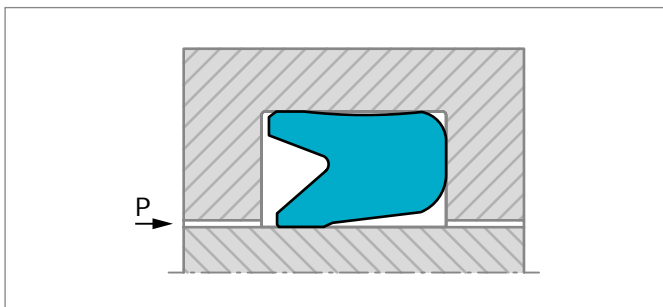


Figure 16: U-Cup, type RU9

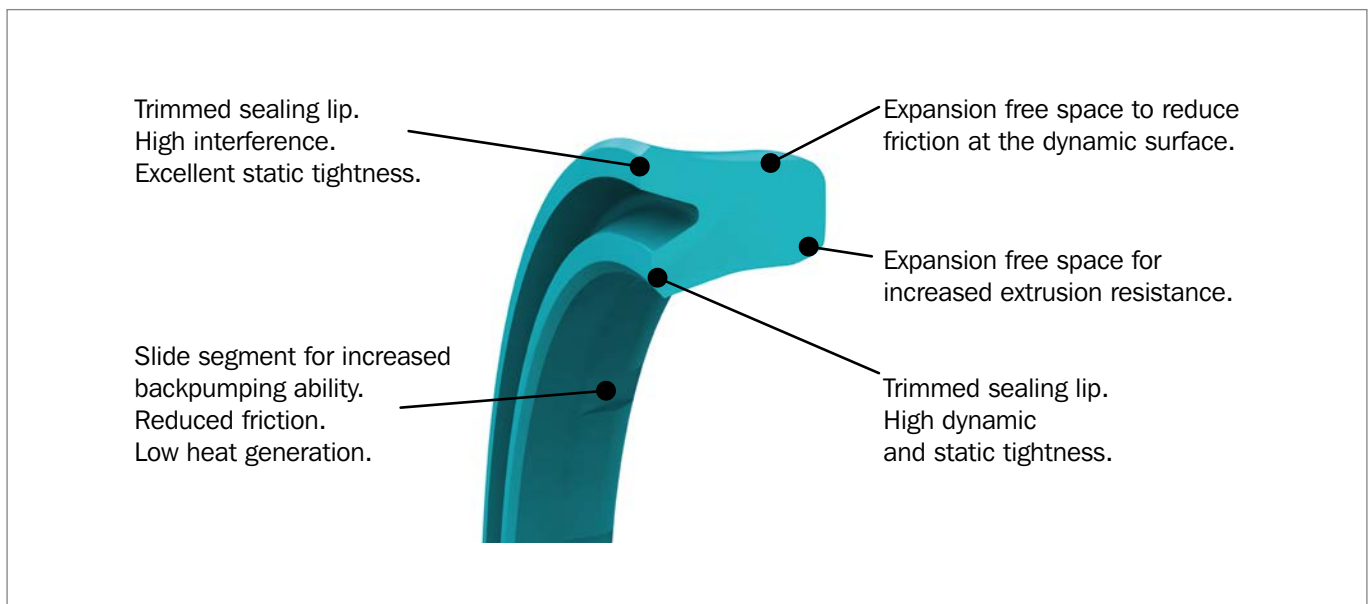


Figure 17: Zurcon® U-Cup RU9 design features



### FRICITION

The friction force of U-Cups dramatically increases between 362 and 1,450 psi. The Zurcon® U-Cup RU9 has a unique feature. As the system pressure increases, the contact surface between the U-Cup and the piston rod increases. Once a specific system pressure is reached, the seal deforms to such an extent that its entire friction-generating inside surface gets in contact with the piston rod. Due to the special design of Zurcon® U-Cup RU9 there is improved pressure distribution on the rod. The resulting tribological benefits restrict the increase in friction. When we compare the friction values of conventional U-Cups with those of the Zurcon® U-Cup RU9 the results are self-evident.

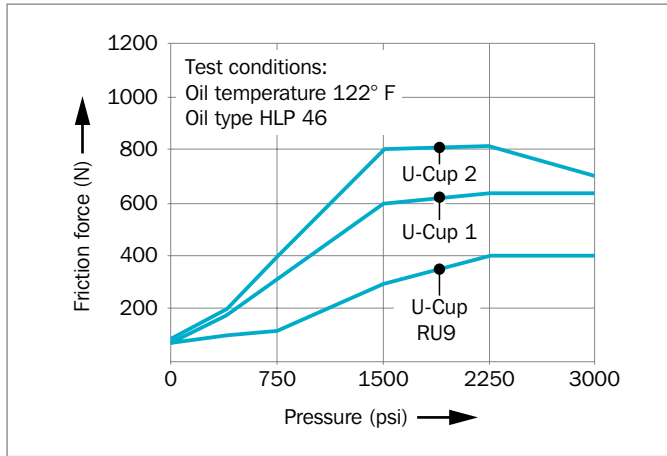


Figure 18: Friction dependent on pressure

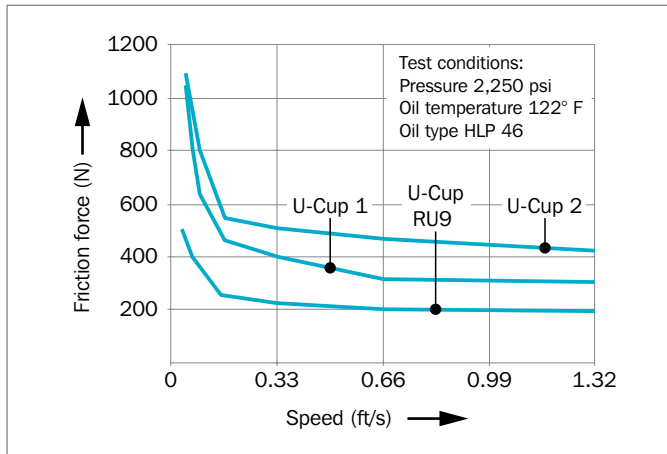


Figure 19: Friction dependent on speed

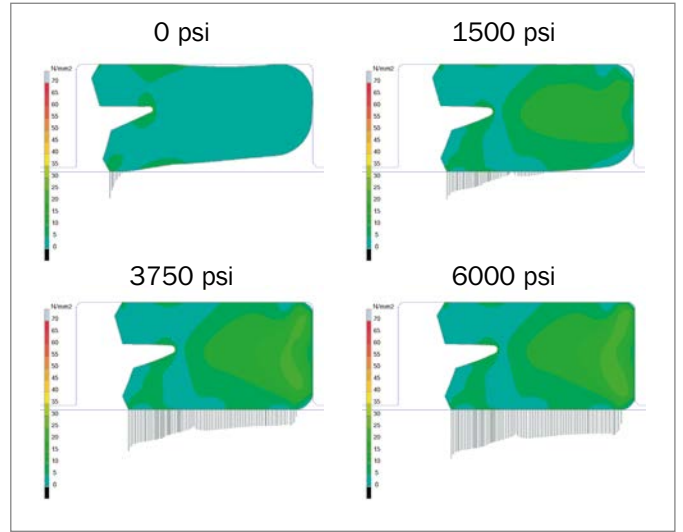


Figure 20: How the Zurcon® U-Cup RU9 performs under pressure

### SEALING PERFORMANCE

The high sealing performance is achieved by:

- Interference fit at the external diameter
- Special shape of both trimmed seal lips
- Controlled pressure distribution and hydrodynamic backpumping ability over a wide pressure range

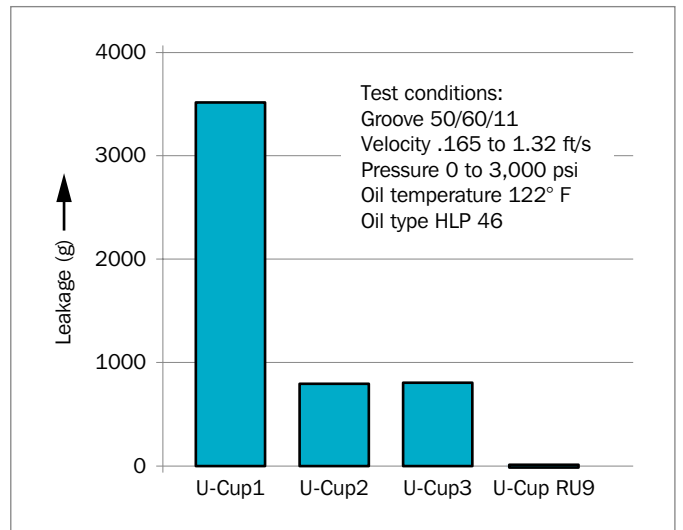


Figure 21: Leakage performance dependent on U-Cup type



## RADIAL CLEARANCE

The new Zurcon® RU9 design combined with the special compound properties shows better extrusion resistance compared to a standard U-Cup under all working conditions. The hardware clearance can be increased significantly.

## ADVANTAGES

- Lower friction than standard U-Cups
- Lower heat generation than standard U-Cups
- High extrusion resistance
- Excellent dynamic and static sealing
- Optimum environment protection
- Back pumping ability over the entire pressure range achieved by grooved profile
- Suitable with the Zurcon® Buffer Seal as secondary seal in “tandem design“
- Suitable for sealing systems with double scraper
- Seal stability within the groove

## MATERIALS

Zurcon® Z20 Standard polyurethane 93 Shore A  
 Temperature: -31 °F to +230 °F (-35 °C to +110 °C)  
 Color: Turquoise

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

## APPLICATION EXAMPLES

Zurcon® U-Cup RU9 can be used in all applications in which previously a conventional U-Cup was applied, such as:

- Hydraulic cylinders
- Construction machinery
- Fork lifts
- Truck cranes
- Telescopic cylinders
- Agricultural machines
- Machine tools
- Injection molding machines
- Hydraulic presses
- Gas springs

In medium/heavy duty applications the preferred solution for tandem rod sealing systems is the combination of the Zurcon® Buffer Seal primary seal and Zurcon® U-Cup RU9 in conjunction with a double acting scraper.

## TECHNICAL DATA

Operating conditions:

<b>Pressure:</b>	Up to 5,800 psi (40 MPa)
<b>Velocity:</b>	Up to 1.65 ft/s (0.5 m/s)
<b>Temperature:</b>	
Zurcon® Z20 Standard:	-31 °F to +230 °F (-35 °C to +110 °C)
<b>Media:</b>	
Hydraulic fluids based on mineral oil:	-31 °F to +230 °F (-35 °C to +110 °C)
Synthetic and natural ester HEES, HETG:	up to +140 °F (+60 °C)
Flame-retardant hydraulic fluids HFA/HFB:	up to +104 °F (+40 °C)

## IMPORTANT NOTE

The above stated limits for pressure and speed are maximum values individually. Friction heat generated by the combination of pressure and speed may cause local heat built-up. Care should be taken not to apply high values for pressure and speed at the same time.



## ■ Installation Recommendation (Inch Rod Series)

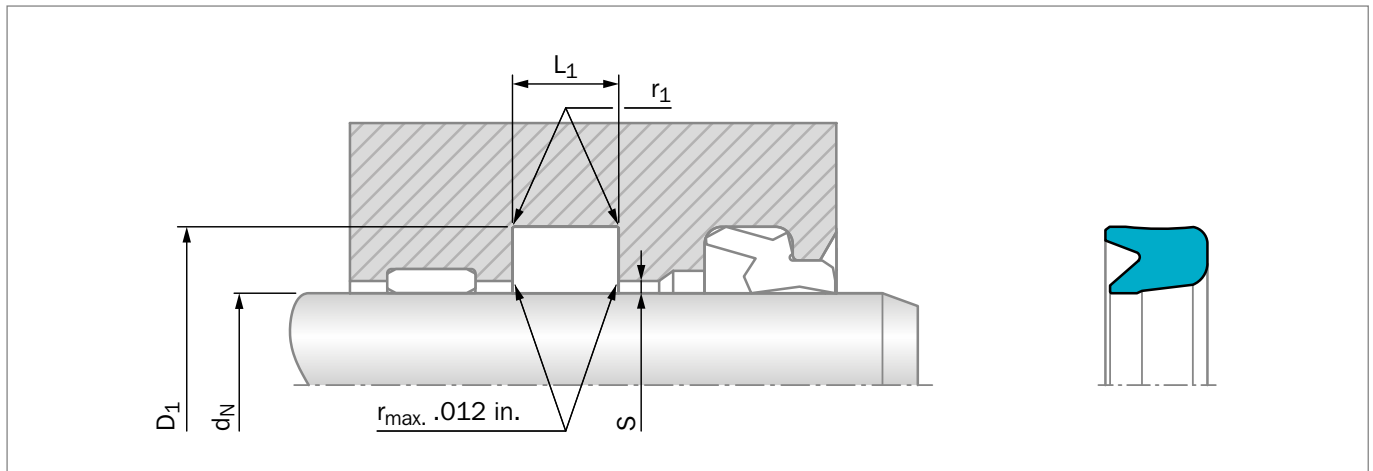


Figure 22: Installation drawing, Gap measure “S” see in Table 10

**Table 10: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9	Groove Diameter	Groove Width	Radius	Radial Clearance $S_{max}$		
	Standard Application	$D_1$ H9	$L_1$ +.010	$r_1$	10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi
RU9AC	.250 - .624	$d_N +.250$	.250	.016	.023	.014	.006
RU9AD	.625 - .999	$d_N +.250$	.281	.016	.023	.014	.006
RU9BF	1.000 - 1.499	$d_N +.375$	.343	.016	.023	.014	.006
RU9BG	1.500 - 1.999	$d_N +.375$	.406	.016	.023	.014	.006
RU9CG	2.000 - 3.499	$d_N +.500$	.406	.016	.023	.014	.006
RU9DH	3.500 - 4.999	$d_N +.625$	.531	.016	.023	.014	.006
RU9EK	5.000 - 7.499	$d_N +.750$	.656	.024	.023	.014	.006
RU9FL	7.500 - 10.000	$d_N +1.000$	.781	.031	.023	.014	.006

### ORDERING EXAMPLE (INCH)

Zurcon® U-Cup Type RU9

<b>Rod Diameter:</b>	$d_N = 2.500$ inches
<b>Groove Diameter:</b>	$D_1 = 3.000$ inches
<b>Groove Width:</b>	$L_1 = .406$ inches
<b>TSS Part No.:</b>	RU9CG2500

**TSS Article No.**

**RU9 CG 2500 - Z20**

TSS Series No. \_\_\_\_\_  
 Cross Section Series \_\_\_\_\_  
 Rod Diameter x 1000 \_\_\_\_\_  
 Quality Index (Standard) \_\_\_\_\_  
 Material Code \_\_\_\_\_

### MATERIAL

Standard Zurcon® : Z20  
 Special polyurethane: 93 Shore A  
 Color: Turquoise

For other groove dimensions please contact your local Customer Solution Center.



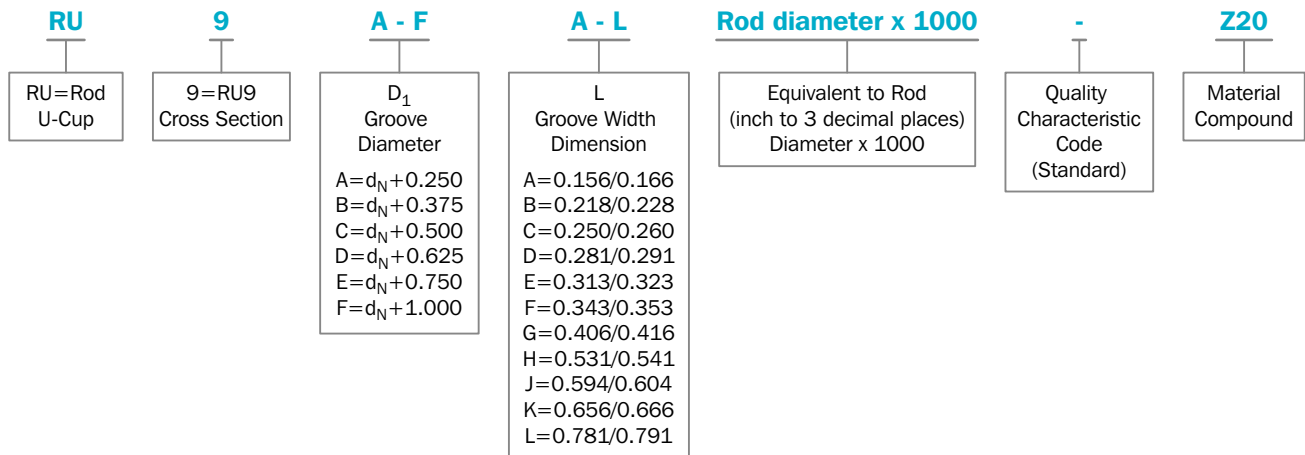


Table 11: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
d <sub>N</sub> f8/h9	D <sub>1</sub> H10	L <sub>1</sub> +.010		d <sub>N</sub> f8/h9	D <sub>1</sub> H10	L <sub>1</sub> +.010	
.375	.625	.250	<a href="#">RU9AC0375</a>	1.750	2.250	.406	<a href="#">RU9CG1750</a>
<b>.500</b>	<b>.750</b>	<b>.218</b>	<b><a href="#">RU9AB0500</a></b>	<b>1.875</b>	<b>2.250</b>	<b>.406</b>	<b><a href="#">RU9BG1875</a></b>
.500	.750	.250	<a href="#">RU9AC0500</a>	1.875	2.375	.406	<a href="#">RU9CG1875</a>
<b>.625</b>	<b>.875</b>	<b>.281</b>	<b><a href="#">RU9AD0625</a></b>	2.000	2.375	.343	<a href="#">RU9BF2000</a>
.750	1.000	.218	<a href="#">RU9AB0750</a>	<b>2.000</b>	<b>2.500</b>	<b>.406</b>	<b><a href="#">RU9CG2000</a></b>
.750	1.000	.250	<a href="#">RU9AC0750</a>	2.125	2.625	.406	<a href="#">RU9CG2125</a>
<b>.750</b>	<b>1.000</b>	<b>.281</b>	<b><a href="#">RU9AD0750</a></b>	<b>2.250</b>	<b>2.750</b>	<b>.406</b>	<b><a href="#">RU9CG2250</a></b>
.875	1.125	.250	<a href="#">RU9AC0875</a>	2.375	2.875	.406	<a href="#">RU9CG2375</a>
<b>.875</b>	<b>1.125</b>	<b>.281</b>	<b><a href="#">RU9AD0875</a></b>	2.500	2.875	.343	<a href="#">RU9BF2500</a>
1.000	1.250	.250	<a href="#">RU9AC1000</a>	<b>2.500</b>	<b>3.000</b>	<b>.406</b>	<b><a href="#">RU9CG2500</a></b>
<b>1.000</b>	<b>1.375</b>	<b>.343</b>	<b><a href="#">RU9BF1000</a></b>	2.500	3.125	.531	<a href="#">RU9DH2500</a>
1.125	1.375	.218	<a href="#">RU9AB1125</a>	2.625	3.125	.406	<a href="#">RU9CG2625</a>
1.125	1.375	.250	<a href="#">RU9AC1125</a>	<b>2.750</b>	<b>3.250</b>	<b>.406</b>	<b><a href="#">RU9CG2750</a></b>
<b>1.125</b>	<b>1.500</b>	<b>.343</b>	<b><a href="#">RU9BF1125</a></b>	3.000	3.625	.531	<a href="#">RU9DH3000</a>
1.250	1.500	.218	<a href="#">RU9AB1250</a>	<b>3.000</b>	<b>3.500</b>	<b>.406</b>	<b><a href="#">RU9CG3000</a></b>
<b>1.250</b>	<b>1.625</b>	<b>.343</b>	<b><a href="#">RU9BF1250</a></b>	3.250	3.750	.406	<a href="#">RU9CG3250</a>
1.375	1.625	.218	<a href="#">RU9AB1375</a>	3.375	3.875	.406	<a href="#">RU9CG3375</a>
<b>1.375</b>	<b>1.750</b>	<b>.343</b>	<b><a href="#">RU9BF1375</a></b>	3.500	3.875	.406	<a href="#">RU9BG3500</a>
1.500	1.875	.281	<a href="#">RU9BD1500</a>	3.500	4.000	.406	<a href="#">RU9CG3500</a>
1.500	1.875	.343	<a href="#">RU9BF1500</a>	3.500	4.125	.531	<a href="#">RU9DH3500</a>
1.500	2.000	.406	<a href="#">RU9CG1500</a>	3.750	4.250	.406	<a href="#">RU9CG3750</a>
<b>1.500</b>	<b>1.875</b>	<b>.406</b>	<b><a href="#">RU9BG1500</a></b>	3.750	4.375	.531	<a href="#">RU9DH3750</a>
<b>1.625</b>	<b>2.000</b>	<b>.406</b>	<b><a href="#">RU9BG1625</a></b>	4.000	4.500	.406	<a href="#">RU9CG4000</a>
1.625	2.125	.406	<a href="#">RU9CG1625</a>	4.000	4.625	.531	<a href="#">RU9DH4000</a>
1.750	2.125	.343	<a href="#">RU9BF1750</a>	4.250	4.625	.406	<a href="#">RU9BG4250</a>
<b>1.750</b>	<b>2.125</b>	<b>.406</b>	<b><a href="#">RU9BG1750</a></b>	4.250	4.875	.531	<a href="#">RU9DH4250</a>



<b>Rod Diameter</b>	<b>Groove Diameter</b>	<b>Groove Width</b>	<b>TSS Part No.</b>
<b><math>d_N</math></b> f8/h9	<b><math>D_1</math></b> H10	<b><math>L_1</math></b> +.010	
4.500	5.125	.531	<a href="#">RU9DH4500</a>
4.750	5.375	.531	<a href="#">RU9DH4750</a>
5.000	5.375	.406	<a href="#">RU9BG5000</a>
5.000	5.625	.531	<a href="#">RU9DH5000</a>
5.000	5.625	.656	<a href="#">RU9DK5000</a>
5.000	5.750	.656	<a href="#">RU9EK5000</a>
5.500	6.250	.656	<a href="#">RU9EK5500</a>
6.000	6.750	.656	<a href="#">RU9EK6000</a>
6.500	7.250	.656	<a href="#">RU9EK6500</a>
6.500	7.500	.781	<a href="#">RU9FL6500</a>
7.000	7.750	.656	<a href="#">RU9EK7000</a>
7.000	8.000	.781	<a href="#">RU9FL7000</a>
8.000	9.000	.781	<a href="#">RU9FL8000</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

# Zurcon® Buffer Seal LM



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Single-acting

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Designed for Lubrication Management  
Technology

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Integrated Back-Up Ring

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**Material:**  
Zurcon®

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## Zurcon® Buffer Seal LM



### Introduction

In heavy-duty applications, leak-free performance and long service life cannot be assured by a single sealing element; therefore, specially developed system seals are arranged in series, building a tandem configuration.

Each sealing element in a system has its specific function, and their interaction needs to be secured to incorporate redundancy into the sealing system. The primary seal, manufactured from Zurcon® material, has excellent wear and extrusion resistance under extreme working conditions. It allows an optimized lubrication film to pass this first barrier, ensuring the necessary lubrication of the secondary sealing element for long service life.

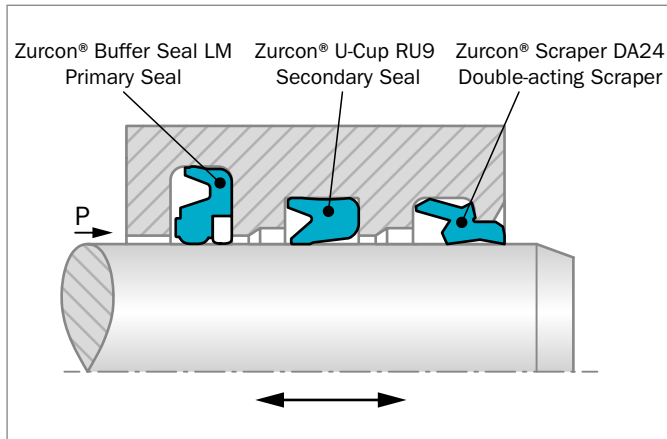


Figure 23: Zurcon® Buffer Seal LM in tandem configuration

In order to further optimize the performance, friction and service life of sealing systems using a tandem sealing configuration, Trelleborg Sealing Solutions developed the already known and appreciated capabilities of Zurcon® Buffer Seal into a new design called Zurcon® Buffer Seal LM.

### DESCRIPTION

The single-acting Zurcon® Buffer Seal LM is designed as a heavy-duty primary rod seal. The design of the product incorporates a combination of a Zurcon® sealing ring with a Back-up Ring. By utilizing two materials, the performance of the product is enhanced and life is extended.

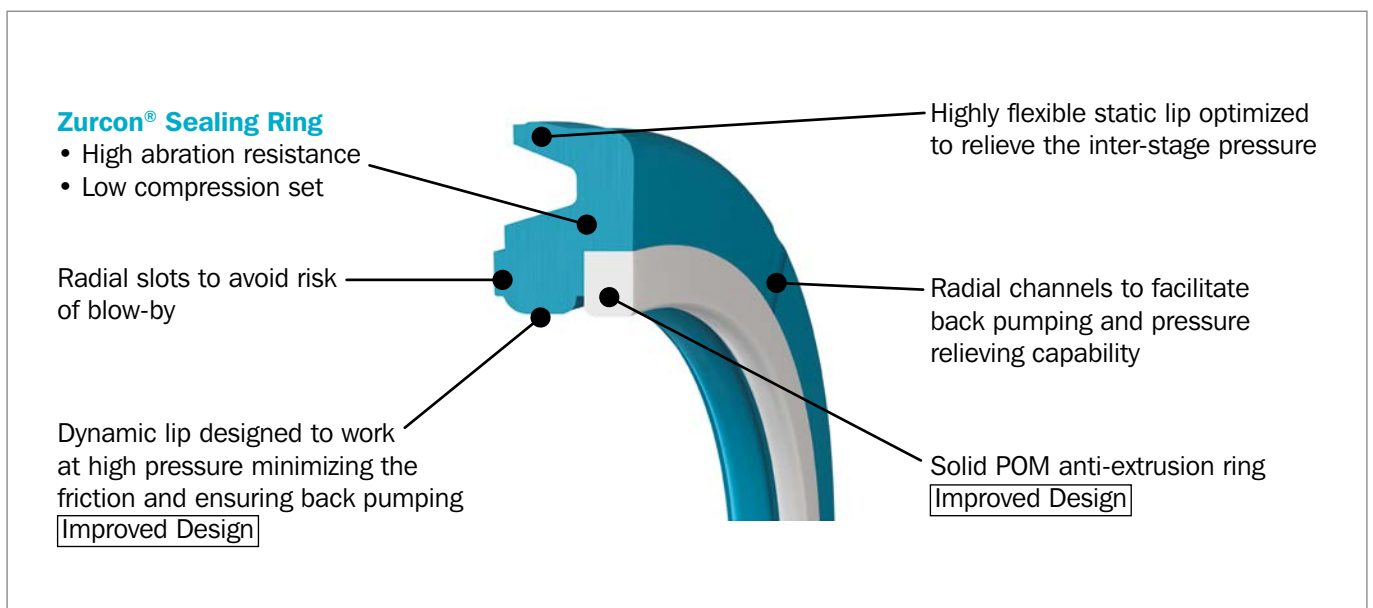


Figure 24: Zurcon® Buffer Seal LM design features



### LUBRICATION MANAGEMENT FEATURE

This innovative design incorporates large radius rounded edges on both seal ring and Back-up Ring that lower the contact pressure, allowing a thicker amount of fluid to lubricate and better activate the secondary seal.

By means of this, friction and wear on the lips are reduced significantly, therefore increasing life time and reliability, as well as rod wear.

This engineered wet running creates the right environment to enhance the Zurcon® PU sealing system. New generation secondary seals like RU9, L-Cup and Rimseal IM can manage the larger oil film in the best way, compensating for pressure from oil accumulation, as well as returning oil to the main pressure chamber due to excellent back pumping behavior under all pressure ranges.

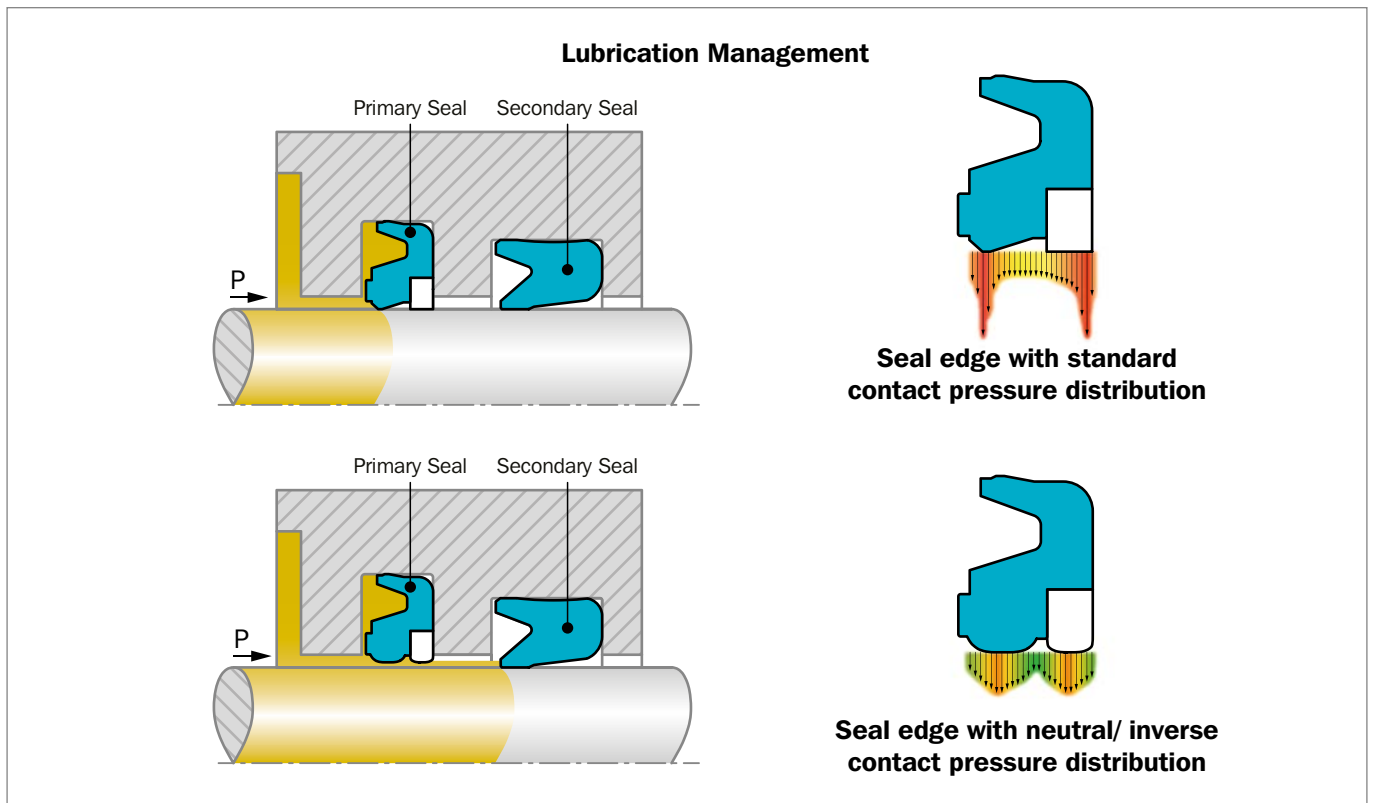


Figure 25: Pressure distribution and function of a standard (top) and a LM (bottom) sealing system



## PRESSURE RELIEF

The relief mechanism is activated by the special seal design, through its thin, short and flexible static lip. The radial channels on the back side offer the fluid a direct stream up to both lips. A minimum difference between the pressure trapped and the pressure in the chamber is able to deflect the seal and recover the same pressure level.

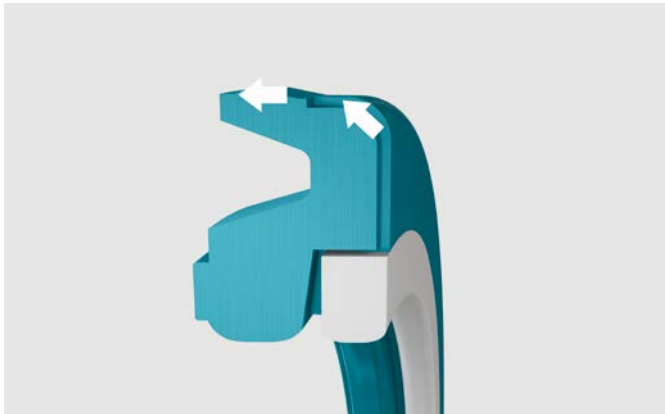


Figure 26: Venting path

Zurcon® Buffer Seal LM is able to guarantee an optimal pressure distribution and sufficient rod lubrication across the entire pressure range.

In unpressurized conditions, head-on slots on the dynamic lip assure correct positioning and avoid any risk of blow-by. When installed, Zurcon® Buffer Seal LM is ready for fast activation, protecting the secondary seal from peaks in pressure.

## ADVANTAGES

- Resistance to very high pressure peaks due to an integrated Back-up Ring that closes the radial gap
- Outstanding pressure relief
- Excellent back-pumping guaranteed over the entire pressure range
- Suitable to use both in ISO 7425/2 standard grooves and in Stepseal® grooves
- High performance Zurcon® material with an excellent abrasion resistance and low compression set

**Table 12: Radial Clearance RUPB Buffer Seal**

Operating Pressure PSI max.	Radial Clearance S <sub>max</sub> at 140 °F max	Radial Clearance S <sub>max</sub> at 194 °F max
1,450	.014	.010
2,900	.010	.008
4,350	.008	.006
5,800	.006	.004

For harsh conditions and high side loads, the gap must be reduced by 50%.

**Table 13: Radial Clearance RUPC Buffer Seal (with backup)**

Operating Pressure PSI max.	Radial Clearance S <sub>max</sub> at 140 °F max	Radial Clearance S <sub>max</sub> at 194 °F max
1,450	.024	.020
2,900	.020	.016
4,350	.018	.014
5,800	.016	.012

For harsh conditions and high side loads, the gap must be reduced by 50%.

## APPLICATION EXAMPLES

Medium and heavy-duty applications:

- Construction machinery
- Earth moving equipment
- Mobile hydraulics
- Fork lifts

## MATERIALS - STANDARD APPLICATION

For hydraulic components in mineral oils or media with good lubricating performance.

Seal Ring: Zurcon® Z20

Back-up Ring: Polyacetal resin (POM)

Set reference: Z2054

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



## OPERATING CONDITIONS

<b>Pressure:</b>	Up to 5,800 psi (40 MPa) Up to 8,700 psi (60 MPa) peak
<b>Velocity:</b>	Up to 3.30 ft/s (1 m/s)
<b>Temperature:</b>	-31 °F to +230 °F (-35 °C to +110 °C)*
<b>Media:</b>	
Mineral oil:	Up to +230 °F (+110 °C)
Synthetic and natural esters HEES, HETG:	Up to +140 °F (+60 °C)
Flame retardant fluids HFA/HFB:	Up to +104 °F (+40 °C)

## 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.

\* in the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact your local Customer Solution Center for more information!





## ■ Installation Recommendation

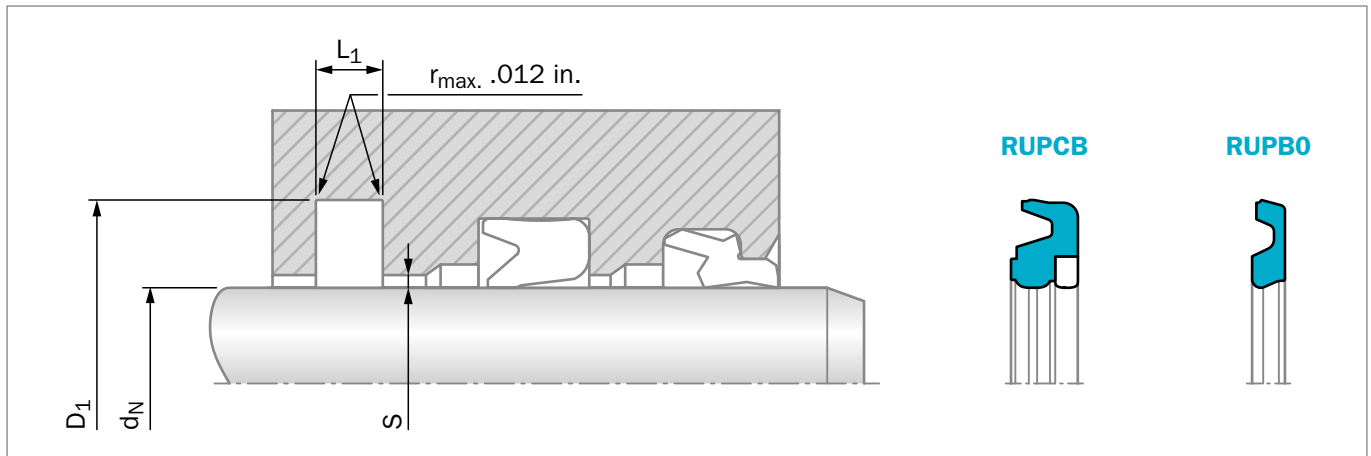


Figure 27: Installation Drawing

### ORDERING EXAMPLE

Zurcon® Buffer Seal LM Type RUPC

<b>Rod Diameter:</b>	$d_N = 3.000$ inches
<b>Groove Diameter:</b>	$D_1 = 3.649$ inches
<b>Groove Width:</b>	$L = 0.234$ inches
<b>TSS Part No.:</b>	RUPCB3000

**TSS Article No.** **RUP CB 3000 - Z2054**

TSS Series No. \_\_\_\_\_  
 Type (Standard) \_\_\_\_\_  
 Rod Diameter x 1000 \_\_\_\_\_  
 Quality Index (Standard) \_\_\_\_\_  
 Material Code (Seal Ring) \_\_\_\_\_

### NOTES

- 1) Sizes with a Rod Diameter ( $d_N$ ) of 2.000 inches or less will not include a back-up ring.
- 2) Tolerances used are per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 3) The clearance stated as S in the above table are for when the seal is specified with Sliding bearings. When not incorporating Sliding bearings, the diametral clearance should be reduced.
- 4) Consult your local Customer Solution Center for diameters that exceed those listed in the above table.

**Table 14: Installation Dimensions / TSS Article No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Article No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
<b>1.250</b>	<b>1.819</b>	<b>.140</b>	<b>RUPB01250</b>
<b>1.500</b>	<b>2.067</b>	<b>.140</b>	<b>RUPB01500</b>
<b>1.750</b>	<b>2.319</b>	<b>.140</b>	<b>RUPB01750</b>
<b>2.000</b>	<b>2.567</b>	<b>.140</b>	<b>RUPB02000</b>
<b>2.250</b>	<b>2.929</b>	<b>.234</b>	<b>RUPCB2250</b>
<b>2.500</b>	<b>3.177</b>	<b>.234</b>	<b>RUPCB2500</b>
<b>2.750</b>	<b>3.402</b>	<b>.234</b>	<b>RUPCB2750</b>
<b>3.000</b>	<b>3.649</b>	<b>.234</b>	<b>RUPCB3000</b>
3.500	4.169	.234	RUPCB3500
4.000	4.669	.234	RUPCB4000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Zurcon® Loaded U-Cup



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Single-acting U-Cup

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Rubber Energized

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**Material:**

Zurcon® + NBR

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## Loaded U-Cup



### Description

In certain scenarios, conventional U-Cups can be prone to leakage at low pressure or low temperature due to lack of loading on the sealing lips. The Zurcon® Loaded U-Cup is a strong choice for these situations as it can retrofit most common U-Cup grooves. The integrated O-Ring improves the performance in low pressure and low temperature applications. Polyurethane (Zurcon® Z06) is a proven material for U-cups due to its good mechanical properties. The Loaded U-Cup is a symmetrical seal that can be used as either a rod or piston seal.

### LOADED U-CUP

The Loaded U-Cup can be installed as a single seal for low to medium duty applications. For sealing systems, the U-Cup shall be installed mainly as a secondary seal together with the Zurcon Buffer Seal LM or Turcon® Stepseal® 2K as primary seals.

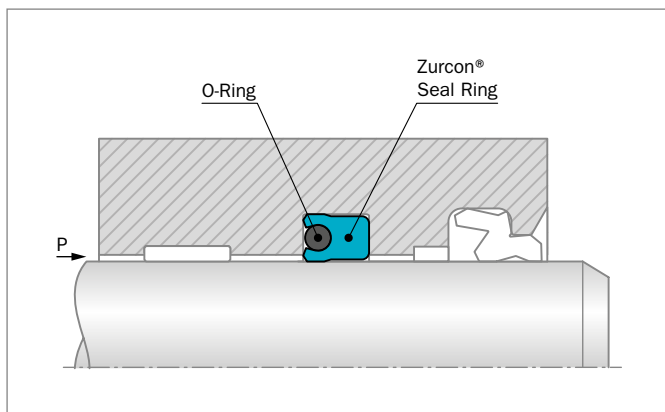


Figure 28: U-Cup, type RU6

### METHOD OF OPERATION

The sealing effect of the U-Cup comes from the intrinsic preload of the seal body and from the compression of the seal lip and the O-Ring during installation. In operating conditions, the radial contact forces are superimposed by the system pressure.

Due to the special design and the integrated O-Ring the Loaded U-Cup has excellent sealing behavior with and without pressure activation. The beveled sealing lip provides additional fluid film cutting ability with increased sealing force from the O-Ring.

### ADVANTAGES

- Very good low pressure/temperature sealability
- Simple installation
- Very low compression set due to O-Ring
- Good fluid film breaking ability
- Good stability in groove

### APPLICATION EXAMPLES

- General hydraulic cylinders
- Injection molding machines
- Lift trucks
- Agricultural and Construction Machinery

### OPERATING CONDITIONS

<b>Pressure:</b>	Max. 5,000 psi (as single element)
<b>Speed:</b>	Up to 1.5 ft/s
<b>Temperature:</b>	Use in mineral oils: -22 °F to +194 °F
<b>Media:</b>	Mineral oil-based hydraulic fluids.

### 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.

### CLEARANCE

Table 15: Radial Clearance Loaded U-Cup

Operating Pressure PSI max.	Radial Clearance $S_{max}$
1,500	.015
3,000	.010
5,000	.005

The values for  $S_{max}$  given in this table apply to the low-pressure side of the U-Cup. They are designed for an operating temperature of 140 °F. (for harsh conditions and high side loads the gap must be reduced by 50%).



## MATERIAL

The thermoplastic polyurethane material Zurcon® Z06 has very good abrasion resistance, a low compression set and exhibits good resistance to clearance extrusion. The integrated O-Ring is a 70 shore A NBR material with a very low compression set.

U-Cup: Polyurethane 93 shore A  
Material code Z06

O-Ring: NBR 70 Shore A  
Material code N7

Set code: Z06N7

**Table 16: Materials**

Material Code	Material Description	Temp. Range	Application
Zurcon® Z06	Standard Polyurethane grade for hydraulic applications; 93 Shore A	-22 °F to +194 °F	Very good abrasion and extrusion resistance, minimal swelling in mineral oil, acceptable hydrolysis resistance.



## Installation Recommendation

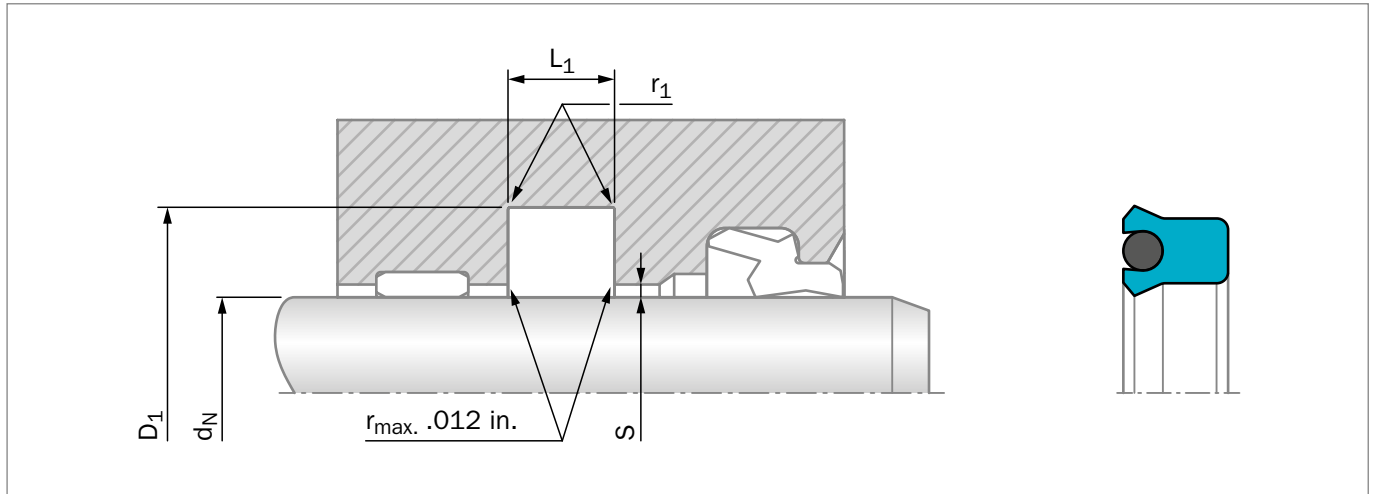


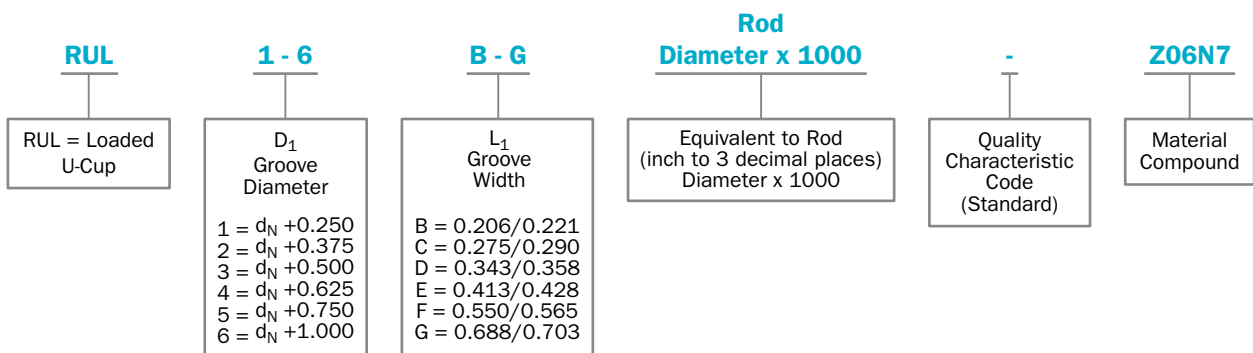
Figure 29: Installation Drawing

### ORDERING EXAMPLE

Loaded U-Cup

<b>Rod Diameter:</b>	$d_N = 3.000$ inches
<b>Groove Diameter:</b>	$D_1 = 3.500$ inches
<b>Groove Width:</b>	$L_1 = .413$ inches
<b>TSS Part No.:</b>	RUL3E3000
<b>Compound code seal:</b>	Z06 blue-grey
<b>Compound code O-Ring:</b>	N7
<b>Material set code:</b>	Z06N7

<b>TSS Article No.</b>	<b>RUL 3E 3000 - Z06N7</b>
TSS Series No.	RUL
Cross Section Series	3E
Rod Diameter x 1000	3000
Quality Index (Standard)	-
Material Code	Z06N7





**Table 17: Installation Dimensions / TSS Part No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H10	$L_1$ +.015		$d_N$ f8/h9	$D_1$ H10	$L_1$ +.015	
.125	.375	.206	RUL1B0125	<b>3.500</b>	<b>4.000</b>	<b>.413</b>	<b>RUL3E3500</b>
.187	.437	.206	RUL1B0187	3.625	4.125	.413	RUL3E3625
.250	.500	.206	RUL1B0250	<b>3.750</b>	<b>4.250</b>	<b>.413</b>	<b>RUL3E3750</b>
.312	.562	.206	RUL1B0312	3.875	4.375	.413	RUL3E3875
.375	.625	.206	RUL1B0375	<b>4.000</b>	<b>4.500</b>	<b>.413</b>	<b>RUL3E4000</b>
.437	.687	.206	RUL1B0437	4.125	4.625	.413	RUL3E4125
<b>.500</b>	<b>.750</b>	<b>.206</b>	<b>RUL1B0500</b>	<b>4.250</b>	<b>4.750</b>	<b>.413</b>	<b>RUL3E4250</b>
.562	.812	.206	RUL1B0562	4.375	4.875	.413	RUL3E4375
<b>.625</b>	<b>.875</b>	<b>.275</b>	<b>RUL1C0625</b>	<b>4.500</b>	<b>5.000</b>	<b>.413</b>	<b>RUL3E4500</b>
.687	.937	.275	RUL1C0687	4.625	5.125	.413	RUL3E4625
<b>.750</b>	<b>1.000</b>	<b>.275</b>	<b>RUL1C0750</b>	4.750	5.250	.413	RUL3E4750
.812	1.062	.275	RUL1C0812	4.875	5.375	.413	RUL3E4875
<b>.875</b>	<b>1.125</b>	<b>.275</b>	<b>RUL1C0875</b>	5.000	5.500	.413	RUL3E5000
.937	1.187	.275	RUL1C0937	5.125	5.875	.688	RUL5G5125
<b>1.000</b>	<b>1.375</b>	<b>.343</b>	<b>RUL2D1000</b>	<b>5.250</b>	<b>6.000</b>	<b>.688</b>	<b>RUL5G5250</b>
1.062	1.437	.343	RUL2D1062	5.375	6.125	.688	RUL5G5375
<b>1.125</b>	<b>1.500</b>	<b>.343</b>	<b>RUL2D1125</b>	5.500	6.250	.688	RUL5G5500
1.187	1.562	.343	RUL2D1187	5.625	6.375	.688	RUL5G5625
<b>1.250</b>	<b>1.625</b>	<b>.343</b>	<b>RUL2D1250</b>	5.750	6.500	.688	RUL5G5750
1.312	1.687	.343	RUL2D1312	6.000	6.750	.688	RUL5G6000
<b>1.375</b>	<b>1.750</b>	<b>.343</b>	<b>RUL2D1375</b>	6.250	7.000	.688	RUL5G6250
1.437	1.812	.343	RUL2D1437	6.375	7.125	.688	RUL5G6375
<b>1.500</b>	<b>1.875</b>	<b>.413</b>	<b>RUL2E1500</b>	<b>6.500</b>	<b>7.250</b>	<b>.688</b>	<b>RUL5G6500</b>
1.562	1.937	.413	RUL2E1562	6.625	7.375	.688	RUL5G6625
<b>1.625</b>	<b>2.000</b>	<b>.413</b>	<b>RUL2E1625</b>	6.750	7.500	.688	RUL5G6750
1.687	2.062	.413	RUL2E1687	7.000	7.750	.688	RUL5G7000
<b>1.750</b>	<b>2.125</b>	<b>.413</b>	<b>RUL2E1750</b>	7.250	8.000	.688	RUL5G7250
<b>1.875</b>	<b>2.250</b>	<b>.413</b>	<b>RUL2E1875</b>	7.375	8.125	.688	RUL5G7375
1.937	2.312	.413	RUL2E1937	7.500	8.250	.688	RUL5G7500
<b>2.000</b>	<b>2.500</b>	<b>.413</b>	<b>RUL3E2000</b>	7.750	8.500	.688	RUL5G7750
2.125	2.625	.413	RUL3E2125				
<b>2.250</b>	<b>2.750</b>	<b>.413</b>	<b>RUL3E2250</b>				
2.375	2.875	.413	RUL3E2375				
<b>2.500</b>	<b>3.000</b>	<b>.413</b>	<b>RUL3E2500</b>				
2.562	3.062	.413	RUL3E2562				
<b>2.625</b>	<b>3.125</b>	<b>.413</b>	<b>RUL3E2625</b>				
<b>2.750</b>	<b>3.250</b>	<b>.413</b>	<b>RUL3E2750</b>				
2.875	3.375	.413	RUL3E2875				
<b>3.000</b>	<b>3.500</b>	<b>.413</b>	<b>RUL3E3000</b>				
3.125	3.625	.413	RUL3E3125				
<b>3.250</b>	<b>3.750</b>	<b>.413</b>	<b>RUL3E3250</b>				
3.375	3.875	.413	RUL3E3375				



# Turcon® Stepseal® 2K



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Single-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Stepseal® 2K\*

### ■ Description

Rod seals must exhibit no dynamic leakage to the atmosphere side under all operating conditions and must be statically completely leak tight when the machine is at a standstill. Furthermore, they should achieve a high degree of mechanical efficiency through low friction and be easy to install in small grooves. Costs and service life must meet the high expectations of the operator.

The rod seal Turcon® Stepseal® 2K comes closest to satisfying these ideal demands. Since the first Stepseal® was patented and introduced to the market in 1972, Trelleborg Sealing Solutions has maintained the series of technically outstanding seal elements through continuous innovative development of the design and of the Turcon® and Zurcon® materials. Turcon® Stepseal® 2K continues the tradition for improvement.

With the introduction of Stepseal® it was possible for the first time to arrange several seals, one behind the other, thus allowing statically and dynamically tight single-acting tandem seal configurations to be created, without any disturbing build-up of intermediate pressure.

The single-acting seal element is made of high-grade Turcon® or Zurcon® materials with outstanding sliding and wear resistance properties. It is installed according to ISO 7425/2 and Trelleborg Sealing Solutions standard grooves, using an O-Ring as the energizing element.

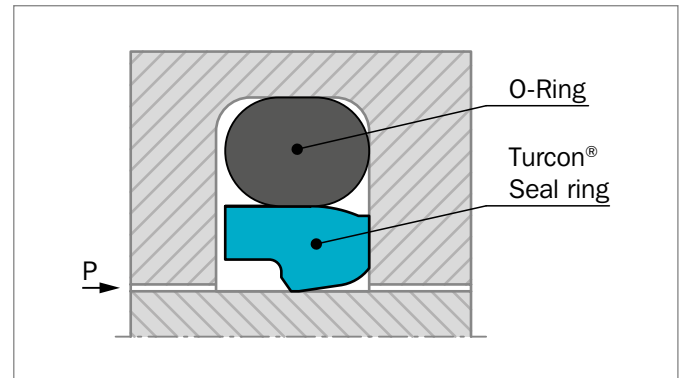


Figure 30: Turcon® Stepseal® 2K

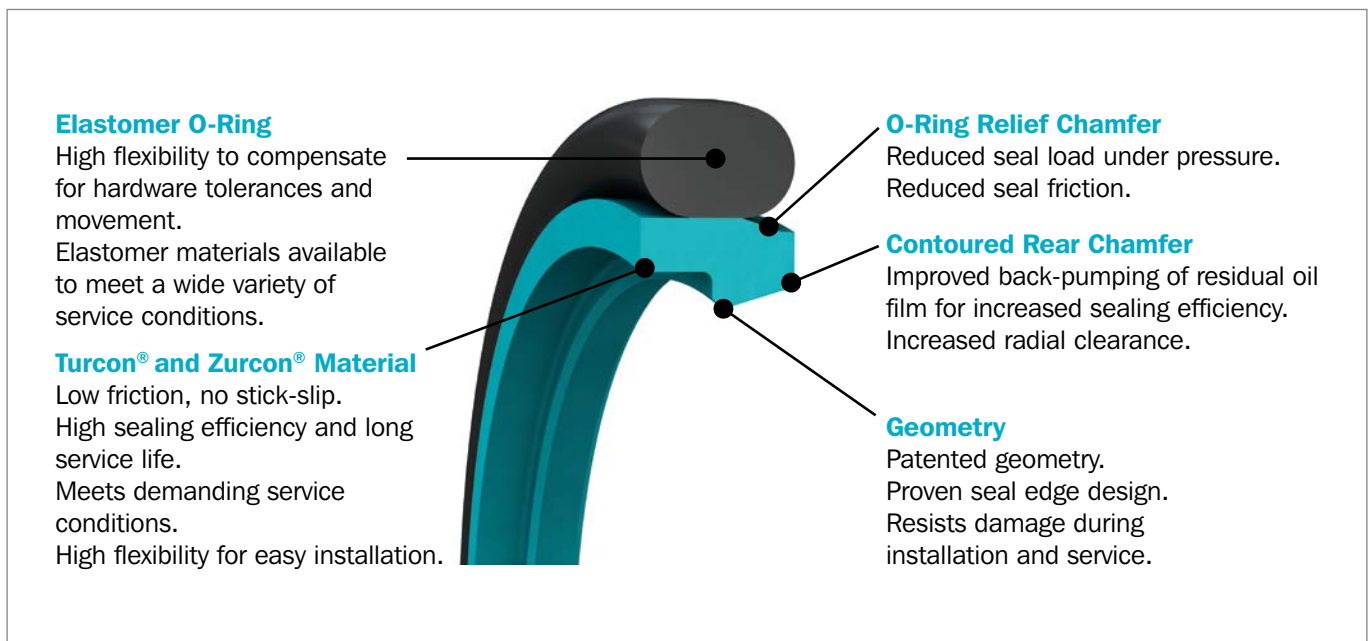


Figure 31: Turcon® Stepseal® 2K design features

\* Patented geometry



## METHOD OF OPERATION

The sealing performance of Stepseal® 2K (Figure 30) results from the hydrodynamic properties of the seal. The classic Stepseal® seal edge creates a steep contact pressure gradient on the high pressure side and a shallow contact pressure gradient on the low pressure side. The controlled pressure gradients minimize fluid adherence to the piston rod during the extending stroke, and enables residual fluid film on the rod to be returned into the system on the return stroke. This is united with new patented design features which further improve the performance of Stepseal® 2K under severe service conditions.

The O-Ring relief chamfer reduces pressure loading on the seal, whereby contact with the rod is optimized and sealing performance is improved at high service pressures. The special high-lift rear chamfer combines a smooth downstream sealing face with the ability to meet large radial clearances and hardware tolerances.

Stepseal® 2K gives high static and dynamic sealing performance, and the build-up of intermediate pressure often found with tandem seal configurations (see Figure 34) is efficiently suppressed.

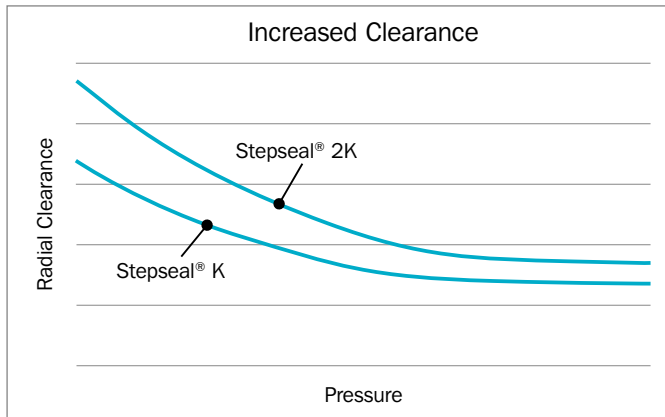


Figure 32: Turcon® Stepseal® 2K possesses superior extrusion resistance and allows increased hardware clearance

## ADVANTAGES

- High static and dynamic sealing effect
- High extrusion resistance, meets high hardware clearances
- Low friction, high efficiency
- Stick-slip free starting, no sticking
- High abrasion resistance, high operational reliability
- Wide range of application temperatures and high resistance to chemicals, depending on the choice of O-Ring material

- Simple installation without seal edge deformation
- Available for all diameters up to 102 inches (2,600mm) rod diameter

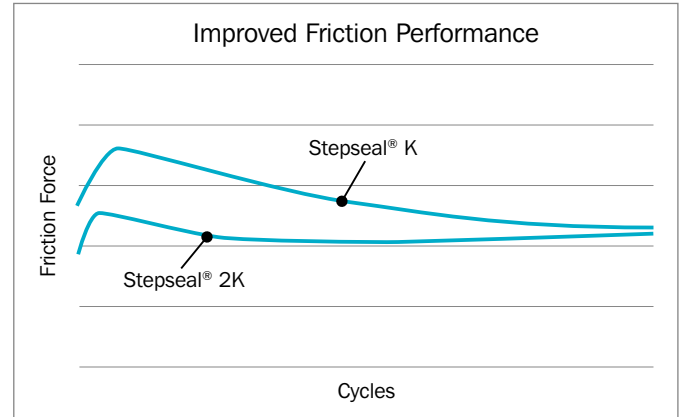


Figure 33: Turcon® Stepseal® 2K offers a uniform, low-friction characteristic

## TECHNICAL DATA

<b>Operating pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s) with reciprocating movements, frequency up to 5 Hz
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water and others, depending on the O-Ring material (see Table 19)
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 20, as a function of the operating pressure and functional diameter.

## 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 dependent on medium.



## MATERIALS

The following material combination has proven effective for applications with hydraulic oils containing zinc:

Seal Ring: Turcon® T46

O-Ring NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on the temperature

Set Code: T46N/T46N7/T46V

For specific applications, other material combinations as listed in Table 19, may also be used.

## SERIES

Different cross section sizes are recommended as a function of the seal diameters. These are the criteria for these recommendations.

Table 20, shows the relationship between the series number according to the seal diameter range and the different application class sizes. These application classes are:

Standard application:	General applications in which no exceptional operating conditions exist
Light-duty application:	Applications with demands for reduced friction or for smaller grooves
Heavy-duty application:	For exceptional operating loads such as high pressures, pressure peaks, etc

**Table 18: Available range**

Series No.	Rod Diameter $d_N$ f8/h9
RSF00	.080 - 5.125
RSF10	.250 - 10.000
RSF20	.375 - 17.500
RSF30	.500 - 25.500
RSF40	1.500 - 25.500
RSF50	7.750 - 40.000
RSF80	10.000 - 48.000
RSF60	25.500 - 99.999

For the Standard Recommendations Application range see Table 20.

## APPLICATION EXAMPLES

- Mobile hydraulics
- Standard cylinders
- Machine tools
- Injection molding machines
- Presses
- Automotive industry
- Hydraulic hammers
- Servo hydraulics

## REDUNDANT SEALING SYSTEM

In many applications, secondary seal systems are demanded. Figure 34 shows such a tandem configuration with the Stepseal® 2K.

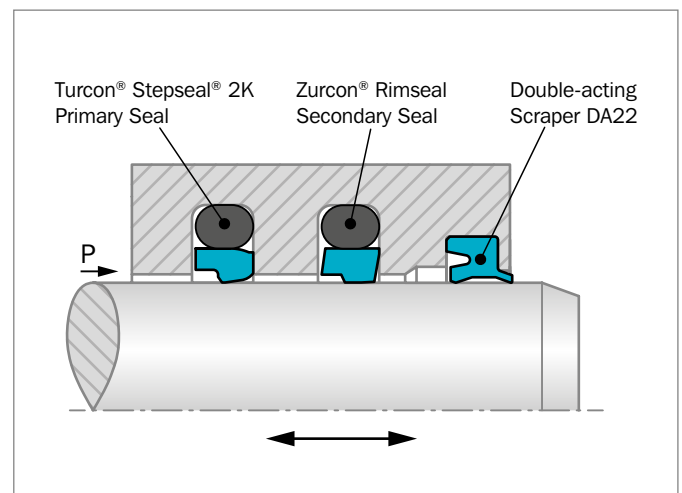


Figure 34: Turcon® Stepseal® 2K and Zurcon® Rimseal in tandem configuration

In this configuration it must be noted that a sufficiently large space is formed between the seals to take the hydraulic fluid, as shown in the figure.

Depending on the application and the operating conditions, the combination of different materials offers a further improvement in the sealing efficiency and the service life of the system, e.g. in hydraulic cylinders subject to high loads and under rough operating conditions, the primary seal should be made of Turcon® and the secondary seal of Zurcon®.



Stepseal® 2K elements should always be used in combination with a double-acting scraper to provide an optimum sealing effect.

The scrapers Turcon® Excluder® 2, Turcon® Excluder® 5, DA17, DA22 and DA24 are well suited to such applications. For further details, please refer to our “Scrapers“ catalog.

**Table 19: Turcon® and Zurcon® Materials for Stepseal® 2K**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T08</b> Very high compressive strength, very good extrusion resistance High bronze filled Color: Light to dark brown	T08	NBR-70	N/N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminium Bronze	
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good slide properties, low friction. Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Turcon® T42</b> For all lubricating and non-lubricating hydraulic fluids, good chemical resistance, good dielectric properties Glass fiber filled + MoS <sub>2</sub> Color: Gray to blue	T42	NBR-70	N/N7	-22 to +212	Steel hardened	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T19</b> For all lubricating fluids and hydraulic oils without zinc, high sealing efficiency, good sliding and wear properties, mild to counter surface Mineral fiber filled Color: Dark green-gray	T19	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron Stainless steel	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temp. resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N/N7	-22 to +176	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

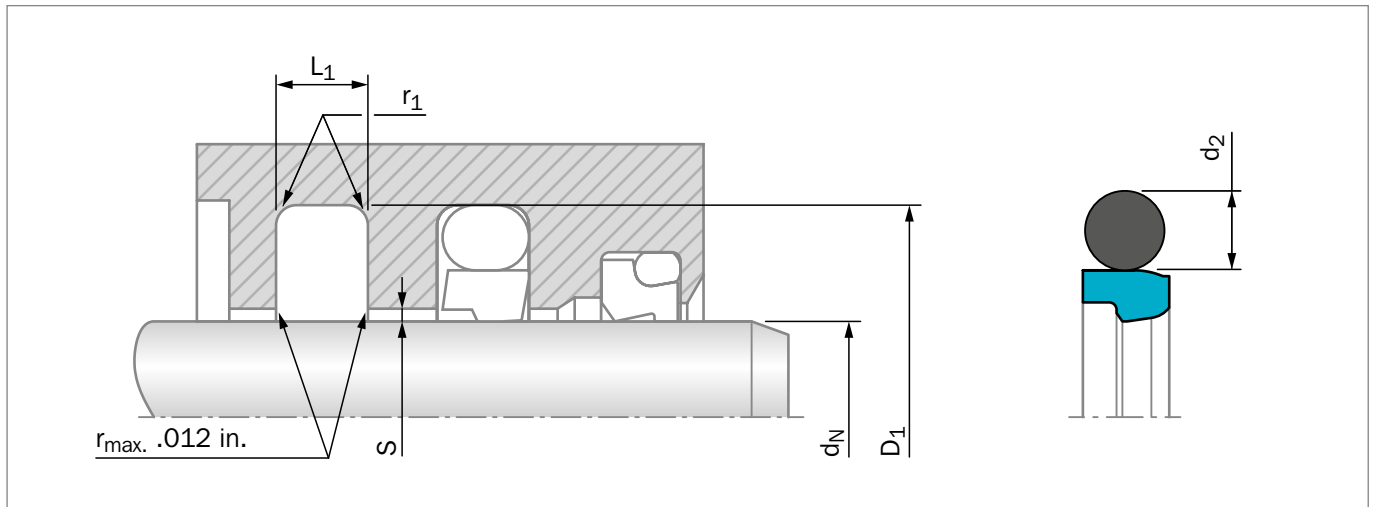


Figure 35: Installation drawing

**Table 20: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_1$ H9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}^*$			O-Ring Cross Section $d_2$
	Standard Application	Light Application**	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
RSF0	.125 - .312	.313 - .749	-	$d_N + .193$	.087	.020	.012	.008	.006	.070
RSF1	.313 - .749	.750 - 1.499	-	$d_N + .287$	.126	.020	.016	.010	.006	.103
RSF2	.750 - 1.499	1.500 - 7.874	.313 - .749	$d_N + .421$	.165	.025	.020	.012	.008	.139
RSF3	1.500 - 7.874	7.875 - 9.999	.750 - 1.499	$d_N + .594$	.248	.030	.028	.016	.010	.210
RSF4	7.875 - 9.999	10.000 - 25.499	1.500 - 7.874	$d_N + .807$	.319	.035	.031	.024	.014	.275
RSF5	10.000 - 25.499	25.500 - 39.999	7.875 - 9.999	$d_N + .945$	.319	.035	.035	.028	.016	.275
RSF8	25.500 - 39.999	$\geq 40.000$	10.000 - 25.499	$d_N + 1.075$	.374	.040	.039	.031	.020	.331
RSF6	$\geq 40.000$	-	25.500 - 39.999	$d_N + 1.496$	.543	.045	.047	.035	.024	.472

\* At pressures >40 Mpa (5,800 psi): use diameter tolerance H8/f8 (bore / rod) in the area behind the seal; or consult Trelleborg Sealing Solutions for alternative material or profiles.

\*\* For easier installation in closed grooves with small rod diameters (<1.575 inches (40mm)).





## ORDERING EXAMPLE

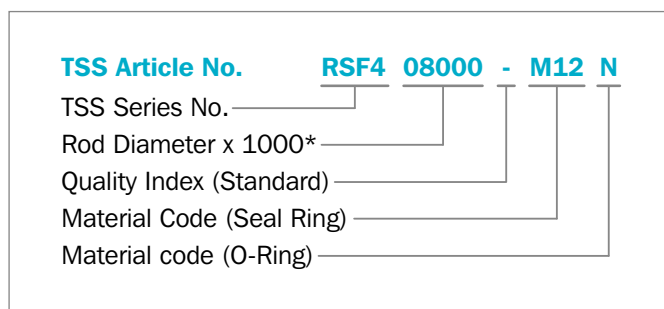
Turcon® Stepseal® 2K complete with O-Ring, standard application, RSF4 (from Table 20).

**Rod diameter:**  $d_N = 8.000$  inches

**TSS Part No.:** RSF408000 from Table 21

Select the material from Table 19. The corresponding code numbers are appended to the TSS Part No. (from Table 21). Together these form the TSS Article No.

The TSS Article No. for all intermediate sizes not shown in Table 21 can be determined following the example below.



\* For diameters  $\geq 102$  inches please consult your Customer Solution Center for special TSS Article No.

## NOTES:

- 1) Tolerances used are per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 2) The clearances stated as S in the above table are for when the seal is specified with Slydring® bearings. When not incorporating Slydring® bearings, the diametral clearance should be reduced.
- 3) Consult your Customer Solution Center for diameters that exceed those listed in the above table.

Turned - other diameters also available, no tool costs.

**Table 21: Installation dimensions / TSS Part No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008		$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
.125	.318	.087	RSF000125	<b>.750</b>	<b>1.037</b>	<b>.126</b>	<b>RSF100750</b>
.188	.381	.087	RSF000188	<b>.750</b>	<b>1.171</b>	<b>.165</b>	<b>RSF200750</b>
.250	.443	.087	RSF000250	.813	1.100	.126	RSF100813
.313	.506	.087	RSF000313	.813	1.234	.165	RSF200813
.313	.600	.126	RSF100313	<b>.875</b>	<b>1.162</b>	<b>.126</b>	<b>RSF100875</b>
.375	.568	.087	RSF000375	<b>.875</b>	<b>1.296</b>	<b>.165</b>	<b>RSF200875</b>
.375	.662	.126	RSF100375	.938	1.225	.126	RSF100938
.438	.631	.087	RSF000438	.938	1.359	.165	RSF200938
.438	.725	.126	RSF100438	<b>1.000</b>	<b>1.287</b>	<b>.126</b>	<b>RSF101000</b>
.500	.693	.087	RSF000500	<b>1.000</b>	<b>1.421</b>	<b>.165</b>	<b>RSF201000</b>
<b>.500</b>	<b>.787</b>	<b>.126</b>	<b>RSF100500</b>	1.063	1.350	.126	RSF101063
.563	.756	.087	RSF000563	1.063	1.484	.165	RSF201063
.563	.850	.126	RSF100563	<b>1.125</b>	<b>1.412</b>	<b>.126</b>	<b>RSF101125</b>
.625	.818	.087	RSF000625	<b>1.125</b>	<b>1.546</b>	<b>.165</b>	<b>RSF201125</b>
<b>.625</b>	<b>.912</b>	<b>.126</b>	<b>RSF100625</b>	1.188	1.475	.126	RSF101188
.688	.881	.087	RSF000688	1.188	1.609	.165	RSF201188
.688	.975	.126	RSF100688	1.250	1.537	.126	RSF101250
.750	.943	.087	RSF000750	<b>1.250</b>	<b>1.671</b>	<b>.165</b>	<b>RSF201250</b>



Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008		$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
1.313	1.600	.126	RSF101313	3.125	3.719	.248	RSF303125
1.313	1.734	.165	RSF201313	3.250	3.671	.165	RSF203250
1.375	1.662	.126	RSF101375	<b>3.250</b>	<b>3.844</b>	<b>.248</b>	<b>RSF303250</b>
<b>1.375</b>	<b>1.796</b>	<b>.165</b>	<b>RSF201375</b>	3.375	3.796	.165	RSF203375
1.438	1.725	.126	RSF101438	3.375	3.969	.248	RSF303375
1.438	1.859	.165	RSF201438	3.500	3.921	.165	RSF203500
<b>1.500</b>	<b>1.787</b>	<b>.126</b>	<b>RSF101500</b>	<b>3.500</b>	<b>4.094</b>	<b>.248</b>	<b>RSF303500</b>
<b>1.500</b>	<b>1.921</b>	<b>.165</b>	<b>RSF201500</b>	3.625	4.046	.165	RSF203625
<b>1.500</b>	<b>2.094</b>	<b>.248</b>	<b>RSF301500</b>	3.625	4.219	.248	RSF303625
1.563	1.984	.165	RSF201563	3.750	4.171	.165	RSF203750
1.563	2.157	.248	RSF301563	<b>3.750</b>	<b>4.344</b>	<b>.248</b>	<b>RSF303750</b>
1.625	2.046	.165	RSF201625	3.875	4.296	.165	RSF203875
<b>1.625</b>	<b>2.219</b>	<b>.248</b>	<b>RSF301625</b>	3.875	4.469	.248	RSF303875
1.688	2.109	.165	RSF201688	4.000	4.421	.165	RSF204000
1.688	2.282	.248	RSF301688	<b>4.000</b>	<b>4.594</b>	<b>.248</b>	<b>RSF304000</b>
1.750	2.171	.165	RSF201750	4.125	4.546	.165	RSF204125
<b>1.750</b>	<b>2.344</b>	<b>.248</b>	<b>RSF301750</b>	4.125	4.719	.248	RSF304125
1.813	2.234	.165	RSF201813	4.250	4.671	.165	RSF204250
1.813	2.407	.248	RSF301813	<b>4.250</b>	<b>4.844</b>	<b>.248</b>	<b>RSF304250</b>
1.875	2.296	.165	RSF201875	<b>4.375</b>	<b>4.796</b>	<b>.165</b>	<b>RSF204375</b>
<b>1.875</b>	<b>2.469</b>	<b>.248</b>	<b>RSF301875</b>	<b>4.375</b>	<b>4.969</b>	<b>.248</b>	<b>RSF304375</b>
1.938	2.359	.165	RSF201938	<b>4.500</b>	<b>4.921</b>	<b>.165</b>	<b>RSF204500</b>
1.938	2.532	.248	RSF301938	<b>4.500</b>	<b>5.094</b>	<b>.248</b>	<b>RSF304500</b>
2.000	2.421	.165	RSF202000	<b>4.625</b>	<b>5.219</b>	<b>.248</b>	<b>RSF304625</b>
<b>2.000</b>	<b>2.594</b>	<b>.248</b>	<b>RSF302000</b>	<b>4.625</b>	<b>5.432</b>	<b>.319</b>	<b>RSF404625</b>
2.125	2.546	.165	RSF202125	<b>4.750</b>	<b>5.344</b>	<b>.248</b>	<b>RSF304750</b>
2.125	2.719	.248	RSF302125	<b>4.750</b>	<b>5.557</b>	<b>.319</b>	<b>RSF404750</b>
2.250	2.671	.165	RSF202250	<b>4.875</b>	<b>5.469</b>	<b>.248</b>	<b>RSF304875</b>
<b>2.250</b>	<b>2.844</b>	<b>.248</b>	<b>RSF302250</b>	<b>4.875</b>	<b>5.682</b>	<b>.319</b>	<b>RSF404875</b>
2.375	2.796	.165	RSF202375	<b>5.000</b>	<b>5.594</b>	<b>.248</b>	<b>RSF305000</b>
2.375	2.969	.248	RSF302375	<b>5.000</b>	<b>5.807</b>	<b>.319</b>	<b>RSF405000</b>
2.500	2.921	.165	RSF202500	<b>5.125</b>	<b>5.719</b>	<b>.248</b>	<b>RSF305125</b>
<b>2.500</b>	<b>3.094</b>	<b>.248</b>	<b>RSF302500</b>	<b>5.125</b>	<b>5.932</b>	<b>.319</b>	<b>RSF405125</b>
2.625	3.046	.165	RSF202625	<b>5.250</b>	<b>5.844</b>	<b>.248</b>	<b>RSF305250</b>
2.625	3.219	.248	RSF302625	<b>5.250</b>	<b>6.057</b>	<b>.319</b>	<b>RSF405250</b>
2.750	3.171	.165	RSF202750	<b>5.375</b>	<b>5.969</b>	<b>.248</b>	<b>RSF305375</b>
<b>2.750</b>	<b>3.344</b>	<b>.248</b>	<b>RSF302750</b>	<b>5.375</b>	<b>6.182</b>	<b>.319</b>	<b>RSF405375</b>
2.875	3.296	.165	RSF202875	<b>5.500</b>	<b>6.094</b>	<b>.248</b>	<b>RSF305500</b>
2.875	3.469	.248	RSF302875	<b>5.500</b>	<b>6.307</b>	<b>.319</b>	<b>RSF405500</b>
3.000	3.421	.165	RSF203000	<b>5.625</b>	<b>6.219</b>	<b>.248</b>	<b>RSF305625</b>
<b>3.000</b>	<b>3.594</b>	<b>.248</b>	<b>RSF303000</b>	<b>5.625</b>	<b>6.432</b>	<b>.319</b>	<b>RSF405625</b>
3.125	3.546	.165	RSF203125	<b>5.750</b>	<b>6.344</b>	<b>.248</b>	<b>RSF305750</b>



Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
5.750	6.557	.319	RSF405750
6.000	6.594	.248	RSF306000
6.000	6.807	.319	RSF406000
6.250	6.844	.248	RSF306250
6.250	7.057	.319	RSF406250
6.500	7.094	.248	RSF306500
6.500	7.307	.319	RSF406500
6.750	7.344	.248	RSF306750
6.750	7.557	.319	RSF406750
7.000	7.594	.248	RSF307000
7.000	7.807	.319	RSF407000
7.250	7.844	.248	RSF307250
7.250	8.057	.319	RSF407250
7.500	8.094	.248	RSF307500
7.500	8.307	.319	RSF407500
7.750	8.344	.248	RSF307750
7.750	8.557	.319	RSF407750
8.000	8.807	.319	RSF408000
8.250	9.057	.319	RSF408250
8.500	9.307	.319	RSF408500
8.750	9.557	.319	RSF408750
9.000	9.807	.319	RSF409000
9.250	10.057	.319	RSF409250
9.500	10.307	.319	RSF409500
9.750	10.557	.319	RSF409750
10.000	10.807	.319	RSF410000
10.000	10.945	.319	RSF510000
10.500	11.307	.319	RSF410500
10.500	11.445	.319	RSF510500
11.000	11.807	.319	RSF411000
11.000	11.945	.319	RSF511000
11.500	12.307	.319	RSF411500
11.500	12.445	.319	RSF511500
12.000	12.945	.319	RSF512000
12.500	13.445	.319	RSF512500
13.000	13.945	.319	RSF513000
13.500	14.445	.319	RSF513500
14.000	14.945	.319	RSF514000
14.500	15.445	.319	RSF514500
15.000	15.945	.319	RSF515000
15.500	16.445	.319	RSF515500
16.000	16.945	.319	RSF516000

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
16.500	17.445	.319	RSF516500
17.000	17.945	.319	RSF517000
17.500	18.445	.319	RSF517500
18.000	18.945	.319	RSF518000
18.500	19.445	.319	RSF518500
19.000	19.945	.319	RSF519000
19.500	20.445	.319	RSF519500
20.000	20.945	.319	RSF520000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Turcon® Stepseal® V



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Single-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Stepseal® V\*

### Description

Stepseal® V is based on the dynamic, unidirectional Turcon® Stepseal® sealing concept. During the extending stroke of the rod, the contact force on the sealing edge creates high local sealing pressure and limits micro fluid-film formation under the seal. When the rod is retracted, the Stepseal® sealing face supports hydrodynamic back-pumping of the fluid film, and ensures leak-free sealing efficiency with low friction and long service life.

In long-stroke cylinders and equipment operating with low speed during retraction, it has been found that hydrodynamic back-pumping may become insufficient to prevent build-up of pressure behind the primary seal. Pressure build-up in the seal system leads to leakage, increased friction and wear, and may ultimately lead to seal replacement. The usual precaution has been to provide space for a buffer volume behind the primary seal, or to install a drain line.

An innovation from Trelleborg Sealing Solutions, the built-in check valve function of the Stepseal® V eliminates pressure build-up and removes the need for buffer volumes and drain lines. The Stepseal® V is available in high-grade Turcon® or Zurcon® materials with outstanding sliding and wear resistance properties. It is installed in Trelleborg Sealing Solutions standard grooves and according to ISO 7425, using an O-Ring as an energizing element.

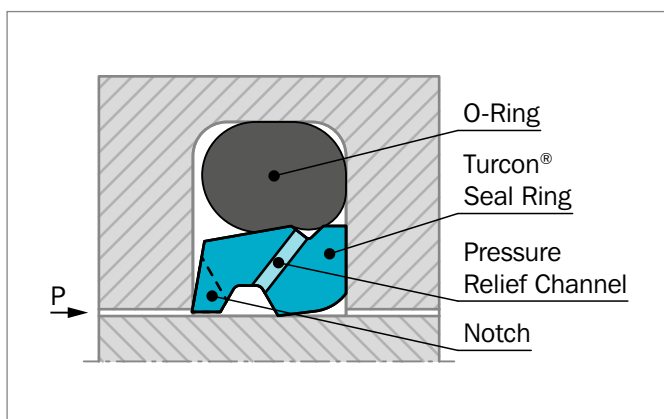


Figure 36: Turcon® Stepseal® V with tight axial groove fit

### ADVANTAGES

- Same advanced functions as Stepseal® 2K
- No system pressure on secondary sealing element and/or Scraper/Excluder®
- Check valve function of O-Ring eliminates risk of fluid bypassing the seal during pressure loading when pressurized
- Not restricted by speed in relation to counter surface, stroke length or deflection
- Minimum contribution of friction to secondary sealing element and/or Scraper/Excluder®
- Minimum wear of secondary sealing element and/or Scraper/Excluder®
- Increased leakage control
- Prolonged seal life
- Increased operational reliability
- Fits standard Stepseal® 2K groove dimensions as well as ISO 7425 seal housings

### APPLICATION EXAMPLES

- Mobile hydraulics
- Construction equipment
- Crane boom cylinders
- Presses
- Injection molding machines
- Used in cylinders for:
  - Clamps
  - Wind-power
  - Long stroke
  - Hydropower
  - Watergates
  - Tensioners
- Theater hydraulics

\* Patented geometry



## CHARACTERISTICS

- Primary seal with hydrostatic ventilation
- Check valve function
- Hydrodynamic back-pumping
- Stabilized position in the groove
- Fits existing Turcon® Stepseal® 2K groove
- Available for ISO 7425/2 seal housing
- Prolonged seal life
- Increased leakage control
- Low-friction operation over whole life of product
- Prevents undefined pressurization of secondary sealing element

## FEATURES

Stepseal® V is developed to meet continuously increasing demands on sealing systems. Under extreme performance requirements, Stepseal® V offers improved leakage control, extended service life and increased reliability.

In dynamic applications, Stepseal® V provides efficient, reliable sealing performance even under the most demanding service conditions. The high seal efficiency and refined valve function of Stepseal® V eliminates seal system pressure build-up between its tandem rod seal configuration, eliminating buffer volume between the seals.

In rod seal systems, Stepseal® V is preferably used with a secondary Turcon® or Zurcon® rod seal, or with a double-acting Excluder® or Scraper.

As a piston seal, Stepseal® V is used with a double-acting Turcon® piston seal.

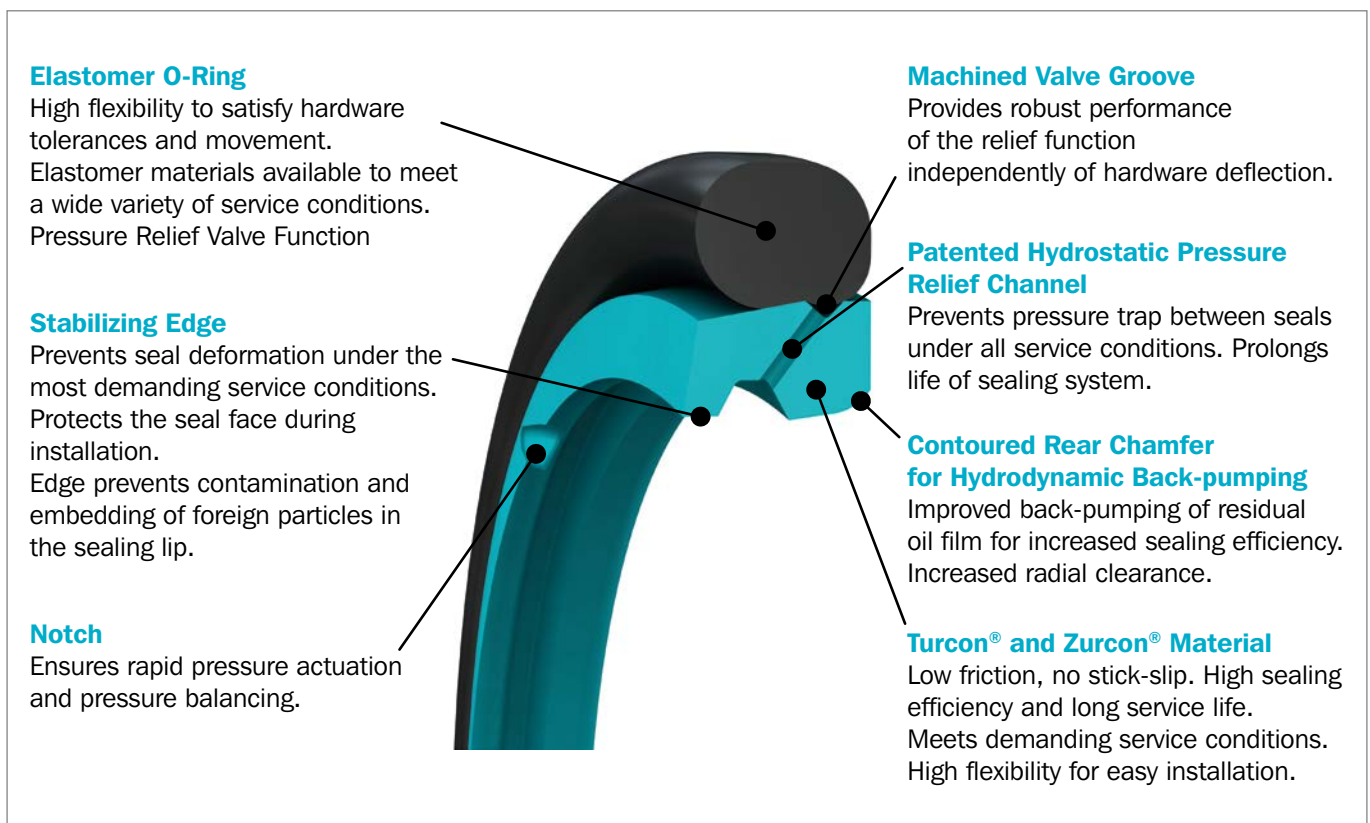


Figure 37: Turcon® Stepseal® V design features





## TECHNICAL DATA

<b>Pressure:</b>	Up to 7,250 psi (50 MPa) (Turcon® M12)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s) with linear movements, frequency up to 15 Hz.
<b>Temperature:</b>	-49° F to +392° F (-45° C to +200° C) (depending on seal and O-Ring material)
<b>Media:</b>	Mineral oil based hydraulic fluids, flame retardant hydraulic fluids, environmentally friendly hydraulic fluids (bio-oils), phosphate ester, water and others, depending on the seal and O-Ring material - see Table 22.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 23, as a function of the operating pressure and functional diameter.

### 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.



**Table 22: Turcon® and Zurcon® Materials for Stepseal® V**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI max. Dynamic
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T05</b> For lubricating fluids Ideal for gas service Very low friction Very good sliding and sealing properties Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392		
<b>Turcon® T08</b> For lubricating fluids and linear motion Very high compressive strength and extrusion resistance Hard counter surfaces are recommended Bronze filled Color: Light to dark brown, which may have variations in shading	T08	NBR-70	N/N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T10</b> For hydraulic and pneumatic applications For lubricating and non-lubricating fluids High extrusion resistance Good chemical resistance Not for electrically conducting fluids BAM tested Carbon, graphite filled Color: Black	T10	NBR-70	N/N7	-22 to +212	Steel	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +176		
<b>Turcon® T29</b> For lubricating and non-lubricating fluids Good extrusion resistance Surface texture is not suitable for gas sealing Not for electrically conducting fluids Carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +176	Stainless steel	

Table continues on next page




Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI max. Dynamic
<b>Turcon® T40</b> For lubricating and non-lubricating fluids High frequency and short strokes Water hydraulics Surface texture is not suitable for gas sealing Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +176	Stainless steel Aluminum	
<b>Turcon® T46</b> For lubricated hydraulics in linear motion High compressive strength High extrusion resistance Very good sliding and wear properties BAM tested Bronze filled Color: Light to dark brown, which may have variations in shading	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated (rod) Cast iron	
		FKM-70	V	+14 to +392	Cast iron	
<b>Zurcon® Z53***</b> For mineral oil based fluids Very high abrasion and extrusion resistance For counter surface with rougher surface finish Limited chemical resistance Max. working temperature +230 °F Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Ceramic coating	
<b>Zurcon® Z80</b> For lubricating and non-lubricating fluids Water based fluids, air and gases Dry air pneumatics High abrasion and extrusion resistance For service in abrasive conditions and media with particles Good chemical resistance Limited temperature capability (-76 to +176 °F) UHMWPE (Ultra High Molecular Weight Polyethylene) Color: White to off-white	Z80	NBR-70	N/N7	-22 to +212	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		EPDM-70	E**	-49 to +176	Stainless steel Aluminum Ceramic coating	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil (except EPDM).

\*\* Material not suitable for mineral oils.

\*\*\* Max. Ø 86 inches (2,200mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

 Highlighted materials are recommended.



## ■ Installation Recommendation (Inch Rod Series)

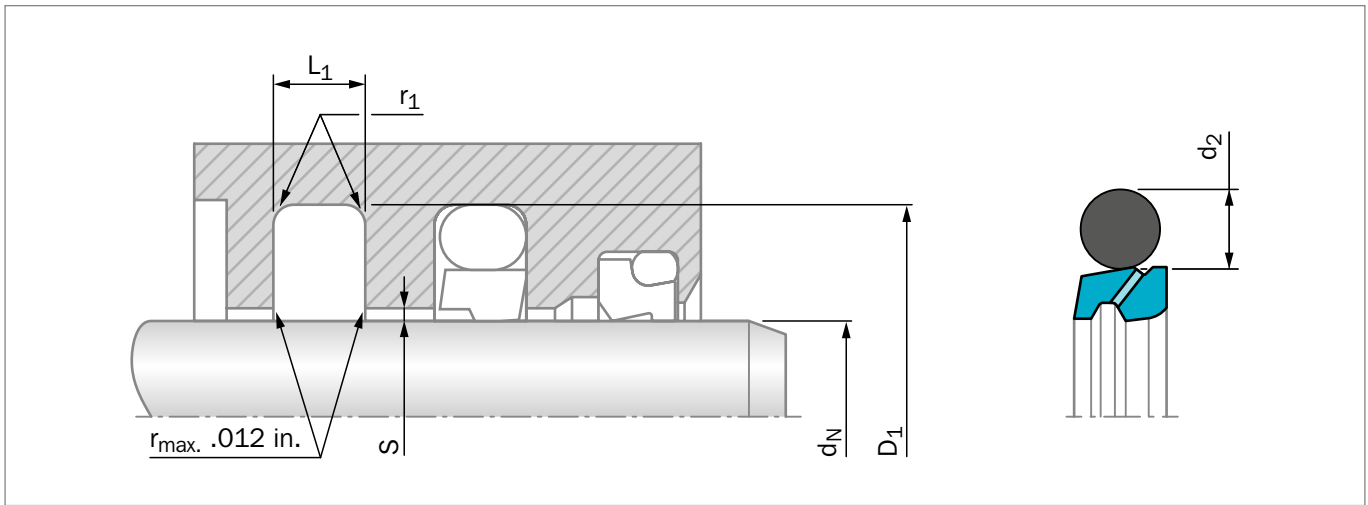


Figure 38: Installation drawing

**Table 23: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_1$ H9	Groove Width $L_1$ +0.2	Radius $r_1$ max	Radial Clearance $S_{max}^*$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
RSVA	.125 - .312	.313 - .749	-	$d_N +.193$	.087	.020	.012	.008	.006	.070
RSVB	.313 - .749	.750 - 1.499	-	$d_N +.287$	.126	.020	.016	.010	.006	.103
RSVC	.750 - 1.499	1.500 - 7.874	.313 - .749	$d_N +.421$	.165	.025	.020	.012	.008	.139
RSVD	1.500 - 7.874	7.875 - 9.999	.750 - 1.499	$d_N +.594$	.248	.030	.028	.016	.010	.210
RSVE	7.875 - 9.999	10.000 - 25.499	1.500 - 7.874	$d_N +.807$	.319	.035	.031	.024	.014	.275
RSVF	10.000 - 25.499	-	7.875 - 9.999	$d_N +.945$	.319	.035	.039	.031	.020	.275

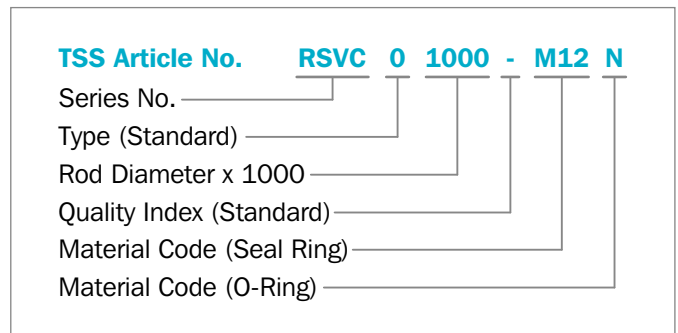
\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/rod) in the area behind seal or consult Trelleborg Sealing Solutions for alternative material or profiles.  
Slydring® / Wear Rings are not applicable at very small radial clearances (S); please consult the Slydring® catalog.

### ORDERING EXAMPLE

Turcon® Stepseal® V complete with O-Ring, standard application:

<b>Series:</b>	RSVC from Table 23
<b>Rod diameter:</b>	$d_N = 1.000$ inch
<b>TSS Part No.:</b>	RSVC01000

Select the material from Table 22. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.



### NOTE:

Turned - other diameters also available, no tool costs.

# Zurcon® Rimseal



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Single-Acting

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O-Ring-Energized Zurcon® Slipper Seal

**Material:**

Zurcon® and Elastomer

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## ■ Zurcon® Rimseal

### ■ Description

When the field of application and system requirements make high demands on leakage control and operational reliability, a redundant sealing system is necessary to ensure reliable sealing of hydraulic cylinders at the piston rod. Sealing systems with elastomer-energized polymer seals are a proven answer to widely varying demands for standardized grooves, simple installation, resistance to media, high and low temperatures and pressures. The system offers enormous flexibility in the choice and matching of materials.

The piston rod sealing system for hydraulic cylinders subject to heavy loads should consist of three elements:

The Turcon® Stepseal® 2K is used as primary seal. This seal element offers the back pumping property necessary for redundant rod seal systems as well as good resistance to high and low temperatures and high media resistance.

The Zurcon® Rimseal was developed as the secondary seal in this system to ensure reliable sealing of thin oil films at low secondary pressures. A Zurcon® material (polyurethane Shore D 58) is used combined with a new seal profile.

The contact pressure curve is automatically optimized under dynamic conditions.

The final outer element of the redundant sealing system is a double-acting scraper seal (e.g. DA 24, DA 22, DA 17, Turcon® Excluder® 2, Turcon® Excluder® 5).

The optimum sealing system thus consists of three independent lip seals installed in line, whereby the hardness of the material decreases from the pressure side to the atmospheric side.

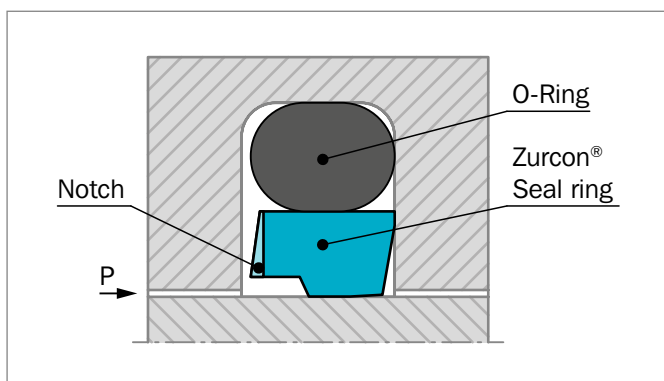


Figure 39: Zurcon® Rimseal

### METHOD OF OPERATION

The Zurcon® Rimseal is an O-Ring-energized seal element. The changes in seal position in the groove necessary for an optimum sealing function are guaranteed by the combination of the two component parts (O-Ring and seal ring).

In order to achieve a contact pressure curve which enhances the sealing effect, the seal has a chamfer on the low pressure side. When under pressure and exposed to friction against the piston rod, this chamfer causes the seal to tilt slightly so that the seal ring is forced against the side of the groove. This creates an area of maximum pressure at the edge of the seal.

When the Zurcon® Rimseal is used in a system with a double-acting scraper DA 24 (DA 22, DA 17, Excluder® 2, Excluder® 5), the sealing function of the system must be assured even if pressure build-up occurs between the Zurcon® Rimseal and the double-acting scraper seal.

For this reason, the high-pressure side of the seal ring also has a chamfer which, in the event of a build-up of pressure behind the Zurcon® Rimseal, comes into contact with the flank of the groove. The Zurcon® Rimseal moves in the groove so that a contact pressure distribution is obtained on the piston rod which enhances the back pumping effect.

### ADVANTAGES

- High static and dynamic leak tightness
- Low friction for reduced power loss
- High wear resistance for long service life
- Small groove
- Easy installation
- ISO/DIN grooves optional
- Available for any diameter from .040 inches (8mm) to 86.500 inches (2,200mm)

### APPLICATION EXAMPLES

- Mobile hydraulics
- Standard cylinders
- Machine tools
- Injection molding machines
- Presses



**TECHNICAL DATA**

<b>Pressure:</b>	In tandem system: Up to 8,700 psi (60 MPa) As an individual element: 3,625 psi (25 MPa)
<b>Velocity:</b>	16 ft/s (5 m/s) with short strokes (<40.000 inches (1 m)) in tandem system
<b>Temperature:</b>	-49 °F to +230 °F (-45 °C to +110 °C) depending on O-Ring material
<b>Media:</b>	Hydraulic fluids - Mineral oil - Synthetic and natural esters - HEES, HETG up to +140 °F (+60 °C) - Flame retardant fluids HFA, HFC

**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 dependent on medium.

**MATERIAL**

The Zurcon® Rimseal is made in the following material combinations as standard:

Seal ring:	Zurcon® Z54 Special polyurethane 58 Shore D
O-Ring:	NBR, 70 Shore A                      N or N7 NBR, 70 Shore A Low temp.      T depending on the temperature
Set code:	Z54N/Z54N7/Z54T

**SERIES**

The Zurcon® Rimseal is a system seal and is preferably used in tandem sealing systems in conjunction with the Turcon® Stepseal® 2K. The cross section series is identical with those for the Turcon® Stepseal® 2K.

**REDUNDANT SEALING SYSTEM**

Redundant sealing systems are used where the application conditions no longer permit reliable sealing over the demanded service life with a single seal.

The property of the tandem sealing system is particularly important during cold starts when, due to the very high viscosity of the oil, the primary seal allows oil to pass as the piston rod is extended. In the tandem system the oil is heated as a result of the friction at the primary seal and is then reliably wiped off - at a now lower viscosity - by the secondary seal, the Zurcon® Rimseal.

As the piston rod is retracted, the oil is stored in the reservoir between the seals, and is then pumped back against the system pressure by the hydrodynamics in the seal clearance of the Turcon® Stepseal® 2K.

Particularly with strokes of more than 40.000 inches (1 meter), constructional measures have to be taken to provide a storage chamber between the seals.

The Zurcon® Rimseal is designed so that it also has the back pumping properties necessary when using a double-acting scraper in the rod sealing system.

Due to the controlled sealing behavior of the individual elements in the sealing system and the appropriate combination of the seal materials, a rod seal system is obtained with a low overall friction.

The Figure 40 shows a redundant rod seal system consisting of Turcon® Stepseal® 2K, Zurcon® Rimseal and rod scraper DA 22 arrangement.

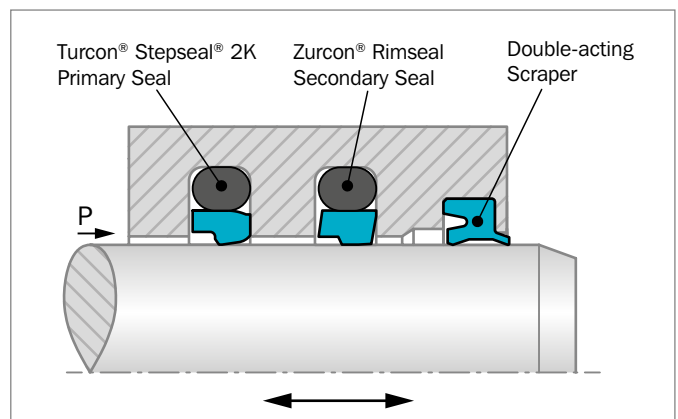


Figure 40: Zurcon® Rimseal in tandem configuration





## ■ Installation Recommendation (Inch Rod Series)

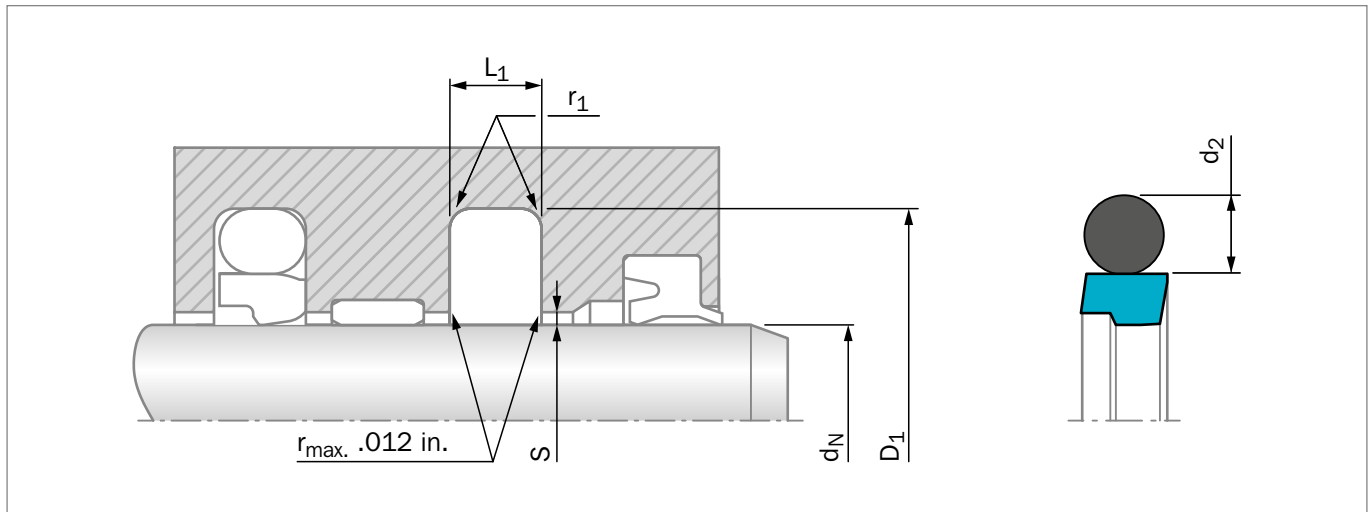


Figure 41: Installation drawing

**Table 24: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_1$ H9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}$		O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	
RRF1	.313 - .749	.750 - 1.499	-	$d_N + .287$	.126	.015	.015	.010	.103
RRF2	.750 - 1.499	1.500 - 7.999	.313 - .749	$d_N + .421$	.165	.020	.015	.010	.139
RRF3	1.500 - 7.999	8.000 - 9.999	.750 - 1.499	$d_N + .594$	.248	.030	.020	.012	.210
RRF4	8.000 - 9.999	10.000 - 25.500	1.500 - 7.999	$d_N + .807$	.319	.035	.025	.015	.275
RRF5	10.000 - 25.500	-	8.000 - 10.000	$d_N + .945$	.319	.035	.025	.015	.275

### ORDERING EXAMPLE

Zurcon® Rimseal complete with NBR O-Ring Series RRF4 (from Table 24).

<b>Rod diameter:</b>	$d_N = 8.000$ inches
<b>TSS Part No.:</b>	RRF408000

The TSS Part No. can be determined following the example opposite.

### NOTE

Turned - other diameters also available, no tool costs.

**TSS Article No.**     **RRF4 08000 - Z54 N\***

TSS Series No. \_\_\_\_\_

Rod Diameter x 1000\*\* \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code (Seal Ring) \_\_\_\_\_

Material code (O-Ring) \_\_\_\_\_

\* Zurcon® Rimseal is always supplied as a set with a Nitrile O-Ring, code N or T.

\*\* For diameters  $\geq 102$  inches please consult your Customer Solution Center for special part no.

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# Turcon® VL Seal®



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Single-Acting

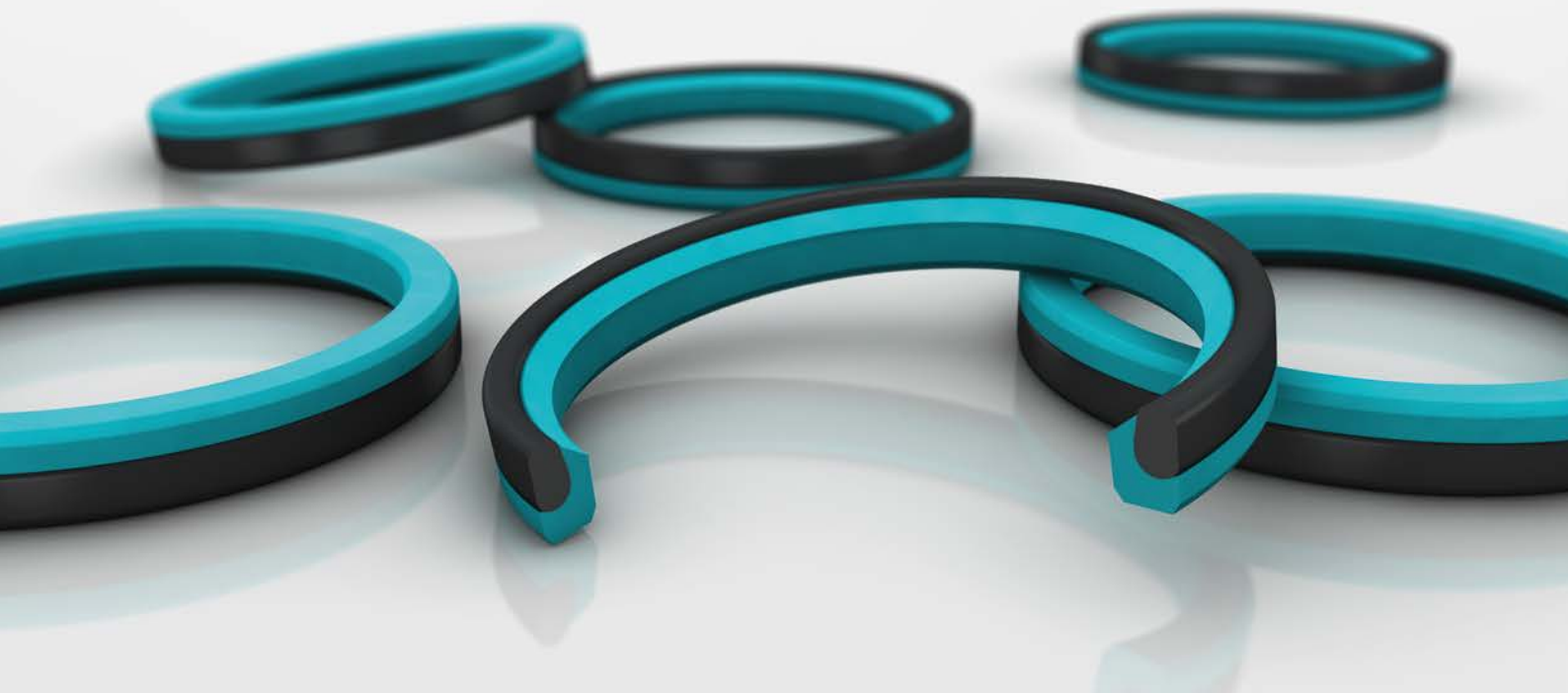
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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® VL Seal® \*

### ■ Description

The Turcon® VL Seal® incorporates theoretical and empirical experience in a new generation seal for the 21<sup>st</sup> century.

The VL Seal® has been developed over the past few years as a new generation unidirectional Rod seal. The design has taken the latest empirical and theoretical experience into account in order to optimize performance, friction, leakage and service life. This has been achieved through in-house testing and qualified in customer applications. See test section.

The back-pumping effect allows the seal to relieve pressure trapped between tandem seals or between seals and double-acting scrapers.

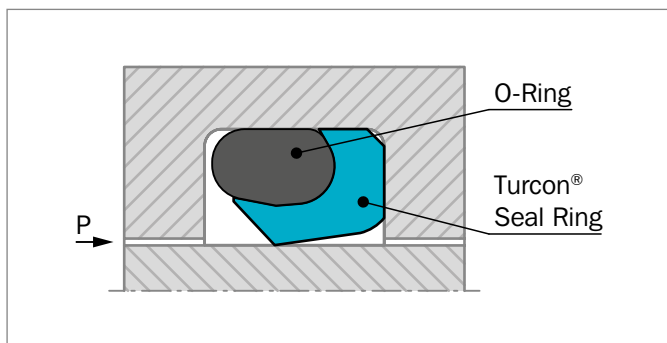


Figure 42: Turcon® VL Seal®

### METHOD OF OPERATION

The sealing mechanism of the Turcon® VL Seal® (Figure 42) is based on the hydrodynamic properties of the seal. The specially formed seal edge has a steep contact pressure gradient on the high pressure side and a shallow contact pressure gradient on the low pressure side. This ensures that the fluid film adhering to the piston rod is returned to the high pressure chamber on the return stroke of the rod. This prevents the micro-fluid layer, that is carried out of the high pressure chamber when the piston rod is extended, from causing leaks.

This return delivery property prevents the build-up of interstage pressure normally associated with tandem seal configurations (Figure 43). Interstage pressure depends on the system pressure, speed, the stroke length and the groove design.

\* Patent pending. (US Patent No. 6,497,415)

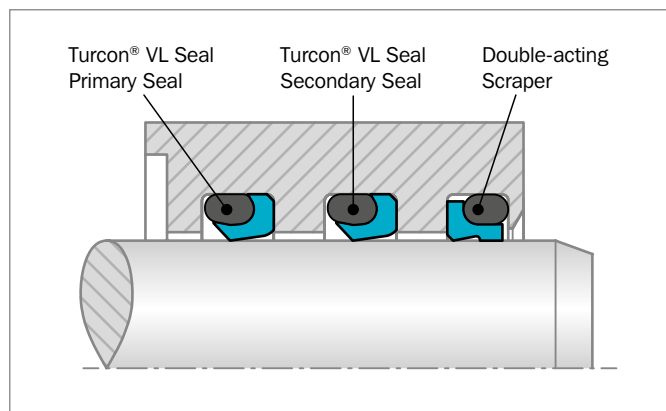


Figure 43: Pressure Distribution in Tandem Installation

### ADVANTAGES

Compared with current rod seals, the following parameters have been improved:

- VL Seal® design allows gland for a reduced radial depth
- Tighter leakage control
- Lower friction: (Reduced contact area between seal and mating surface)
- Simplicity of design, using standard size O-Ring
- Featuring the Turcon® Stepseal® 2K back pumping effect
- The seal geometry prevents seal roll at low or shuffling pressure



**TECHNICAL DATA**

<b>Operating pressure:</b>	Up to 7,250 psi (50 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s) with reciprocating movements
<b>Temperature range:</b>	-49 °F to +390 °F (-45 °C to +200 °C) depending on elastomer material
<b>Clearance:</b>	As per Table 26
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), Phosphate Ester, water and others, depending on the elastomer material

**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 dependent on medium.

**Table 25: Turcon® and Zurcon® Materials for Turcon® VL Seal®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminium Bronze	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good slide properties, low friction Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Zurcon® Z54***</b> For mineral oils based fluids Linear and slowly turning movements High abrasion resistance For counter surface with rougher surface finish Good extrusion resistance Limited chemical resistance Max. working temperature 230 °F Color: Turquoise	Z54	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

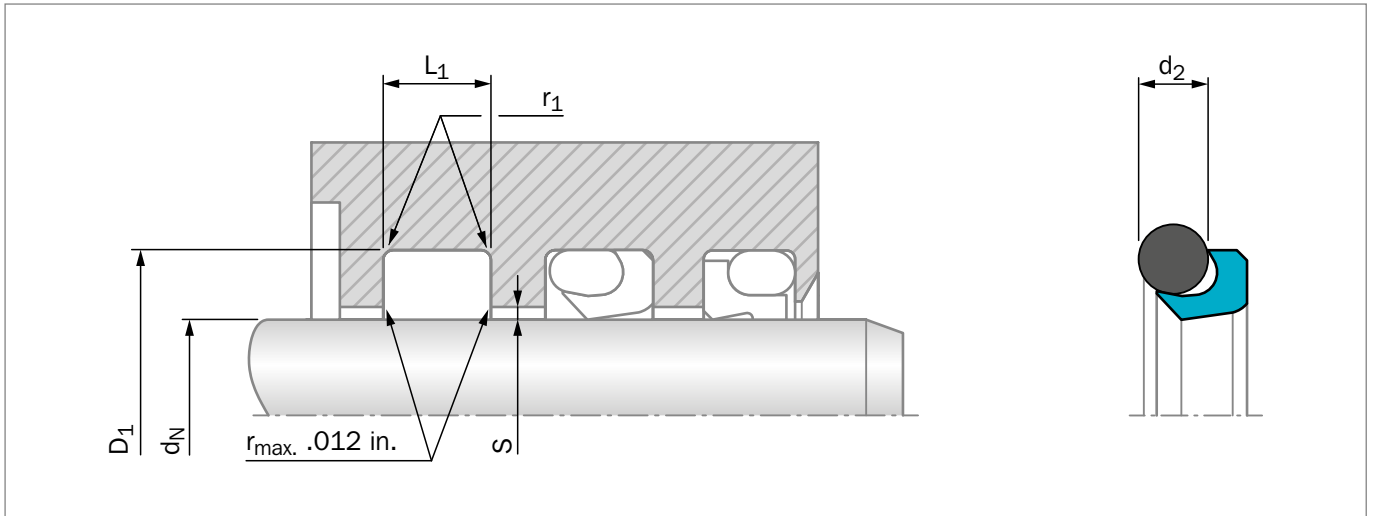


Figure 44: Installation drawing

**Table 26: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_1$ H9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}$			O-ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	30 MPa 5800 psi	
REL1	.375 - .749	.750 - 4.000	.250 - .374	$d_N + .177$	.142	.016	.016	.010	.006	.070
REL2	.750 - 1.499	1.500 - 8.000	.438 - .749	$d_N + .244$	.189	.024	.016	.010	.008	.103
REL3	1.500 - 4.749	4.750 - 16.000	.750 - 1.499	$d_N + .370$	.280	.032	.020	.012	.008	.139
REL4	4.750 - 15.999	16.000 - 25.000	1.375 - 4.749	$d_N + .480$	.374	.032	.024	.014	.010	.210
REL5	16.000 - 40.000	-	5.000 - 15.999	$d_N + .626$	.480	.032	.028	.020	.012	.275

The seal is designed for MIL-G5514F/AS4716 groove geometries, but higher clearances can be accommodated according to service conditions.

The seal is designed for 0 back-up ring groove width, but installation may be facilitated by the use of a 1 back-up ring groove width and filling the groove with a back-up ring, as a spacer.

Seals for 1 & 2 back-up ring groove widths can be used with solid b/u-rings (a scarfcut is only recommended for small diameters <25mm / 1 inch) to ease installation. Special back-up rings can be designed and supplied for unique application requirements.

The standard range can be installed in closed groove down to .800 inches / 20mm, 0 back-up ring. Smaller diameters down to .630 inches / 16mm can be installed for 1 or 2 back-up ring groove width. Back-up ring to be installed afterwards.

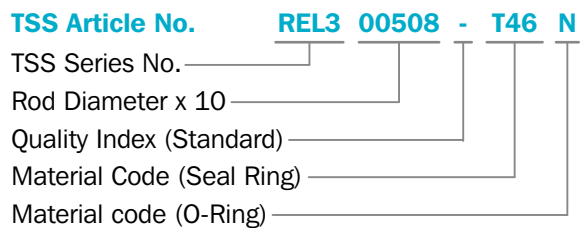
### ORDERING EXAMPLE

Turcon® VL Seal®, complete with O-Ring, standard application, Series REL3. Part Numbering scheme follows TSS metric guidelines.

**TSS Series No:** REL3

**Rod diameter:** 2.000 inches (50.8mm)

**Material:** Turcon® T46





# Turcon® Variseal® M2



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Single-Acting

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Spring-Energized Turcon® U-Cup

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**Material:**

Turcon® or Zurcon®

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## Turcon® Variseal® M2

### Description

The Turcon® Variseal® M2 is a single-acting seal consisting of a U-shaped seal jacket and a V-shaped corrosion-resistant spring.

Variseal® M2 has an asymmetric seal profile. The heavy profile of its dynamic lip with an optimized front angle offers good leakage control, reduced friction and long service life.

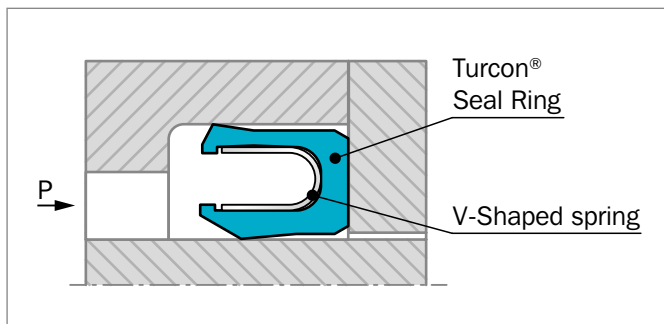


Figure 45: Turcon® Variseal® M2

At low and zero pressure, the metal spring provides the primary sealing force. As the system pressure increases, the main sealing force is achieved by the system pressure and ensures a tight seal from zero to high pressure.

The possibility of matching suitable materials for the seal and the spring allows use in a wide range of applications going beyond the field of hydraulics, e.g. in the chemical, pharmaceutical and foodstuff industries.

The Variseal® M2 can be sterilized and is available in a special Hi-Clean version where the spring cavity is filled with a silicone gel preventing contaminants from being entrapped in the seal. This design also works well in applications involving mud, slurries or adhesives to keep grit from packing into the seal cavity and inhibiting the spring action.

For applications with highly viscous media, please contact our engineering department.

Variseal® M2 seals can be installed in grooves to AS4716 and ISO 3771. The seal can only be installed to a limited extent in closed grooves, for installation instructions, see Figure 15.

### ADVANTAGES

- Resistant to most fluids and chemicals
- Low coefficients of friction
- Stick-slip-free operating for precise control
- High abrasion resistance and dimensional stability
- Can handle rapid changes in temperature
- No contamination in contact with foodstuffs, pharmaceutical and medicinal fluids
- High temperature range
- Sterilizable
- Unlimited shelf life

### APPLICATION EXAMPLES

Turcon® Variseal® M2 is the recommended sealing element for all applications requiring stick slip free operation as well as chemical resistance against almost all media such as:

- Valves
- Pumps
- Separators
- Actuators
- Dosing devices

It requires a mating surface of high quality to avoid high wear rate.

### TECHNICAL DATA

Operating conditions

<b>Pressure:</b>	For static loads: 5,800 psi (40 MPa) For dynamic loads: 2,900 psi (20 MPa)
<b>Velocity:</b>	Reciprocating up to 50 ft/s (15 m/s) Rotating up to 4.2 ft/s (1.3 m/s)
<b>Temperature:</b>	-94 °F to +572 °F (-70 °C to +300 °C) For specific applications beyond indicated range, please inquire.
<b>Media:</b>	Virtually all fluids, chemicals and gases

### IMPORTANT NOTE

The above data are maximum values, when using standard materials and geometries, 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 dependent on medium.



**MATERIALS**

All materials used are physiologically safe. They contain no odor or taste-affecting substances.

The following material combination has proven effective for most fluid applications:

Seal ring: Turcon® T40

Spring: Stainless Steel Material No. AISI 301 Code S

For gas application use:

Seal ring: Turcon® T05/Zurcon® Z80

For use in accordance with the demands of the "Food and Drug Administration", suitable materials are available on request.

**Table 27: Turcon® and Zurcon® Materials for Variseal® M2**

Material, Applications, Properties	Code	Spring Material	Code	Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, hard mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: Gray	T40	AISI 301	S	-94 to +500	Steel hardened Steel chrome plated	5,800
<b>Turcon® T05</b> For all lubricating hydraulic fluids, soft mating surfaces, very good sliding properties, low friction Color: Turquoise	T05	AISI 301	S	-94 to +500	Steel Steel chrome plated Cast iron Stainless steel Aluminium Bronze Alloys	2,900
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temperature resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	AISI 301	S	-94 to +176	Steel Steel chrome plated Stainless steel Aluminum Bronze Ceramic coating	5,800
<b>Turcon® Z48</b> For tight sealing with long wear life, in applications without high temperatures or corrosive chemicals Color: Black	Z48	AISI 301	S	-76 to +266	Steel Steel chrome plated Cast iron Stainless steel Aluminium Bronze Alloys Ceramic coating	5,800

\* Depending on media.

Highlighted materials is standard.



### Spring Materials

The standard spring material for Turcon® Variseal® is stainless steel (spring code S).

**Table 28: Spring Material**

Media	Spring materials	Spring order code
<b>For General use e.g.</b> Oil Grease Air Water, steam Solvents Food, drugs Gas	<b>Stainless steel</b> DIN Mat No. 1.4310/1.4319 AISI 301/302 UNS 30100	S (Standard spring material)
<b>For use in corrosive media e.g.</b> Acids Caustics Seawater	<b>Hastelloy® C-276</b> DIN Mat No. 2.4819 UNS N10276	H
<b>For petrochemical use e.g.</b> Crude oil Sour gas	<b>Elgiloy® 1)</b> DIN Mat No. 2.4711 UNSR30003	E

® Hastelloy is a registered trademark of Haynes International, Inc.

® Elgiloy is a registered trademark of the Elgiloy Specialty Metals  
 Alternative brand may be used.

1) NACE-approval



## Groove Design

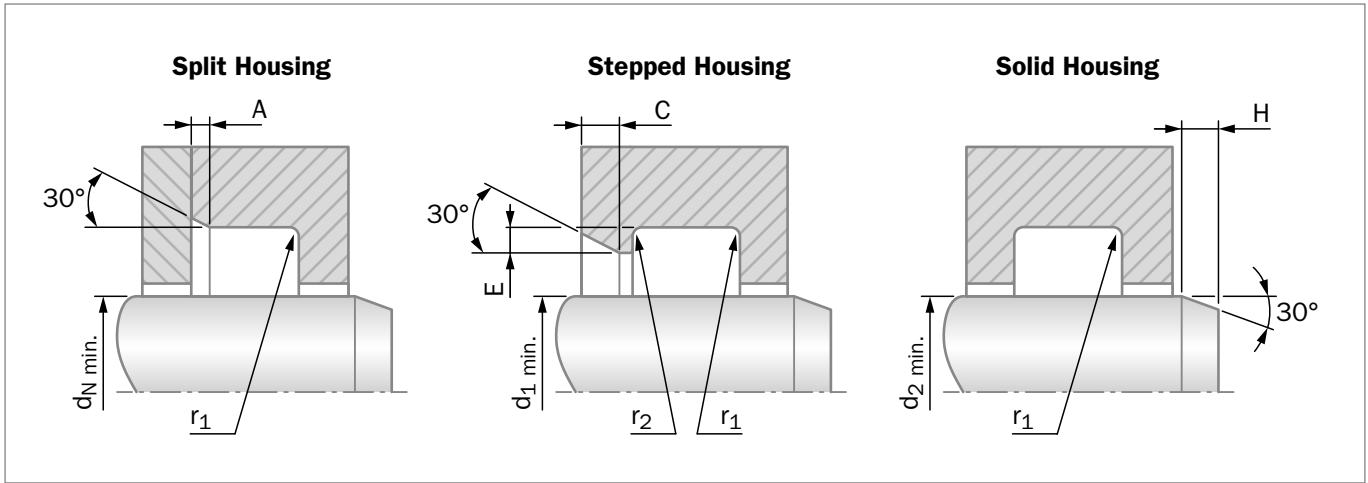


Figure 46: Variseal Groove Configurations

Installation lead-in chamfers and steps to include blend radii and are to be polished.

Table 29: Dimensions for Groove Designs

Series	Rod / Piston Groove Dimensions					
	A Chamfer	r1 Maximum Radius	C Minimum Chamfer	r2 Maximum Radius	E Minimum Step Height	H Minimum Chamfer
000	.010 / .015	.010	.028	.005	.016	.047
100	.015 / .020	.015	.043	.005	.024	.059
200	.015 / .020	.015	.050	.007	.028	.098
300	.020 / .027	.015	.055	.010	.031	.177
400	.020 / .027	.020	.063	.010	.035	.236
500	.030 / .040	.020	.102	.015	.059	.433

Table 30: Groove Design for Rod

Series	Rod Diameter Recommendations		
	Split Groove Ø d <sub>N</sub> Minimum	Stepped Groove Ø d <sub>1</sub> Minimum	Solid Groove Ø d <sub>2</sub> Minimum
000	.118	.787	1.250
100	.236	1.181	2.750
200	.394	1.378	4.375
300	.787	1.575	11.750
400	1.378	1.772	19.500
500	3.150	3.150	30.000



## ■ Installation Recommendation (Inch Rod Series)

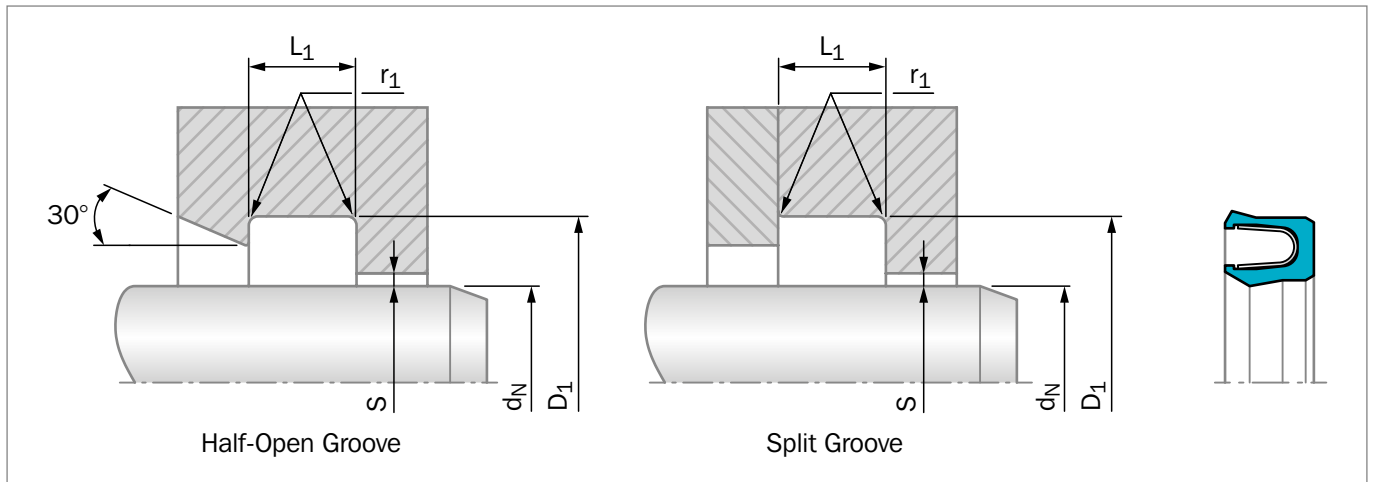


Figure 47: Installation drawing

**Table 31: Installation recommendation**

TSS Series No. for Types	Cross-section	Groove Width	Radius	Radial Clearance $S_{max}^*$			
				300 psi	1500 psi	3000 psi	5000 psi
<b>Variseal® M2</b>	$(D_1 - d_N)2$ (Ref)	$L_1 + .010$	$r_1 \text{ max}$				
RVAA	.062	.094	.010	.008	.004	.003	.002
RVAB	.093	.141	.015	.010	.006	.004	.003
RVAC	.125	.188	.015	.014	.008	.006	.003
RVAD	.187	.281	.015	.020	.010	.008	.004
RVAE	.250	.375	.020	.024	.012	.010	.005
RVAG	.375	.591	.020	.030	.015	.012	.006

### ORDERING EXAMPLE

Turcon® Variseal® M2, recommended range, Series RVAC (from Table 31).

**Dash No.:** 230

**TSS Part No.:** RVACNB230 (from Table 32)

For other seal and spring materials please contact your local Customer Solution Center.

**TSS Article No.** RVAC NB230 - T40 S M

TSS Series No. \_\_\_\_\_  
 Size / Dash No. \_\_\_\_\_  
 Quality Index (Standard) \_\_\_\_\_  
 Material Code (Seal Ring) \_\_\_\_\_  
 Material Code (O-Ring) \_\_\_\_\_  
 Load (Spring) \_\_\_\_\_



**Table 32: Installation dimensions / TSS Part No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ h9	$D_1$ H9	$L_1$ +.010		$d_N$ h9	$D_1$ H9	$L_1$ +.010	
.250	.437	.141	<a href="#">RVABNB108</a>	4.000	4.375	.281	<a href="#">RVADNB345</a>
.313	.500	.141	<a href="#">RVABNB109</a>	4.125	4.500	.281	<a href="#">RVADNB346</a>
.375	.562	.141	<a href="#">RVABNB110</a>	4.250	4.625	.281	<a href="#">RVADNB347</a>
.438	.625	.141	<a href="#">RVABNB111</a>	4.375	4.750	.281	<a href="#">RVADNB348</a>
.500	.687	.141	<a href="#">RVABNB112</a>	4.500	4.875	.281	<a href="#">RVADNB349</a>
.563	.750	.141	<a href="#">RVABNB113</a>	4.625	5.125	.375	<a href="#">RVAENB426</a>
.625	.875	.188	<a href="#">RVACNB208</a>	4.750	5.250	.375	<a href="#">RVAENB427</a>
.688	.938	.188	<a href="#">RVACNB209</a>	4.875	5.375	.375	<a href="#">RVAENB428</a>
.750	1.000	.188	<a href="#">RVACNB210</a>	5.000	5.500	.375	<a href="#">RVAENB429</a>
.813	1.063	.188	<a href="#">RVACNB211</a>	5.125	5.625	.375	<a href="#">RVAENB430</a>
.875	1.125	.188	<a href="#">RVACNB212</a>	5.250	5.750	.375	<a href="#">RVAENB431</a>
.938	1.188	.188	<a href="#">RVACNB213</a>	5.375	5.875	.375	<a href="#">RVAENB432</a>
1.000	1.250	.188	<a href="#">RVACNB214</a>	5.500	6.000	.375	<a href="#">RVAENB433</a>
1.063	1.313	.188	<a href="#">RVACNB215</a>	5.625	6.125	.375	<a href="#">RVAENB434</a>
1.125	1.375	.188	<a href="#">RVACNB216</a>	5.750	6.250	.375	<a href="#">RVAENB435</a>
1.188	1.438	.188	<a href="#">RVACNB217</a>	6.000	6.500	.375	<a href="#">RVAENB437</a>
1.250	1.500	.188	<a href="#">RVACNB218</a>	6.250	6.750	.375	<a href="#">RVAENB438</a>
1.313	1.563	.188	<a href="#">RVACNB219</a>	6.500	7.000	.375	<a href="#">RVAENB439</a>
1.375	1.625	.188	<a href="#">RVACNB220</a>	6.750	7.250	.375	<a href="#">RVAENB440</a>
1.438	1.688	.188	<a href="#">RVACNB221</a>	7.000	7.500	.375	<a href="#">RVAENB441</a>
1.500	1.875	.281	<a href="#">RVADNB325</a>	7.250	7.750	.375	<a href="#">RVAENB442</a>
1.625	2.000	.281	<a href="#">RVADNB326</a>	7.500	8.000	.375	<a href="#">RVAENB443</a>
1.750	2.125	.281	<a href="#">RVADNB327</a>	7.750	8.250	.375	<a href="#">RVAENB444</a>
1.875	2.250	.281	<a href="#">RVADNB328</a>	8.000	8.500	.375	<a href="#">RVAENB445</a>
2.000	2.375	.281	<a href="#">RVADNB329</a>	8.500	9.000	.375	<a href="#">RVAENB446</a>
2.125	2.500	.281	<a href="#">RVADNB330</a>	9.000	9.500	.375	<a href="#">RVAENB447</a>
2.250	2.625	.281	<a href="#">RVADNB331</a>	9.500	10.000	.375	<a href="#">RVAENB448</a>
2.375	2.750	.281	<a href="#">RVADNB332</a>	10.000	10.500	.375	<a href="#">RVAENB449</a>
2.500	2.875	.281	<a href="#">RVADNB333</a>	10.500	11.000	.375	<a href="#">RVAENB450</a>
2.625	3.000	.281	<a href="#">RVADNB334</a>	11.000	11.500	.375	<a href="#">RVAENB451</a>
2.750	3.125	.281	<a href="#">RVADNB335</a>	11.500	12.000	.375	<a href="#">RVAENB452</a>
2.875	3.250	.281	<a href="#">RVADNB336</a>	12.000	12.500	.375	<a href="#">RVAENB453</a>
3.000	3.375	.281	<a href="#">RVADNB337</a>	12.500	13.000	13.000	<a href="#">RVAENB454</a>
3.125	3.500	.281	<a href="#">RVADNB338</a>	13.000	13.500	13.500	<a href="#">RVAENB455</a>
3.250	3.625	.281	<a href="#">RVADNB339</a>	13.500	14.000	14.000	<a href="#">RVAENB456</a>
3.375	3.750	.281	<a href="#">RVADNB340</a>	14.000	14.500	14.500	<a href="#">RVAENB457</a>
3.500	3.875	.281	<a href="#">RVADNB341</a>	14.500	15.000	15.000	<a href="#">RVAENB458</a>
3.625	4.000	.281	<a href="#">RVADNB342</a>	15.000	15.500	15.500	<a href="#">RVAENB459</a>
3.750	4.125	.281	<a href="#">RVADNB343</a>	15.500	16.000	16.000	<a href="#">RVAENB460</a>
3.875	4.250	.281	<a href="#">RVADNB344</a>				



# Turcon® Glyd Ring® T



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## Turcon® Glyd Ring® T\*

### ■ Description

Turcon® Glyd Ring® T is a further technical development of the Turcon® Glyd Ring® seal which has been successfully used for decades. It is fully interchangeable with the earlier Glyd Ring® seals in all new applications. Glyd Ring® T meets all the market demands for a function-specific seal solution, observing economic and ecological aspects.

The benefits of the patented seal concept are provided by the innovative functional principle of the trapezoidal profile cross-section.

Both lateral profile flanks are inclined so that the seal profile tapers towards the seal surface. The profile can thus retain the robust and compact form typical of piston seals without losing

any of the flexibility required to achieve a pressure-related maximum compression (Figure 48).

The edge angle created by the special Glyd Ring® T cross-sectional form permits an additional degree of freedom and enables a slight tilting movement of the seal. The maximum compression is always shifted towards the area of the seal edge directly exposed to the pressure. On the low-pressure edge of the seal, on the other hand, the Glyd Ring® T exhibits only zones with neutral strains without compressive or shearing loads, effectively reducing the danger of gap extrusion. The resulting benefits for the user can be seen in the following list.

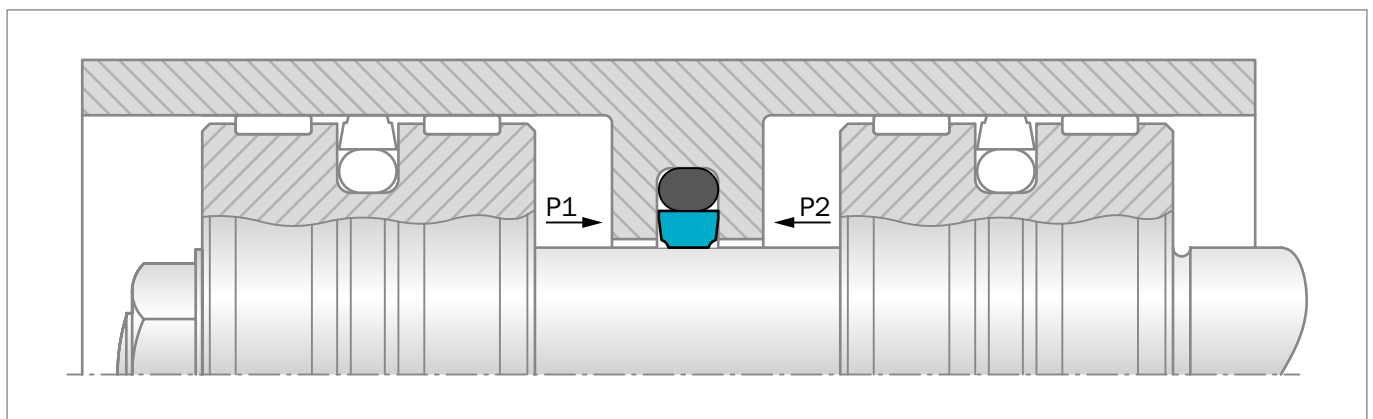


Figure 48: Turcon® Glyd Ring® T

### ADVANTAGES

The benefits offered to date by the Glyd Ring® are still retained in full, and are now complemented by a number of further important advantages:

- Very good static leak-tightness
- Increased clearance possible (approx. +50%), depending on the operating conditions
- Low friction, no stick-slip effect
- Simple groove design
- Available for all rod diameters up to 102 inches (2,600mm)

\* Patent-No.:

DE	41 40833 C3
EP	0 582 593
Japan	2 799 367
USA	5,433,452

### APPLICATION EXAMPLES

The Turcon® Glyd Ring® T is the recommended sealing element for double acting inside sealing seal for hydraulic components such as:

- Special Cylinders
- Pumps and valves
- Machine tools
- Robotics/manipulators
- Presses

It is particularly recommended for heavy duty and large diameter applications.

**TECHNICAL DATA**

<b>Operating Pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water, air and others, depending on the O-Ring material (see Table 33)
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 34 as a function of the operating pressure and functional diameter.

**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 dependent on medium.

**MATERIALS****Standard Application:**

For hydraulic components with reciprocating movement in mineral oils containing zinc or medium with good lubricating performance

Seal Ring: Turcon® T46

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on the temperature

Set code: T46N/T46N7/T46V

**Special Application:**

Non-lubricating fluids or pneumatic applications require self-lubricating sealing materials. Therefore we recommend:

Seal Ring: Turcon® T40

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on the temperature

Set code: T40N/T40N7/T40V

If rougher surface finish must be sealed, we recommend:

Seal Ring: Zurcon® Z53

Energizer: NBR, 70 Shore A    N or N7

Set code: Z53N or Z53N7

**Table 33: Turcon® and Zurcon® Materials for Glyd Ring® T**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases Carbon fiber-filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm)

BAM: Tested by "Bundesanstalt Materialprüfung, Germany"

  Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

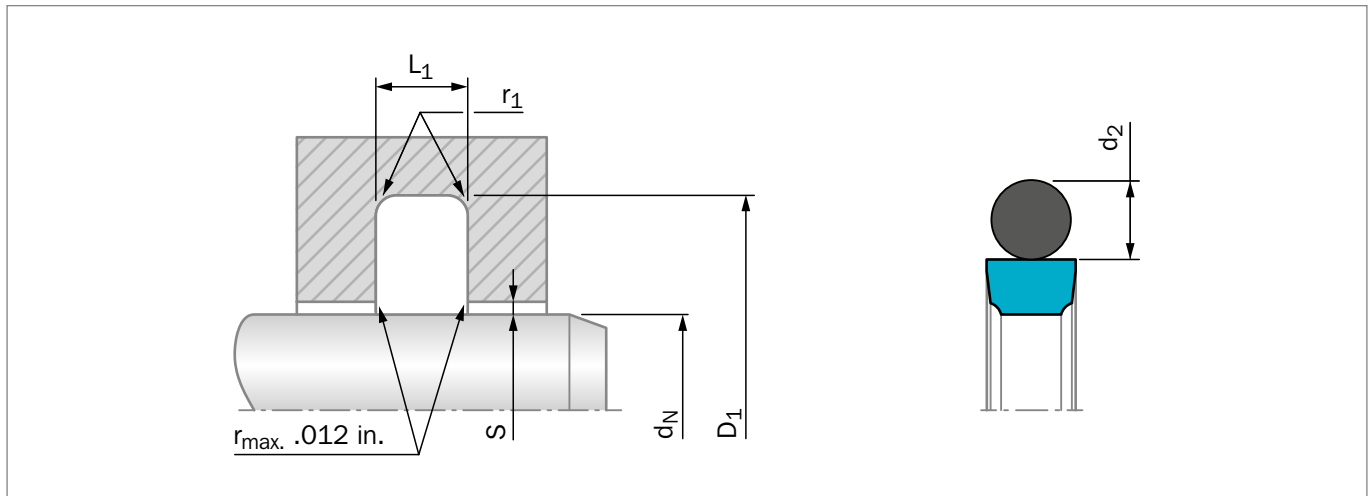


Figure 49: Installation drawing

**Table 34: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter* $D_1$ H9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}$ **			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
RT10	-	.313 - .624	-	$d_N +.193$	.087	.020	.020	.012	.008	.070
RT11	.313 - .624	.625 - 1.624	-	$d_N +.287$	.126	.020	.024	.016	.008	.103
RT12	.625 - 1.624	1.625 - 3.249	.313 - .624	$d_N +.421$	.165	.025	.024	.016	.008	.139
RT13	1.625 - 7.749	3.250 - 5.374	.625 - 1.624	$d_N +.594$	.248	.030	.031	.020	.012	.210
RT14	7.750 - 9.999	5.375 - 12.999	1.625 - 3.249	$d_N +.807$	.319	.035	.031	.020	.012	.275
RT15	10.000 - 20.000	13.000 - 26.000	3.250 - 5.375	$d_N +.945$	.319	.035	.035	.020	.016	.275

\* Installation with groove dimensions to ISO 7425-2 is possible.

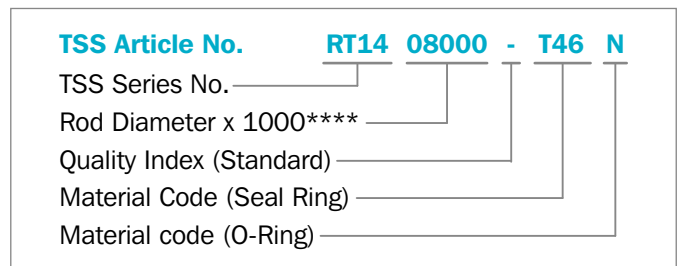
\*\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/rod) in the area of the seal.

### ORDERING EXAMPLE

Turcon® Glyd Ring® T, complete with O-Ring, standard application, Series RT14 (from Table 34)

**Rod diameter:**  $d_N = 8.000$  inches  
**TSS Part No.:** RT1408000

Select the material from Table 33. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.



\*\*\*\* For diameters  $\geq 20$  inches please consult your Customer Solution Center for special TSS Article No.

### NOTE

Turned - other diameters also available, no tool costs.

# Turcon® Glyd Ring®



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Glyd Ring®

### ■ Description

Successfully used for decades, the Turcon® Glyd Ring® is a very effective and reliable low friction seal. It is particularly suitable as a rod seal in both high and low pressure systems.

The double acting Turcon® Glyd Ring® is a combination of a Turcon® based slipper seal and an energizing O-Ring. It is produced with an interference fit which together with the squeeze of the O-Ring ensures a good sealing effect even at low pressure. At higher system pressures, the O-Ring is energized by the fluid, pushing the Turcon® Glyd Ring® against the sealing face with increased force.

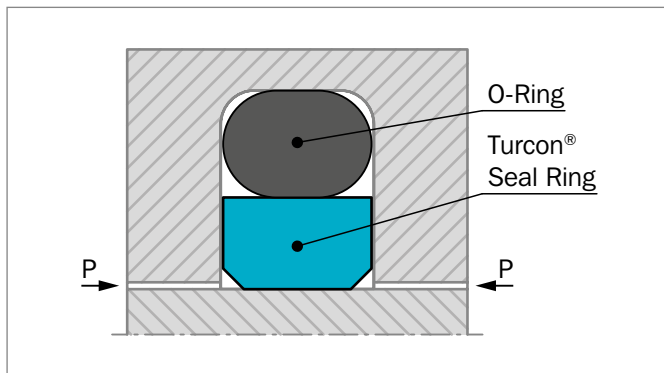


Figure 50: Turcon® Glyd Ring®

The geometry of the Turcon® Glyd Ring® ensures a good static sealing and allows the lubricating hydrodynamic oil film to build under the seal in reciprocating applications.

### NOTCHES

To assure that a rapid energizing of the seal takes place at sudden changes of pressure and direction of motion, the seal can be delivered with radial notches on both sides.

For ordering of Glyd Ring® with notches, see ordering example for this section.

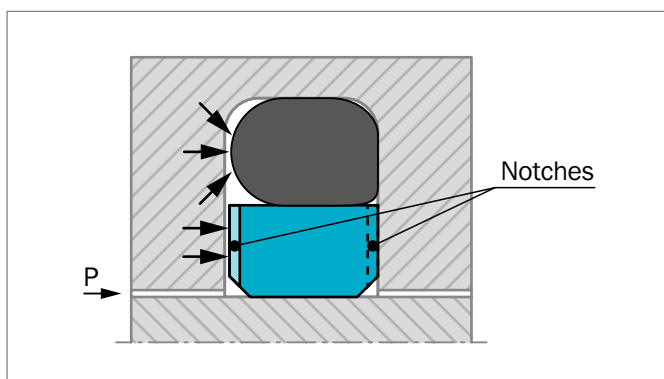


Figure 51: Turcon® Glyd Ring®

### ADVANTAGES

- No stick-slip effect when starting for smooth operation
- Minimum static and dynamic friction coefficient for minimum energy loss and operating temperature
- Suitable for non lubricating fluids depending on seal material for optimum design flexibility
- High wear resistance ensures long service life
- No adhesive effect to the mating surface during long periods of inactivity or storage
- Suitable for most hydraulic fluids in relation to most modern hardware materials and surface finishes depending on material selected.
- Suitable for new environmentally safe hydraulic fluids
- Available for all rod diameters up to 102 inches (2,600mm)

### APPLICATIONS EXAMPLES

Over several decades the Turcon® Glyd Ring® has been successfully implemented in many applications as double or single-acting rod seals of hydraulic components such as:

- Special cylinders
- Pumps and valves
- Machine tools
- Servo equipment



## TECHNICAL DATA

Operating conditions:

The Turcon® Glyd Ring® is recommended for reciprocating (with a length of stroke at least twice the groove width) and helical movements.

<b>Pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Frequency:</b>	Up to 5 Hz.
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (biological degradable oils), water, air and others, depending on the O-Ring material compatibility.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in the Table 36, as a function of the operating pressure and functional diameter.

## 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 dependent on medium.

## MATERIALS

### Standard Application:

For hydraulic components with reciprocating movement in mineral oils or medium with good lubricating performance.

Turcon® Seal: Turcon® T46

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on the temperature

Set code: T46N/T46N7/T46V

### Special Application:

Short stroke movements, non-lubricating fluids or pneumatic applications require self-lubricating sealing materials. Therefore we recommend:

Turcon® Seal: Turcon® T29

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on the temperature

Set code: T29N/T29N7/T29V

If low friction coefficient is required, we recommend:

Turcon® Seal: Turcon® T05

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on the temperature  
For special requirements, other elastomers are available on request.

Set code: T05N/T05N7/T05V

If rougher surface finish must be sealed, we recommend:

Zurcon® seal: Zurcon® Z53

Energizer: NBR, 70 Shore A    N or N7

Set code: Z53N or Z53N7

**Table 35: Turcon® and Zurcon® Materials for Glyd Ring®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N or N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N or N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T08</b> Very high compressive strength, very good extrusion resistance High bronze filled Color: Light to dark brown	T08	NBR-70	N or N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N or N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber filled Color: Gray	T29	NBR-70	N or N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminium Bronze	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good slide properties, low friction. Color: Turquoise	T05	NBR-70	N or N7	-22 to +212	Steel hardened	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Turcon® T42</b> For all lubricating and non-lubricating hydraulic fluids, good chemical resistance, good dielectric properties Glass fiber filled + MoS <sub>2</sub> Color: Gray to blue	T42	NBR-70	N or N7	-22 to +212	Steel hardened	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T19</b> For all lubricating fluids and hydraulic oils without zinc, high sealing efficiency, good sliding and wear properties, mild to counter surface Mineral fiber filled Color: Dark green-gray	T19	NBR-70	N or N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron Stainless steel	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N or N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temp. resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N or N7	-22 to +176	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

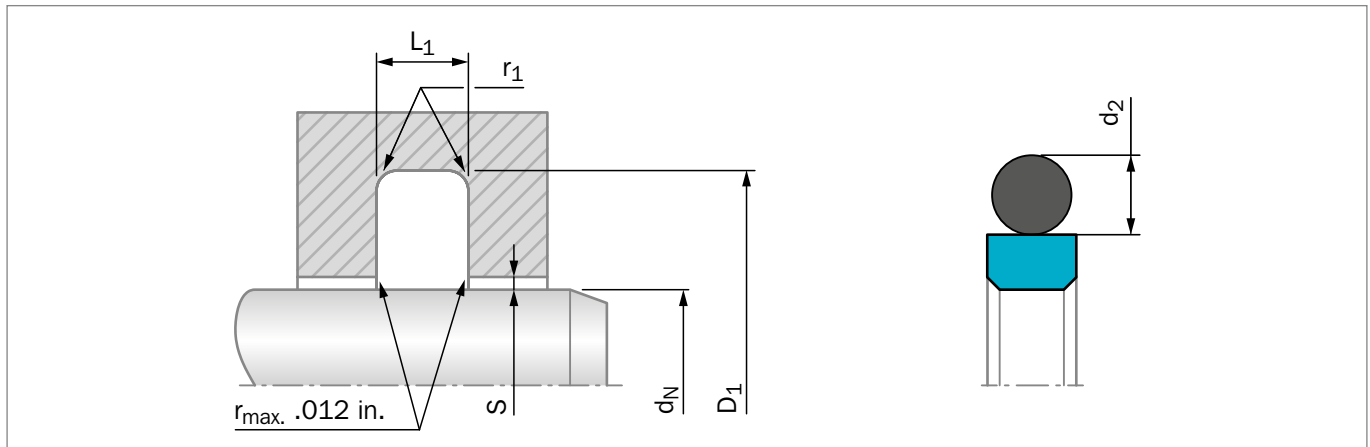


Figure 52: Installation drawing

**Table 36: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter* $D_1$ H9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}$ **			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
RG00	.313 - .624	.625 - 1.624	-	$d_N + .193$	.087	.015	.020	.012	.008	.070
RG01	.625 - 1.624	1.625 - 3.249	-	$d_N + .287$	.126	.025	.024	.016	.008	.103
RG02	1.625 - 3.249	3.250 - 5.374	.625 - 1.624	$d_N + .421$	.165	.025	.024	.016	.008	.139
RG03	3.250 - 5.374	5.375 - 12.999	1.625 - 3.249	$d_N + .594$	.248	.035	.031	.020	.012	.210
RG04	5.375 - 12.999	13.000 - 26.000	3.250 - 5.374	$d_N + .807$	.319	.035	.031	.020	.012	.275
RG05	13.000 - 26.000	-	5.375 - 13.000	$d_N + .945$	.319	.035	.035	.020	.016	.275

\* Installation with groove dimensions to ISO 7425/2 is possible.

\*\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/rod) in the area of the seal or consult Trelleborg Sealing Solutions for alternative material or profiles.

### ORDERING EXAMPLE

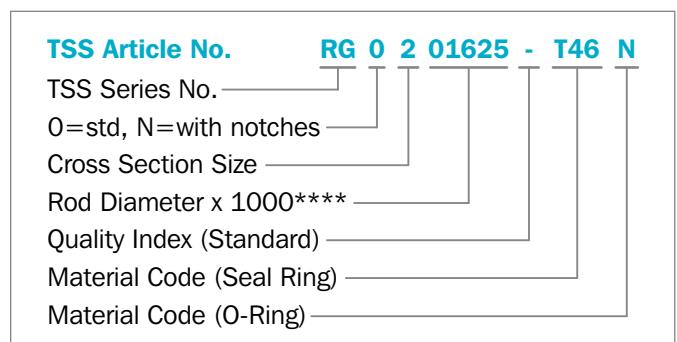
Turcon® Glyd Ring®, complete with O-Ring, standard application, Series RG02 (from Table 36)

**Rod diameter:**  $d_N = 1.625$  inches

**TSS Part No.:** RG0201625

Select the material from Table 35. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.

To order parts with notches substitute “N” for “O” in 3rd digit.



\*\*\*\* For diameters  $d_N \geq 20$  inches please consult your Customer Solution Center for special TSS Article No.

### NOTE

Turned - other diameters also available, no tool costs.

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# Turcon® Glyd Ring® C



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Glyd Ring® C

### ■ Description

The Turcon® Glyd Ring® C is a very effective and reliable low frictional seal. It is suitable as a double acting rod seal in both low and medium pressure systems.

The Turcon® Glyd Ring® C is a combination of a Turcon® based slipper seal and an energizing O-Ring. It is produced with an interference fit, which, together with the squeeze of the O-Ring, ensures a good sealing effect even at low pressure. At higher system pressures, the O-Ring is energized by the fluid, pushing the Turcon® Glyd Ring® C against the sealing face with increased force.

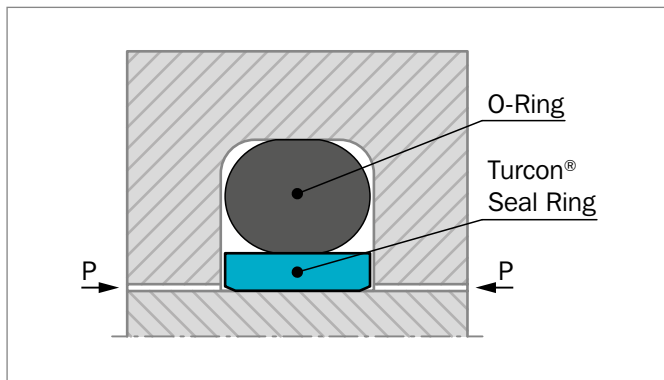


Figure 53: Turcon® Glyd Ring® C

The geometry of the Turcon® Glyd Ring® C ensures effective static sealing and allows the lubricating hydrodynamic fluid film to build under the seal in reciprocating applications.

### NOTCHES

To assure that a rapid energizing of the seal takes place at sudden changes of pressure and direction of motion, the seal can be delivered with radial “notches” on both sides.

Ordering of Glyd Ring® C with “notches” see page 125.

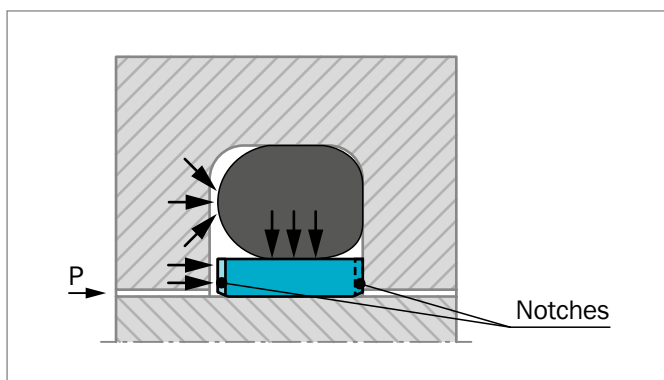


Figure 54: Turcon® Glyd Ring® C with notches on both sides

### ADVANTAGES

- No stick-slip effect when starting for smooth operation
- Minimum static and dynamic friction coefficient for a minimum energy loss and operating temperature
- Suitable for non lubricating fluids depending on seal material for optimum design flexibility
- High wear resistance ensures long service life
- No adhesive effect to the mating surface during long period of inactivity or storage
- Suitable for most hydraulic fluids in relation with most modern hardware materials and surface finish depending on material selected
- Suitable for new environmentally safe hydraulic fluids

### APPLICATIONS EXAMPLES

Over several decades the Turcon® Glyd Ring® C has been successfully implemented in countless applications as double acting Rod seals of hydraulic components such as:

- Machine tools
- Robotics
- Handling machinery
- Manipulators
- Valves for hydraulic & pneumatic circuits
- Fittings
- Testing machinery
- Hydraulic power steering
- Brake systems
- Brake boosters
- Low temperature hydraulics
- Chemical processing equipment
- Filling machines

**TECHNICAL DATA**

Operating conditions:

The Turcon® Glyd Ring® C is recommended for reciprocating movements (with a length of stroke at least twice the groove width).

<b>Pressure:</b>	Up to 5,000 psi (35 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Frequency:</b>	Up to 5 Hz.
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (depending on O-Ring material)
<b>Media:</b>	Mineral oil based hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (biological degradable oils), water, air and others. Depending on the O-Ring material compatibility.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in the Table 38, as a function of the operating pressure and functional diameter.

**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 dependent on medium.

**MATERIALS****Standard Application:**

For hydraulic components with reciprocating movement in mineral oils or medium with good lubricating performance.

Seal Ring:	Turcon® T46	
Energizer:	NBR, 70 Shore A	N or N7
	FKM, 70 Shore A	V
	depending on the temperature	
Set code:	T46N or T46V	

**Special Application:**

For short stroke movements, non-lubricating fluids or applications requiring self-lubricating sealing materials we recommend:

Seal Ring:	Turcon® T40	
Energizer:	NBR, 70 Shore A	N or N7
	FKM, 70 Shore A	V
	depending on the temperature	
Set code:	T40N or T40V	

If low friction coefficient is required, we recommend:

Seal Ring:	Turcon® T05	
Energizer:	NBR, 70 Shore A	N or N7
Set code:	T05N	

If exposure to water is required, we recommend:

Seal Ring:	Zurcon® Z80	
Energizer:	NBR, 70 Shore A	N or N7
Set code:	Z80N	

**Table 37: Turcon® Glyd Ring® C**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T24</b> For all lubricating and non-lubricating hydraulic fluids, soft mating surfaces Carbon filled Color: Black	T24	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron	
		FKM-70	V	+14 to +392	Stainless steel Aluminum	
		EPDM-70	E**	-49 to +293	Bronze	
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good sliding properties, low friction Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel tubes	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel hardened	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, water hydraulic, soft mating surfaces. Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Cast iron Stainless steel	
		FKM-70	V	+14 to +392	Aluminum	
		EPDM-70	E**	-49 to +293	Bronze Alloys	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Zurcon® Z53</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temperature resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N/N7	-22 to +176	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring Operation Temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany"

  Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

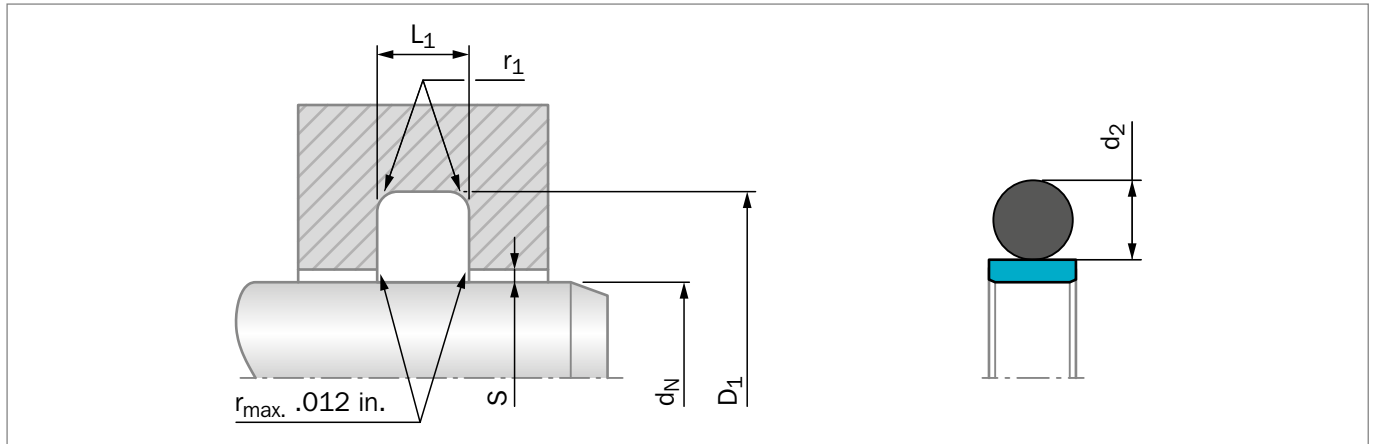


Figure 55: Installation drawing

**Table 38: Installation recommendation**

Dash No.	Rod Diameter $d_N$ f8/h9		Groove Diameter <b>D1</b> H9	Groove Width <b>L1</b> +.008	Radius <b>r1</b> max	Radial Clearance $S_{max}$ 35 MPa 5000 psi*	O-Ring Cross-Section $d_2$
	Standard Application	Light Application					
006 - 009	.125 - .219	-	$d_N +.143$	.079	.020	.002	.070
010 - 027	.250 - .312	.375 - 1.312	$d_N +.172$	.079	.020	.002	.070
110 - 148	.375 - .687	.750 - 2.750	$d_N +.236$	.112	.020	.002	.103
210 - 221	.750 - 1.437	-	$d_N +.300$	.149	.030	.003	.139
222 - 247	-	1.500 - 4.625	$d_N +.363$	.149	.030	.003	.139
325 - 348	1.500 - 4.375	-	$d_N +.491$	.221	.050	.003	.210
425 - 436	4.500 - 5.875	-	$d_N +.593$	.297	.060	.004	.275
437 - 444	6.000 - 7.750	-	$d_N +.718$	.297	.060	.004	.275
445 - 459	8.000 - 15.000	-	$d_N +.968$	.297	.060	.004	.275

\* maximum pressures

### ORDERING EXAMPLE

Turcon® Glyd Ring® C, complete with O-Ring, standard application, Series RG46 (from Table 38)

**Dash No.:** 231

**TSS Article No.:** RG460B231 (from Table 39)

The corresponding code numbers are appended to the TSS Part No. (from Table 39). Together they form the TSS Article No. All intermediate sizes not shown in Table 39 will have special TSS Article No.

**TSS Article No.** RG46 0 B 231 - T46 N

TSS Series No. \_\_\_\_\_

0=std, N=with notches \_\_\_\_\_

Groove Standard \_\_\_\_\_

Dash Size \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code (Seal Ring) \_\_\_\_\_

Material Code (O-Ring) \_\_\_\_\_

### NOTE

Turned - other diameters also available, no tool costs.  
Dash sizes represent rod sizes and groove dimensions are per TSS specifications.

**Table 39: Installation dimensions / TSS Part No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008		$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008	
.250	.422	.079	RG460B010	3.125	3.488	.149	RG460B235
.313	.485	.079	RG460B011	3.250	3.613	.149	RG460B236
.375	.547	.079	RG460B012	3.375	3.738	.149	RG460B237
.438	.610	.079	RG460B013	3.500	3.991	.221	RG460B341
.500	.672	.079	RG460B014	3.625	4.116	.221	RG460B342
.563	.735	.079	RG460B015	3.750	4.241	.221	RG460B343
.625	.797	.079	RG460B016	3.875	4.366	.221	RG460B344
.688	.860	.079	RG460B017	4.000	4.491	.221	RG460B345
.750	.922	.079	RG460B018	4.125	4.616	.221	RG460B346
.813	.985	.079	RG460B019	4.250	4.741	.221	RG460B347
.875	1.047	.079	RG460B020	4.375	4.866	.221	RG460B348
.938	1.110	.079	RG460B021	4.500	5.093	.297	RG460B425
1.000	1.236	.112	RG460B120	4.625	5.218	.297	RG460B426
1.063	1.299	.112	RG460B121	4.750	5.343	.297	RG460B427
1.125	1.361	.112	RG460B122	4.875	5.468	.297	RG460B428
1.188	1.424	.112	RG460B123	5.000	5.593	.297	RG460B429
1.250	1.486	.112	RG460B124	5.125	5.718	.297	RG460B430
1.313	1.549	.112	RG460B125	5.250	5.843	.297	RG460B431
1.375	1.611	.112	RG460B126	5.375	5.968	.297	RG460B432
1.438	1.674	.112	RG460B127	5.500	6.093	.297	RG460B433
1.500	1.736	.112	RG460B128	5.625	6.218	.297	RG460B434
1.563	1.799	.112	RG460B129	5.750	6.343	.297	RG460B435
1.625	1.861	.112	RG460B130	5.875	6.468	.297	RG460B436
1.688	1.924	.112	RG460B131	6.000	6.718	.297	RG460B437
1.750	1.986	.112	RG460B132	6.250	6.968	.297	RG460B438
1.813	2.049	.112	RG460B133	6.500	7.218	.297	RG460B439
1.875	2.111	.112	RG460B134	6.750	7.468	.297	RG460B440
1.938	2.174	.112	RG460B135	7.000	7.718	.297	RG460B441
2.000	2.236	.112	RG460B136	7.250	7.968	.297	RG460B442
2.063	2.299	.112	RG460B137	7.500	8.218	.297	RG460B443
2.125	2.361	.112	RG460B138	7.750	8.468	.297	RG460B444
2.188	2.424	.112	RG460B139	8.000	8.968	.297	RG460B445
2.250	2.486	.112	RG460B140	8.500	9.468	.297	RG460B446
2.313	2.549	.112	RG460B141	9.000	9.968	.297	RG460B447
2.375	2.611	.112	RG460B142	9.500	10.468	.297	RG460B448
2.438	2.674	.112	RG460B143	10.000	10.968	.297	RG460B449
2.500	2.736	.112	RG460B144	10.500	11.468	.297	RG460B450
2.625	2.988	.149	RG460B231	11.000	11.968	.297	RG460B451
2.750	3.113	.149	RG460B232	11.500	12.468	.297	RG460B452
2.875	3.238	.149	RG460B233	12.000	12.968	.297	RG460B453
3.000	3.363	.149	RG460B234				

# Turcon® Double Delta®



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

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For O-Ring Grooves

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**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Double Delta®

### ■ Description

Turcon® Double Delta® is an O-Ring-energized plastic-faced seal. The seal is designed to expand and improve the service parameters of O-Rings and is installed in existing O-Ring grooves.

Double Delta® combines the flexibility and response of O-Rings with the wear and friction characteristics of the Turcon® materials in dynamic applications.

The figures below show the cross section of the Double Delta®.

The double-acting performance of the seal comes from the symmetrical cross section which allows the seal to respond to pressure in both directions.

Initial contact pressure is provided by radial compression of the O-Ring. When the system pressure is increased the O-Ring transforms this into additional contact pressure. The contact pressure of the seal is thereby automatically adjusted so sealing is ensured under all service conditions.

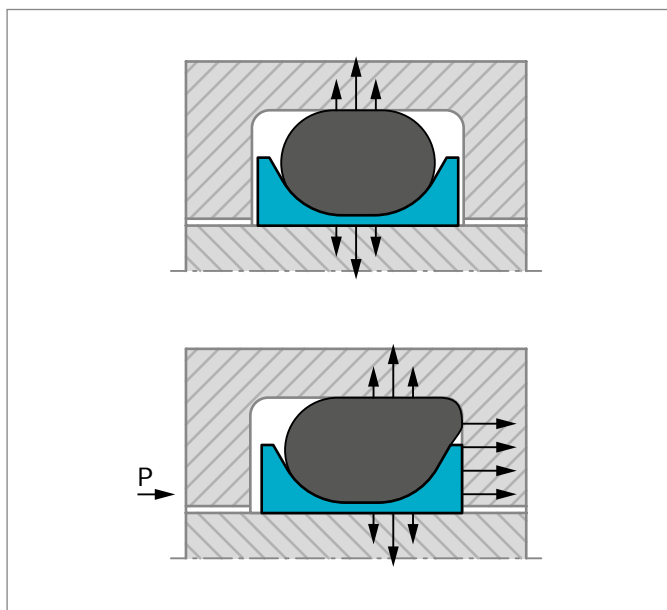


Figure 56: Turcon® Double Delta® with and without pressure

### ADVANTAGES

- Compact groove dimensions and simple installation
- Low friction without stick-slip
- Resistance against wear and extrusion
- Rod seals available for all diameters from .080 to 40.000 inches (2 to 999.9mm)
- Standard cross sections cover AS 568B and important metric O-Rings, other cross sections available on request
- Also fits groove dimensions per MIL-G-5514F

### APPLICATION EXAMPLES

The Turcon® Double Delta® is preferably used as a double acting seal for hydraulic and pneumatic equipment in sectors such as:

- Valve stems
- Mini hydraulics
- Hydraulic tools

It is particularly recommended for light duty and small diameter applications.

### TECHNICAL DATA

Operating conditions

<b>Pressure:</b>	Up to 5,000 psi (35 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (according to O-Ring material)
<b>Media:</b>	Mineral oil, non-flammable fluids, environmentally safe fluids and others according to O-Ring material

### 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 dependent on medium.



## MATERIALS

### Standard Application:

For hydraulic components with reciprocating movement in mineral oils containing zinc or medium with good lubricating performance and hard mating surface:

Seal Ring: Turcon® T46

Energizer: NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on the temperature

Set code: T46N or T46V

### Special Application:

Short stroke movements, poor lubricating fluids and soft mating surfaces.

Seal Ring: Turcon® T24

Energizer: NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on the temperature

Set code: T24N or T24V

For low friction requirement in dynamic hydraulic components with good lubricating medium:

Seal Ring: Turcon® T05

Energizer: NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on the temperature

Set code: T05N or T05V

For specific applications other material combinations as listed may also be used. Please contact your local Customer Solution Center.

**Table 40: Turcon® Materials for Double Delta®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T24</b> For all lubricating and non-lubricating hydraulic fluids, soft mating surfaces Carbon filled Color: Black	T24	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze	
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good sliding properties, low friction Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		

\* The O-Ring Operation Temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany"

  Highlighted materials are standard.



## ■ Installation Recommendation (Inch Rod Series)

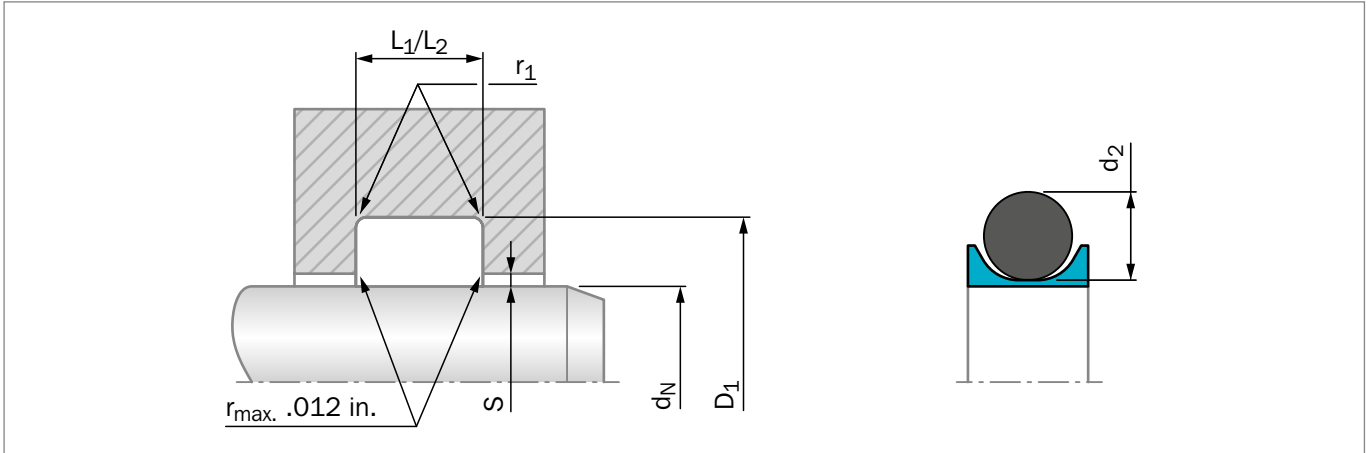


Figure 57: Installation drawing

**Table 41: Installation recommendation**

Dash Sizes	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_1$ H9	Groove Width		Radius $r_1$ max	Radial Clearance $S_{max}$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application		$L_1$ +.008*	$L_2$ +.008**		10 MPa 1500 psi	20 MPa 3000 psi	35 MPa 5000 psi	
006 - 028	.125 - .437	.500 - 1.375	-	$d_N + .110$	.093	.138	.005	.004	.003	.002	.070
104 - 151	.500 - .812	.875 - 3.000	.125 - .437	$d_N + .176$	.140	.171	.005	.006	.004	.003	.103
201 - 250	.875 - 1.500	1.625 - 5.000	.187 - .812	$d_N + .242$	.187	.208	.010	.008	.006	.003	.139
309 - 353	1.625 - 4.375	.437 - 5.000	.437 - 1.500	$d_N + .370$	.281	.311	.020	.010	.008	.004	.210
425 - 461	4.500 - 16.000	-	-	$d_N + .474$	.375	.408	.020	.012	.010	.006	.275

\*  $L_1$  is for "0" Back-up width groove - RD00\_B series.

\*\* $L_2$  is for "1" Back-up width groove - RD01\_B series.

### ORDERING EXAMPLE

Turcon® Double Delta®, complete with O-Ring, standard range, series RD00 (from Table 41).

<b>Dash No.:</b>	445
<b>TSS Part No.:</b>	RD000B445 (from Table 42)

Select the material from Table 40. The corresponding code numbers are appended to the TSS Part No. (from Table 42). Together they form the TSS Article No.

For all intermediate sizes not shown in Table 42, the TSS Article No. can be determined from the example opposite.

**TSS Article No.** **RD00 0 B 445 - T05 N**

TSS Series No. \_\_\_\_\_

RD00 - 0 Back-up width groove  $L_1$

RD01 - 1 Back-up width groove  $L_2$

0=std, N=with notches \_\_\_\_\_

Groove Standard \_\_\_\_\_

Dash Size \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code (Seal Ring) \_\_\_\_\_

Material Code (O-Ring) \_\_\_\_\_



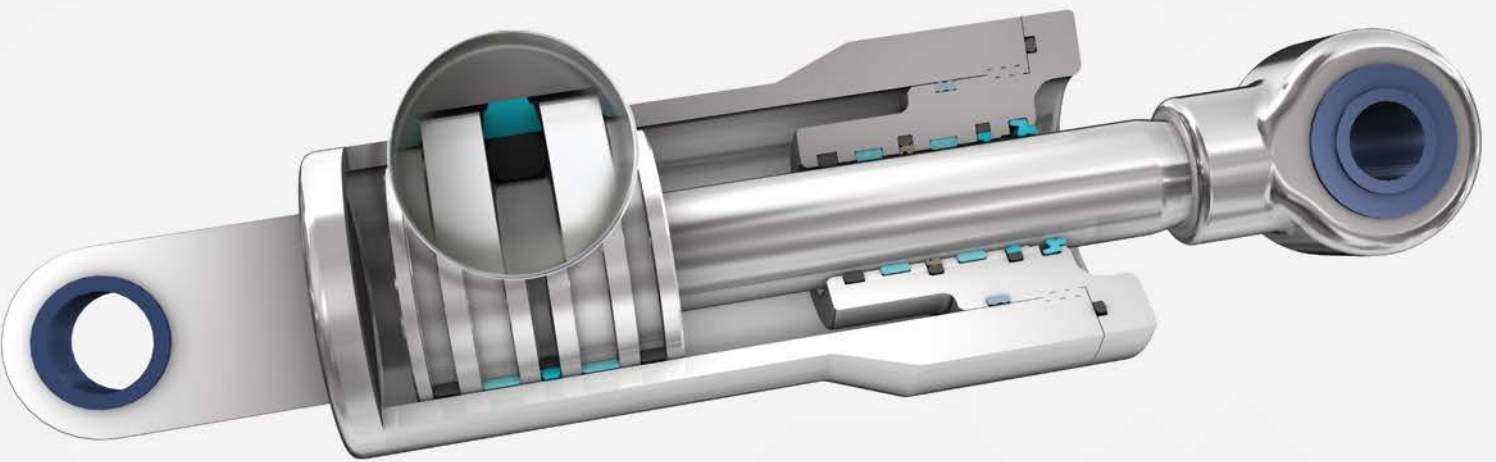
Table 42: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008		$L_2$ +.008	
.187	.297	.093	RD000B008	.138	RD010B008
.219	.329	.093	RD000B009	.138	RD010B009
.250	.360	.093	RD000B010	.138	RD010B010
.312	.422	.093	RD000B011	.138	RD010B011
.375	.485	.093	RD000B012	.138	RD010B012
.437	.547	.093	RD000B013	.138	RD010B013
.500	.610	.093	RD000B014	.138	RD010B014
.563	.672	.093	RD000B015	.138	RD010B015
.625	.735	.093	RD000B016	.138	RD010B016
.688	.797	.093	RD000B017	.138	RD010B017
.750	.860	.093	RD000B018	.138	RD010B018
.813	.922	.093	RD000B019	.138	RD010B019
.875	.985	.093	RD000B020	.138	RD010B020
.938	1.047	.093	RD000B021	.138	RD010B021
1.000	1.176	.140	RD000B120	.171	RD010B120
1.063	1.238	.140	RD000B121	.171	RD010B121
1.125	1.301	.140	RD000B122	.171	RD010B122
1.188	1.363	.140	RD000B123	.171	RD010B123
1.250	1.426	.140	RD000B124	.171	RD010B124
1.313	1.488	.140	RD000B125	.171	RD010B125
1.375	1.551	.140	RD000B126	.171	RD010B126
1.438	1.613	.140	RD000B127	.171	RD010B127
1.500	1.676	.140	RD000B128	.171	RD010B128
1.563	1.738	.140	RD000B129	.171	RD010B129
1.625	1.801	.140	RD000B130	.171	RD010B130
1.688	1.863	.140	RD000B131	.171	RD010B131
1.750	1.926	.140	RD000B132	.171	RD010B132
1.813	1.988	.140	RD000B133	.171	RD010B133
1.875	2.051	.140	RD000B134	.171	RD010B134
1.938	2.113	.140	RD000B135	.171	RD010B135
2.000	2.176	.140	RD000B136	.171	RD010B136
2.063	2.238	.140	RD000B137	.171	RD010B137
2.125	2.301	.140	RD000B138	.171	RD010B138
2.188	2.363	.140	RD000B139	.171	RD010B139
2.250	2.426	.140	RD000B140	.171	RD010B140
2.313	2.488	.140	RD000B141	.171	RD010B141
2.375	2.551	.140	RD000B142	.171	RD010B142
2.438	2.613	.140	RD000B143	.171	RD010B143
2.500	2.676	.140	RD000B144	.171	RD010B144
2.625	2.867	.187	RD000B231	.208	RD010B231



Rod Diameter	Groove Diameter	Groove Width	TSS Part No.	Groove Width	TSS Part No.
$d_N$ f8/h9	$D_1$ H9	$L_1$ +.008		$L_2$ +.008	
2.750	2.992	.187	RD000B232	.208	RD010B232
2.875	3.117	.187	RD000B233	.208	RD010B233
3.000	3.242	.187	RD000B234	.208	RD010B234
3.125	3.367	.187	RD000B235	.208	RD010B235
3.250	3.492	.187	RD000B236	.208	RD010B236
3.375	3.617	.187	RD000B237	.208	RD010B237
3.500	3.742	.187	RD000B238	.208	RD010B238
3.625	3.867	.187	RD000B239	.208	RD010B239
3.750	3.992	.187	RD000B240	.208	RD010B240
3.875	4.117	.187	RD000B241	.208	RD010B241
4.000	4.242	.187	RD000B242	.208	RD010B242
4.125	4.367	.187	RD000B243	.208	RD010B243
4.250	4.492	.187	RD000B244	.208	RD010B244
4.375	4.617	.187	RD000B245	.208	RD010B245
4.500	4.742	.187	RD000B246	.208	RD010B246
4.625	4.867	.187	RD000B247	.208	RD010B247
4.750	4.992	.187	RD000B248	.208	RD010B248
4.875	5.117	.187	RD000B249	.208	RD010B249
5.000	5.474	.375	RD000B429	.408	RD010B429
5.125	5.599	.375	RD000B430	.408	RD010B430
5.250	5.724	.375	RD000B431	.408	RD010B431
5.375	5.849	.375	RD000B432	.408	RD010B432
5.500	5.974	.375	RD000B433	.408	RD010B433
5.625	6.099	.375	RD000B434	.408	RD010B434
5.750	6.224	.375	RD000B435	.408	RD010B435
5.875	6.349	.375	RD000B436	.408	RD010B436
6.000	6.474	.375	RD000B437	.408	RD010B437
6.250	6.724	.375	RD000B438	.408	RD010B438
6.500	6.974	.375	RD000B439	.408	RD010B439
6.750	7.224	.375	RD000B440	.408	RD010B440
7.000	7.474	.375	RD000B441	.408	RD010B441
7.250	7.724	.375	RD000B442	.408	RD010B442
7.500	7.974	.375	RD000B443	.408	RD010B443
7.750	8.224	.375	RD000B444	.408	RD010B444
8.000	8.474	.375	RD000B445	.408	RD010B445
8.500	8.974	.375	RD000B446	.408	RD010B446
9.000	9.474	.375	RD000B447	.408	RD010B447
9.500	9.974	.375	RD000B448	.408	RD010B448
10.000	10.474	.375	RD000B449	.408	RD010B449

# Piston Seals



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<b>191</b>	<b>Turcon® AQ-Seal®</b>		
<b>197</b>	<b>Turcon® AQ-Seal® 5</b>		
<b>203</b>	<b>Turcon® Double Delta®</b>		
<b>211</b>	<b>Turcon® CST Seal</b>		

## ■ Choice of the Sealing Element

Sealing elements have a decisive influence on the design, function and service life of hydraulic and pneumatic cylinders and systems.

This also applies to piston seals. Leak tightness, wear and gap extrusion resistance, resistance to process media and temperatures, low friction, compact form and simple installation are required to meet the demands of the industry.

The significance of these parameters and their limits depends on the requirements of the specific application. Trelleborg Sealing Solutions has developed a complete range of seals which, due to their optimized geometries and designs and the use of high-quality materials such as Turcon® and Zurcon®, satisfies the technical and economic demands of the industry.

In order to be in a position to select the most appropriate seal type and material, it is necessary to first define all the desired functional parameters. Table 43 can then be used to make an initial selection of seals according to the specific requirements of the application.

The second column of the table contains the page number on which general information and specific design and installation instructions on the particular seal type and materials (or material combinations with multi-element seals, e.g. Turcon® Glyd Ring® T) can be found.

Furthermore, attention is drawn to the quality of the mating surface. We recommend that the limits specified there be observed, as they have a decisive influence on the functionality and service life of the system.

The final choice of seal type and material must also take into account the detailed information on the seal elements.

Please do not hesitate to contact your local Customer Solution Center for further information on specific applications and special technical questions.

### NOTE ON ORDERING






All multi-element standard piston seals, e.g. Glyd Ring® T, are supplied as complete seal sets. The supply includes the seal and matching elastomer energizing elements.

For all new applications, we recommend the use of the seal types and preferred sizes listed in this catalog.

Other combinations of Turcon® materials and special designs can be developed and supplied for special applications in all intermediate sizes up to 106 inches (2,700mm) diameter.







The sizes contained in this catalog are generally available from stock or can be supplied on short notice. We reserve the right to modify our supply program.

Table 43: Selection Criteria for Piston Seals

Seal		Application				Size Range	Action		Technical Data*			Recommended Seal Material
Type	Page	Field of Application			Inch	Single	Double	Temp. Range**	Velocity	Pressure		
			Light	Media				Heavy	°F	ft/s	PSI Max.	
Zurcon® Wynseal 	149	Standard cylinders	•	•	.500 - 10.000		•	-31/ +230	1.65	3,625	Zurcon® Z20	
		Mobile hydraulics	•	•								
Turcon® Glyd Ring® T 	155	Mobile hydraulics	•	•	.312 - 106		•	-49/ +392	50	5,800	Turcon® M12	
		Standard cylinders	•	•						7,250	Zurcon® T46	
		Machine tools	•	•								
		Injection molding machines	•	•						8,700	Zurcon® Z53	
		Presses	•	•								
Automotive industry	•	•	.312 - 90									
Zurcon® Glyd Ring® P (ISO) 	163	Mobile hydraulics		•	1.250 - 10.000		•	-40/ +230	3.3	7,250	Zurcon® Z66	
		Construction machinery		•								
		Agriculture machinery		•								
Turcon® Glyd Ring® 	169	Mobile hydraulics	•	•	.312 - 102		•	-49/ +392	50	7,250	Turcon® M12	
		Machine tools	•	•						2,900	Turcon® T46	
		Injection molding machines	•	•								
		Presses	•	•						.312 - 86		
Zurcon® Glyd Ring® D 	177	Earthmoving Equipment		•	.500 - 10.000		•	-22/ +230	1.6	5,800	Zurcon® Z13	
		Mobile hydraulics		•								
		Construction Machinery		•								




\* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

\*\* Temperature range depends on choice of elastomer material and media. In the case of Turcon® seals in unpressurized applications in temperatures below 32 °F please contact your local Customer Solution Center.

Seal		Application				Size Range	Action		Technical Data*			Recommended Seal Material
Type	Page	Field of Application				Inch	Single	Double	Temp. Range**	Velocity	Pressure	
			Light	Media	Heavy				°F	ft/s	PSI Max.	
Turcon® Glyd Ring® C 	183	Special cylinders	•	•	•	.250 - 106	•	-49/ +392	50	7,250	Turcon® M12	
		Pumps and valves	•	•	•					7,250	Turcon® T46	
		Machine tools	•	•	•					2,900	Turcon® T05	
		Robotics/ manipulators	•	•	•							
Turcon® AQ-Seal® 	191	Standard cylinders	•	•	.625 - 100	•	-49/ +392	6.5	5,800	Turcon® M12		
		Piston accumulators	•	•					5,800	Turcon® T46		
		Fluid/gas separation	•	•								
		Holding cylinders	•	•								
Turcon® AQ-Seal® 5 	197	Mobile hydraulics		•	.750 - 100	•	-49/ +392	10	7,250	Turcon® M12		
		Holding cylinders		•					7,250	Turcon® T46		
		Piston accumulators		•								
Turcon® Double Delta® 	203	Machine tools	•	•	.250 - 106	•	-49/ +392	50	2,900	Turcon® T05		
		Handling devices/ manipulators	•	•					5,000	Turcon® M12		
		Valves	•	•								
		Chemical industry	•	•					5,000	Turcon® T46		
Turcon® CST Seal 	211	Hydraulics		•	1 - 106	•	-60/ +250	5	7,250	Turcon® T46		
		Mobile hydraulics		•					Turcon® M12			
Turcon® Stepseal® 2K 	217	Mobile hydraulics	•	•	.313 - 106	•	-49/ +392	50	7,250	Turcon® M12		
		Standard cylinders	•	•					7,250	Turcon® T46		
		Machine tools	•	•								
		Injection molding machines	•	•								
Presses	•	•	.312 - 90	-49/ +212	6.5	8,700	Zurcon® Z53					

\* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

\*\* Temperature range depends on choice of elastomer material and media. In the case of Turcon® seals in unpressurized applications in temperatures below 32 °F please contact your local Customer Solution Center.

Seal		Application				Size Range	Action		Technical Data*			Recommended Seal Material
Type	Page	Field of Application			Inch	Single	Double	Temp. Range**	Velocity	Pressure		
			Light	Media				Heavy	°F	ft/s	PSI Max.	
Turcon® Stepseal® V 	225	Mobile hydraulics	•	•	•	.625 - 106	•	-49/ +392	50	7,250	Turcon® M12	
		Machine tools	•	•	•							
		Injection molding machines	•	•	•							
		Presses	•	•	•							
		Accumulators	•	•	•							
Zurcon® Loaded U-Cup 	233	Hydraulic cylinders	•	•	.375 - 8.5	•	-22/ +194	1.5	5,000	Zurcon® Z06		
		Industrial hydraulics	•	•								
		Mobile hydraulics	•	•								
Turcon® Variseal® M2 	239	High and low temperatures	•	•	.236 - 98.425	•	-94/ +572	50	5,800	Turcon® T40		
		Aggressive media	•	•	.236 - 102							
		Foodstuffs	•	•								

\* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

\*\* Temperature range depends on choice of elastomer material and media. In the case of Turcon® seals in unpressurized applications in temperatures below 32 °F please contact your local Customer Solution Center.

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## ■ Design Instructions

### LEAD-IN CHAMFERS

Piston seals are always fitted with an interference fit. In order to avoid damage during installation, lead-in chamfers and rounded edges must be provided on the cylinder barrel (Figure 58). If this is not possible for design reasons, a separate installation tool must be used.

The minimum lead-in chamfer  $Z_{min}$  depends on the profile size of the seal and can be seen in the following tables.

Generally  $Z_{min}$ , from Table 44, Table 45 and Table 46 is recommended, but at 15°  $Z$  must also exceed 2.5% of the bore diameter  $D_N$ . at 20°,  $Z$  is calculated correspondingly.

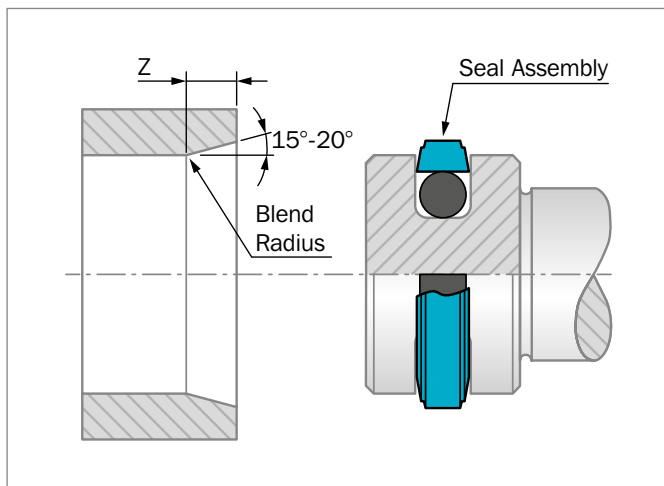


Figure 58: Lead-in chamfer

### Table 44: Elastomer Energized Seals

Minimum chamfer for a calibrated seal.

Groove Width $L_1^*$	Lead-in Chamfer Length $Z_{min}$	
	15°	20°
.087	.098	.079
.126	.118	.098
.165	.138	.118
.248	.197	.157
.319	.256	.197
.374	.295	.217
.543	.413	.315

\* The groove width can be found in table "Installation dimensions" for Turcon® Glyd Ring®, Glyd Ring® T, AQ-Seal®, Stepseal® 2K, Zurcon® Wynseal and Wynseal M.

### Table 45: Compact Seal and Variseal®

Minimum for a calibrated seal (Variseal®)

Variseal® M2 Series	Lead-in Chamfer Length $Z_{min}$	
	15°	20°
PVAA	.177	.118
PVAB/PVAC	.197	.157
PVAD	.295	.256
PVAE	.472	.354
PVAG	.669	.512

### Table 46: Double Delta®

Minimum chamfer for a calibrated seal.

O-Ring Cross Section** $d_2$	Lead-in Chamfer* Length $Z_{min}$	
	15°	20°
.070	-	.098
.094	.103	.118
.118	.139	.138
.210	.225	.197
.275	-	.256
.331	-	.295

\* Though not less than 2.5% of the bore diameter.

\*\* The O-Ring cross section,  $d_2$ , can be found in the appropriate table, "Installation Dimensions", from the Double Delta® chapter.

For Turcon® seals which have been expanded over a piston; the seal must be calibrated with a separate calibration sleeve, or the cylinder tube, where the inlet chamfer is minimum 2 x the value from Table 44: Elastomer Energized Seals.

**SURFACE ROUGHNESS DIN EN ISO 4287**

The functional reliability and service life of a seal depends to a very great extent on the quality and surface finish of the mating surface to be sealed.

Scores, scratches, pores and concentric or spiral machining marks are not permitted. Higher demands must be made on the surface finishes of dynamic surfaces than those of static mating surfaces.

The characteristics most frequently used to describe the surface microfinish  $R_a$ ,  $R_z$  and  $R_{max}$  are defined in DIN EN ISO 4287. These characteristics alone, however, are not sufficient for assessing the suitability of seal technology. The material contact area of the surface roughness profile  $M_r$  in accordance with DIN EN ISO 4287 should be demanded. The significance of this surface specification is illustrated in Figure 59. It shows clearly that specification of  $R_a$  and  $R_z$  alone does not describe the surface roughness profile accurately enough for the seal technology and is not sufficient for assessing the suitability. The material contact area  $M_r$  is essential for assessing surfaces, as this parameter is determined by the specific surface roughness profile. This depends on the machining process employed.

Trelleborg Sealing Solutions recommends that the following surface finishes be observed:

**Table 47: Surface Roughness**

Parameter	Surface Roughness $\mu\text{inch}$		
	Mating Surface		Groove Surface
	Turcon® Materials	Zurcon® and Rubber	
$R_{max}$	25 - 100	40 - 160	<625
$R_z$ DIN	16 - 63	25 - 100	<400
$R_a$	2 - 8	4 - 16	<63

The material contact area  $M_r$  should be approx. 50 to 70%, determined at a cut depth  $c = 0.25 \times R_z$ , relative to a reference line of  $C_{ref}$ . 5%.



Surface profile $\mu\text{inch}$	$R_a$	$R_z$	$M_r$
closed profile form 	4	40	70%
open profile form 	8	40	15%

Figure 59: Profile forms of surfaces

Figure 59 shows two surface profiles, both of which exhibit nearly the same value for  $R_z$  in the test procedure. The difference becomes obvious only when the material contact area of the surface roughness profiles are compared. This shows that the upper roughness profile with  $M_r = 70\%$  has the better seal/mating surface ratio.



## ■ Installation of Piston Seals

### GENERAL INSTALLATION INSTRUCTIONS

The following points should be observed before installation of the seals:

- Ensure the cylinder tube has a lead-in chamfer; if not, use an installation sleeve
- Deburr and chamfer or round sharp edges, cover the tips of screw threads
- Remove machining residues such as chips, dirt and other foreign particles and carefully clean all parts
- The seals can be installed more easily if they are greased or oiled. Attention must be paid to the compatibility of the seal materials with these lubricants. Use only grease without solid additives (e.g. molybdenum disulphide or zinc sulphide).
- Use no sharp-edged installation tools

### INSTALLATION IN SPLIT GROOVES

Installation in split grooves is simple. The sequence of installation corresponds to the configuration of the seal. Individual seal elements must not be allowed to twist. During final installation (installation of the piston in the cylinder), elastomer or spring-preloaded seals must be sized. The corresponding cylinder barrel can be used for this purpose, provided it has a long lead-in chamfer. Alternatively, a sizing sleeve should be used.

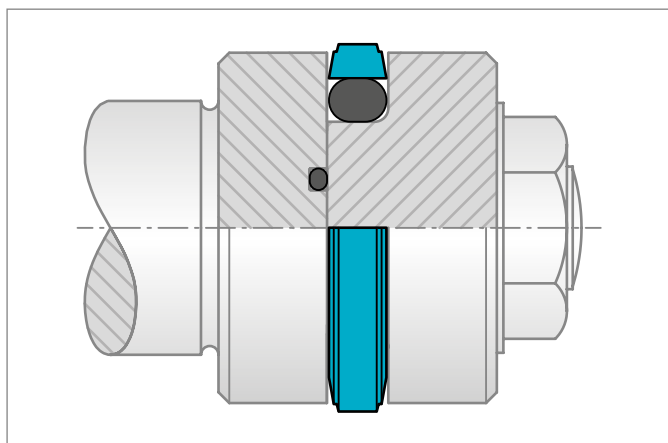


Figure 60: Installation in a split groove

### INSTALLATION IN CLOSED GROOVES

- Without installation aids

If observing the instructions in the chapter “General installation instructions,” installation of Compact Seal and Wynseal seal elements in closed grooves is relatively simple.

For Turcon® and Zurcon® seals, the use of installation aids is recommended. If installation has to be performed without installation aids, however, the following points should be observed:

Turcon® seals can be installed more easily by heating in oil or water or using a hot air fan to approx. 176 °F to 212 °F (80 °C to 100 °C) (expanding and then shrinking back to the original form).

Use no sharp edged tools to expand the seal rings.

Sizing of the seal ring is achieved with a separate sizing sleeve, or with the cylinder tube provided this has lead-in chamfers equivalent to 2x the values from Table 44.

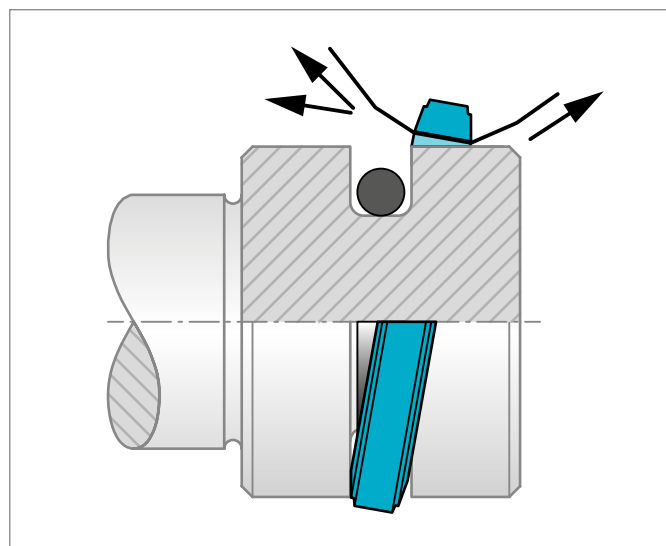


Figure 61: Fitting the seal ring onto the O-Ring in the groove

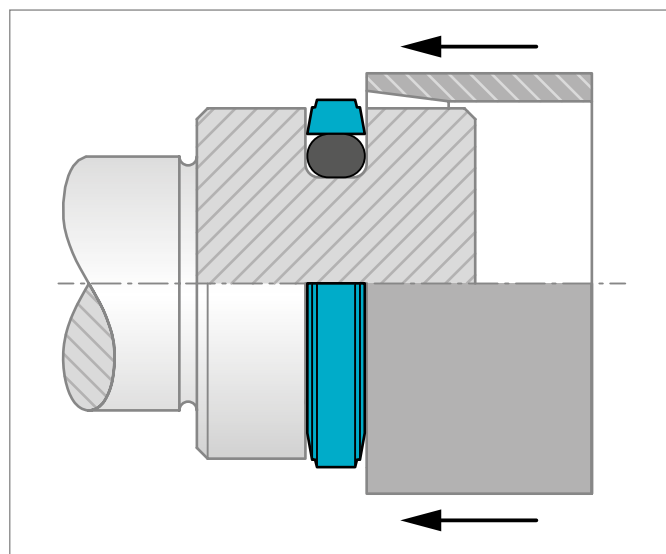


Figure 62: Sizing of the installed seal

**INSTALLATION IN CLOSED GROOVES**

- With installation aids  
Use of a three-piece installation tool is recommended for the series production installation of Turcon® and Zurcon® seal elements. The tool consists of:
  - Installation sleeve
  - Expanding sleeve
  - Sizing sleeve

All these parts should be made of a polymer material (e.g. PA6) with good sliding characteristics and low abrasiveness to avoid damage to the seals.

In view of the wide range of sizes and the application-specific installation conditions, these installation tools cannot be supplied as standard by Trelleborg Sealing Solutions.

On request, however, we will gladly provide specimen drawings to allow you to manufacture these tools.

The sequence of installation is illustrated in Figure 63 to Figure 65.

Note, however, that the installation of Turcon® seal elements should be performed quickly in order to ensure optimum recovery of the seal ring.

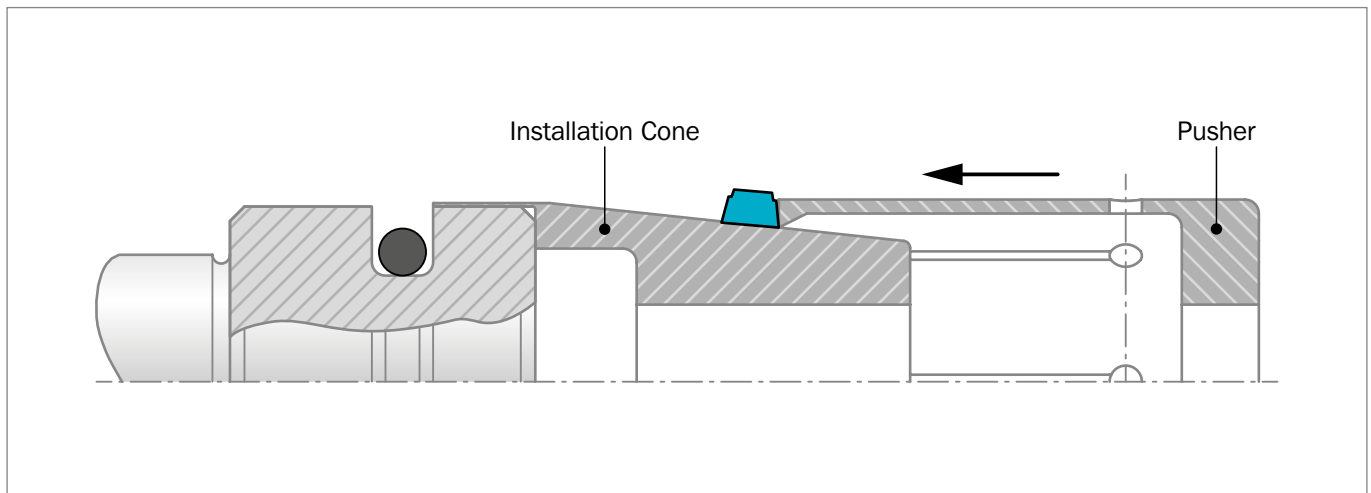


Figure 63: Expanding the Turcon® or Zurcon® sealing element using an expanding sleeve over the installation sleeve

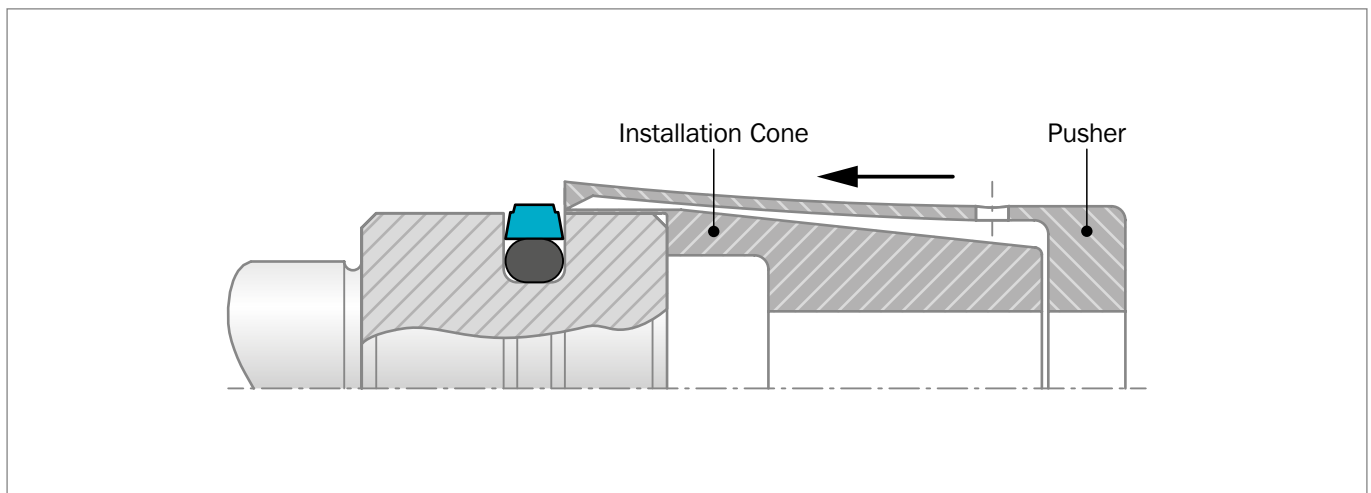


Figure 64: Sealing element after snapping into the groove

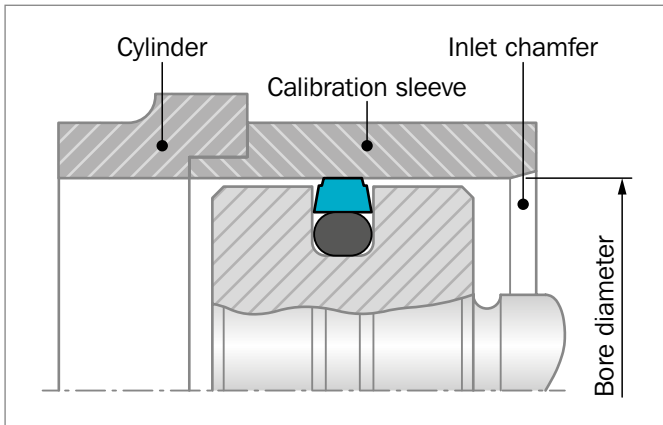


Figure 65: Sizing the sealing element with sizing sleeve

**Table 48: Closed groove installation for Turcon® piston seals**

Glyd Ring® and seals for similar groove sizes can be installed in closed grooves above the following piston diameters:

O-Ring Series	Material M12, T05, T29, T40, T46	Material M04, T08, T10, Z52	Material Z51, Z80
	D <sub>N</sub> (in)	D <sub>N</sub> (in)	D <sub>N</sub> (in)
000	.312	.591	.787
100	.591	.787	1.378
200	.984	1.378	2.362
300	1.575	1.969	2.953
400	2.362	3.150	4.331
400 H	5.236	5.236	5.906
.331*	9.843	9.843	9.843
.472**	15.748	15.748	15.748

\* O-Ring cross section according to SMS 1586.

\*\* The energizer can have a special shape.

**INSTALLATION OF TURCON® DOUBLE DELTA®**

Installation in closed grooves is possible from .315 inches (8mm) bore diameter. For diameters smaller than 1.968 inches (50mm) a loading mandrel (Figure 66) is recommended. After installation the seal must be calibrated and this may be done with the lead-in chamfer of the cylinder tube or by means of a separate calibration sleeve.

Turcon® piston seals can be installed more easily by heating to approx. 176 °F to 212 °F (80 °C to 100 °C) (expanding and then shrinking back to the original form).

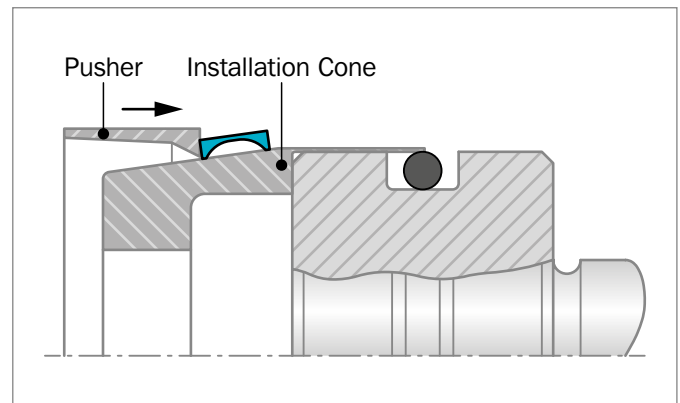


Figure 66: Installation in a closed groove

**INSTALLATION OF SPRING-ENERGIZED SEALS**

Turcon® Variseal® seals should preferably be installed in split grooves. Installation in half-open grooves is possible with a snap fitting. Figure 67 shows the design of the groove.

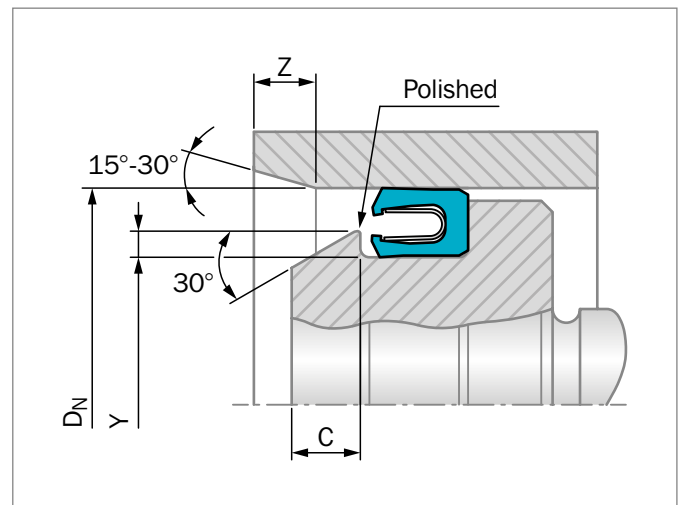


Figure 67: Installation in a half-open groove

**Table 49: Installation in Half-Open Grooves**

Series No.	D <sub>N</sub> min.	Y min.	Z min.	C min.
PVAA	.236	.016	.158	.098
PVAB	.393	.023	.197	.138
PVAC	.629	.027	.197	.138
PVAD	1.102	.031	.295	.178
PVAE	1.772	.035	.472	.295
PVAG	2.559	.059	.472	.295

In exceptional cases or with existing designs, an installation in closed grooves is also possible. The details in Table 50 should be regarded as guide values for installation.

**Table 50: Installation in closed grooves**

Series No.	D <sub>N</sub> min.
PVAA	1.378
PVAB	1.968
PVAC	2.756
PVAD	4.134
PVAE	5.511
PVAG	8.661

## INSTALLATION OF THE COMPACT SEAL

The Compact Seal can be installed in one-piece or split pistons. On one-piece pistons, the inner rubber-elastic sealing element is first installed in the middle of the groove diameter by expanding over the piston. Then the cut back-up ring is fitted on both sides of the sealing element and the two cut guide rings are installed.

On split pistons the individual parts are installed in the following order: guide ring, back-up ring, sealing element, back-up ring, guide ring.

Before installation all seal parts, including piston and cylinder, should be oiled or greased.

# Zurcon® Wynseal



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Double-Acting

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O-Ring-Energized Zurcon® Slipper Seal

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High static and dynamic sealing effect

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**Material:**

Zurcon® and Elastomer

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## ■ Zurcon® Wynseal

### ■ Description

The Zurcon® Wynseal is a double-acting seal consisting of a special polyurethane seal ring and an O-Ring as energizing element (Figure 68).

The unique characteristic of the seal is the special design of the seal edge profile. Two external seal edges act as a primary seal for pressures from both sides and prevent any build-up of hydrodynamic pressure over the seal profile and the risk of the blow-by effect. The central back-up and sealing bulge increases the sealing effect\*. Grooves are provided on both sides of the plane surfaces to provide activation of the energizing O-Ring. These ensure direct pressure loading of the seal under all operating conditions.

Since the installation groove is identical to that for the Turcon® Glyd Ring®, the seal is ideal for the standardization of cylinder construction if efficient and low cost seal elements are demanded in large quantities and the cylinder can be adapted to meet different operating conditions.

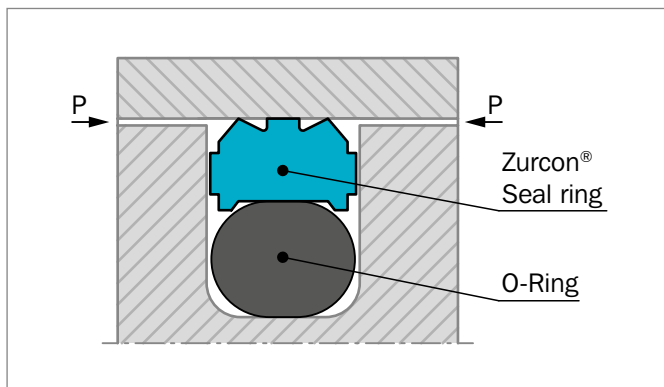


Figure 68: Zurcon® Wynseal

### ADVANTAGES

- High static and dynamic sealing effect
- High abrasion resistance
- Simple groove design, one-piece piston possible
- Suitable for grooves to ISO 7425, Part 1

\* Because of cross-sectional area constraints, PW10 and PW11 cross sections do not have the center support buldge.

### APPLICATION EXAMPLES

The Zurcon® Wynseal is the recommended element for double-acting pistons of hydraulic components in various sectors such as:

- Standard cylinders
- Mobile hydraulics

### TECHNICAL DATA

<b>Pressure:</b>	Up to 3,625 psi (25 MPa) (Z20N)
<b>Velocity:</b>	Up to 1.65 ft/s (0.5 m/s)
<b>Temperature:</b>	-31 °F to +230 °F (-35 °C to + 110 °C)
<b>Media:</b>	Mineral oil-based hydraulic fluids

### 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 dependent on medium.

### MATERIALS

#### Standard Materials:

Seal ring: Zurcon® Z20, 93 Shore A

O-Ring: NBR, 70 Shore A N or N7

Set reference: Z20N or Z20N7



## ■ Installation Recommendation (Inch Piston Series)

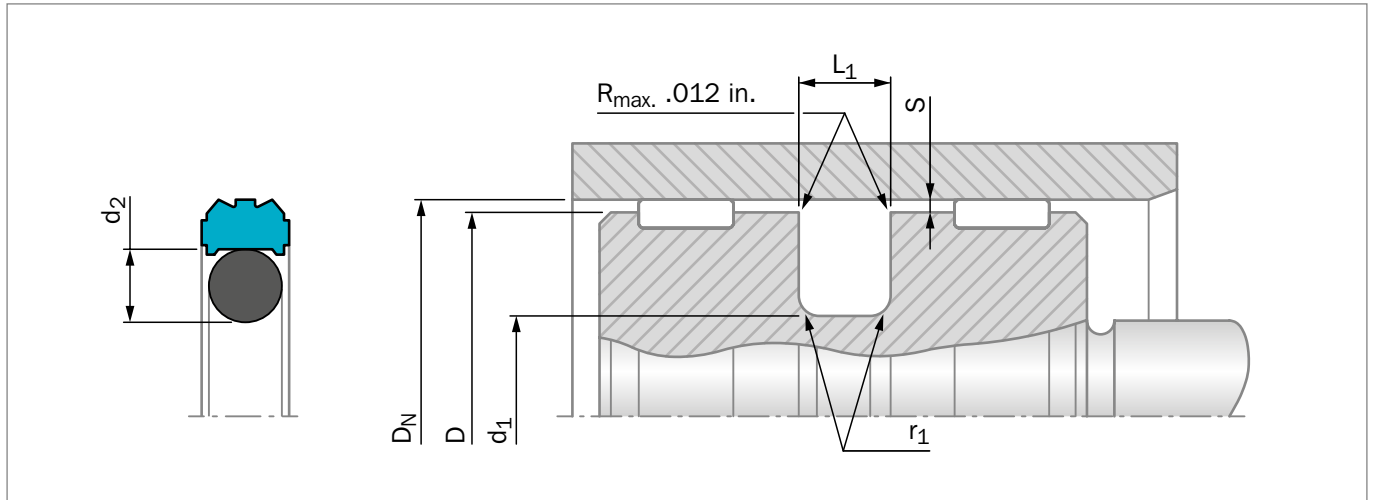


Figure 69: Installation drawing

- 1) Tolerances used are per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 2) The groove diameter h9 tolerance is recommended per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 3) The clearance stated as S in the below table are for when the seal is specified with Slydring® bearings. When not incorporating Slydring® bearings, the radial clearance should be reduced.
- 4) To determine minimum piston diameter D, subtract the diametral clearance ( 2 x S ) from maximum bore diameter  $D_N$ .
- 5) Consult your Customer Solution Center for diameters that exceed those listed in the below table.

**Table 51: Installation recommendation**

TSS Series No.	Bore Diameter $D_N$ H9	Groove Diameter $d_1$ h9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}$	O-Ring Cross Section $d_2$
PW11	.500 - 1.563	$D_N$ -.295	.126	.025	.010	.103
PW12	1.563 - 3.125	$D_N$ -.433	.165	.025	.010	.139
PW13	3.125 - 5.250	$D_N$ -.610	.248	.035	.012	.210
PW14	5.250 - 10.000	$D_N$ -.827	.319	.035	.012	.275

### ORDERING EXAMPLE

Zurcon® Wynseal for ISO groove

<b>Bore Diameter:</b>	$D_N$ = 3.000 inches
<b>Series No.:</b>	PW12
<b>TSS Part No.:</b>	PW1203000 (from Table 52)
<b>Seal ring Material Code:</b>	Z20
<b>O-Ring Material Code:</b>	N
<b>Set Code:</b>	Z20N

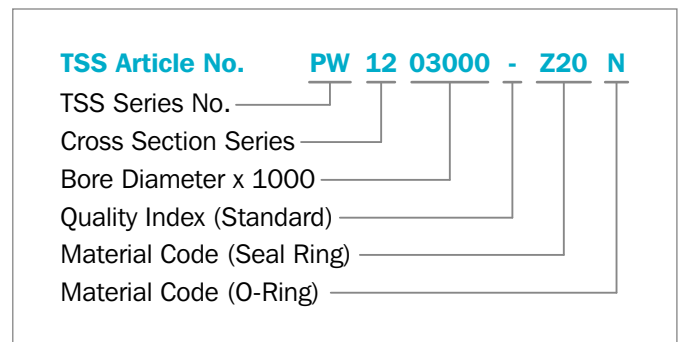






Table 52: Installation dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008	
<b>1.000</b>	<b>.705</b>	<b>.126</b>	<b>PW1101000</b>
1.125	.830	.126	PW1101125
<b>1.250</b>	<b>.955</b>	<b>.126</b>	<b>PW1101250</b>
<b>1.375</b>	<b>1.080</b>	<b>.126</b>	<b>PW1101375</b>
<b>1.500</b>	<b>1.205</b>	<b>.126</b>	<b>PW1101500</b>
1.625	1.192	.165	PW1201625
<b>1.750</b>	<b>1.317</b>	<b>.165</b>	<b>PW1201750</b>
1.875	1.442	.165	PW1201875
<b>2.000</b>	<b>1.567</b>	<b>.165</b>	<b>PW1202000</b>
2.125	1.692	.165	PW1202125
<b>2.250</b>	<b>1.817</b>	<b>.165</b>	<b>PW1202250</b>
<b>2.375</b>	<b>1.942</b>	<b>.165</b>	<b>PW1202375</b>
<b>2.500</b>	<b>2.067</b>	<b>.165</b>	<b>PW1202500</b>
<b>2.750</b>	<b>2.317</b>	<b>.165</b>	<b>PW1202750</b>
<b>3.000</b>	<b>2.567</b>	<b>.165</b>	<b>PW1203000</b>
<b>3.250</b>	<b>2.640</b>	<b>.248</b>	<b>PW1303250</b>
<b>3.500</b>	<b>2.890</b>	<b>.248</b>	<b>PW1303500</b>
<b>3.750</b>	<b>3.140</b>	<b>.248</b>	<b>PW1303750</b>
<b>4.000</b>	<b>3.390</b>	<b>.248</b>	<b>PW1304000</b>
<b>4.250</b>	<b>3.640</b>	<b>.248</b>	<b>PW1304250</b>
<b>4.500</b>	<b>3.890</b>	<b>.248</b>	<b>PW1304500</b>
<b>4.750</b>	<b>4.140</b>	<b>.248</b>	<b>PW1304750</b>
<b>5.000</b>	<b>4.390</b>	<b>.248</b>	<b>PW1305000</b>
5.250	4.640	.248	PW1305250
<b>5.500</b>	<b>4.673</b>	<b>.319</b>	<b>PW1405500</b>
5.750	4.923	.319	PW1405750
<b>6.000</b>	<b>5.173</b>	<b>.319</b>	<b>PW1406000</b>
<b>6.500</b>	<b>5.673</b>	<b>.319</b>	<b>PW1406500</b>
<b>7.000</b>	<b>6.173</b>	<b>.319</b>	<b>PW1407000</b>
<b>7.500</b>	<b>6.673</b>	<b>.319</b>	<b>PW1407500</b>
<b>8.000</b>	<b>7.173</b>	<b>.319</b>	<b>PW1408000</b>
8.500	7.673	.319	PW1408500
9.000	8.173	.319	PW1409000
9.500	8.673	.319	PW1409500
<b>10.000</b>	<b>9.173</b>	<b>.319</b>	<b>PW1410000</b>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Turcon® Glyd Ring® T



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Glyd Ring® T

### ■ Description

The Turcon® Glyd Ring® T is a further technical development of the Turcon® Glyd Ring® seal, which has been successfully used for decades. It is fully interchangeable with the earlier Glyd Ring® seals in all new applications. The Glyd Ring® T meets all the market demands for a function-specific sealing solution, observing economic and ecological aspects.

The benefits of the patented seal concept are provided by the innovative functional principle of the trapezoidal profile cross-section.

Both lateral profile flanks are inclined so that the seal profile tapers towards the seal surface. The profile can thus retain the robust and compact form typical of piston seals without losing any of the flexibility required to achieve a pressure-related maximum compression (Figure 70).

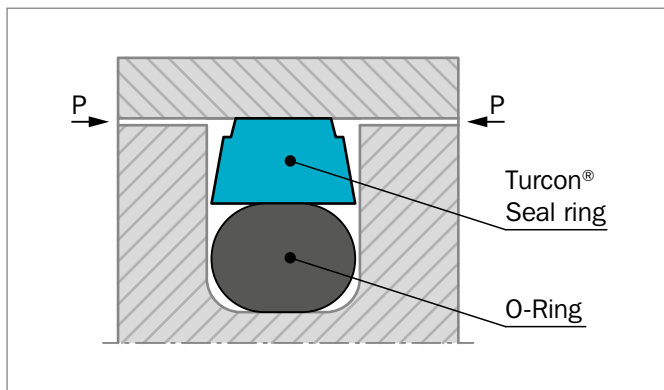


Figure 70: Turcon® Glyd Ring® T

The edge angle created by the special Glyd Ring® T cross-sectional form permits an additional degree of freedom and enables a slight tilting movement of the seal. The maximum compression is always shifted towards the area of the seal edge directly exposed to the pressure. On the low-pressure edge of the seal the Glyd Ring® T exhibits only zones with neutral strains without compressive or shearing loads, effectively reducing the danger of gap extrusion. The resulting benefits for the user can be seen in the following list.

Since the installation groove is identical to that for the Turcon® Glyd Ring®, the seal is ideal for the standardization of cylinder construction if efficient and low cost seal elements are demanded in large quantities and the cylinder can be adapted to meet different operating conditions.

### ADVANTAGES

The benefits offered by the Glyd Ring® remain and are now complemented by these further advantages:

- Very good static leak-tightness
- Increased clearance possible (approx. +50%), depending on the operating conditions
- Due to the larger extrusion gap, safe use even with soiled media
- Low friction, no stick-slip effect
- Simple groove design, one-piece pistons possible
- Adaptable to the operating conditions due to a wide range of possible materials (Turcon®, Zurcon®)
- Suitable for new environmentally safe hydraulic fluids
- Available for all cylinder diameters up to 106 inches (2,700mm)

### APPLICATION EXAMPLES

The Turcon® Glyd Ring® T is the recommended sealing element for double-acting pistons of hydraulic components such as:

- Mobile hydraulics
- Standard cylinders
- Machine tools
- Injection molding machines
- Presses
- Automotive industry

It is particularly recommended for heavy duty and large diameter applications.

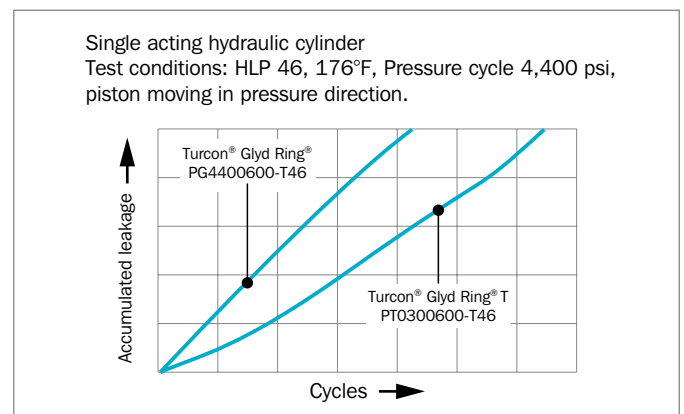


Figure 71: Dynamic leakage Turcon® Glyd Ring® T/ Turcon® Glyd Ring® as single acting piston seal



## TECHNICAL DATA

### Operating conditions

<b>Pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C)* (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water, air and others, depending on the O-Ring material (see Table 53)
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 54, as a function of the operating pressure and functional diameter.

## 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 dependent on medium.

\* In the case of unpressurized applications in temperatures below 32 °F (0 °C ) please contact our application engineers for assistance!

## MATERIALS

### Standard Application:

For hydraulic components with reciprocating movement in mineral oils containing zinc or medium with good lubricating performance

Seal ring:	Turcon® T46
Energizer:	NBR, 70 Shore A N or N7 FKM, 70 Shore A V depending on temperature
Set reference:	T46N/T46N7/T46V

### Special Application:

Non-lubricating fluids or pneumatic applications require self-lubricating sealing materials. Therefore we recommend:

Seal ring:	Turcon® T40
Energizer:	NBR, 70 Shore A N or N7 FKM, 70 Shore A V depending on temperature
Set reference:	T40N/T40N7/T40V

If rougher surface finish must be sealed, we recommend:

Seal ring:	Zurcon® Z53
Energizer:	NBR, 70 Shore A N or N7
Set reference:	Z53N or Z53N7

**Table 53: Turcon® and Zurcon® Materials for Glyd Ring® T**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases Carbon fiber-filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm)

BAM: Tested by "Bundesanstalt Materialprüfung, Germany"

□ Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

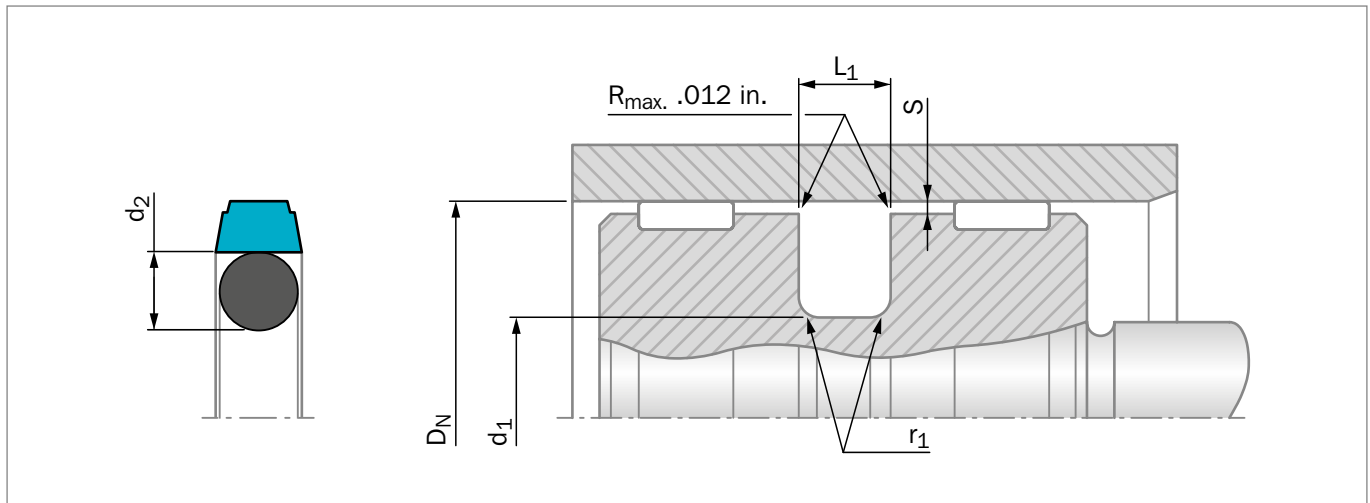


Figure 72: Installation drawing

**Table 54: Installation recommendation**

TSS Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ $+.008$	Radius $r_1$ max	Radial Clearance $S_{max.}^*$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
PT10	.312 - .562	.625 - 1.500	-	$D_N$ -.193	.087	.015	.020	.012	.008	.070
PT11	.562 - 1.563	1.563 - 3.125	-	$D_N$ -.295	.126	.025	.024	.016	.008	.103
PT12	1.563 - 3.125	3.125 - 5.250	.560 - 1.563	$D_N$ -.433	.165	.025	.024	.016	.008	.139
PT13	3.125 - 5.250	5.250 - 12.500	1.563 - 3.125	$D_N$ -.610	.248	.035	.031	.020	.012	.210
PT14	5.250 - 12.500	12.500 - 26.000	3.125 - 5.250	$D_N$ -.827	.319	.035	.031	.020	.012	.275
PT15	12.500 - 26.000	-	5.250 - 12.500	$D_N$ -.965	.319	.035	.035	.020	.016	.275

\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal. The radial clearance is valid for material Turcon® T46 at +140 °F (+60 °C).

### ORDERING EXAMPLE

Turcon® Glyd Ring® T, complete with O-Ring, standard application, series PT12 (from Table 54)

**Bore diameter:**  $D_N$  = 3.000 inches

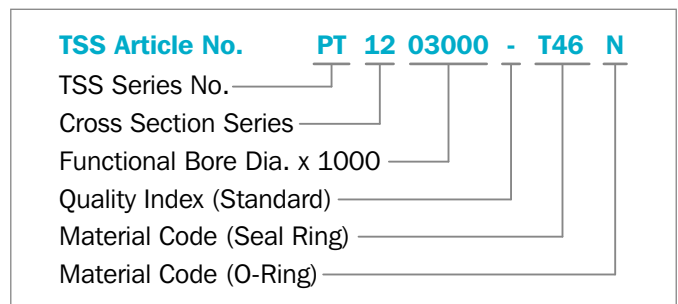
**TSS Part No.:** PT1203000 (from Table 55)

Select the material from Table 53. The corresponding code numbers are appended to the TSS Part No. (from Table 55). Together they form the TSS Article No.

For all intermediate sizes not shown in Table 55, the TSS Article No. can be determined from the example opposite.

### NOTE

Turned - other diameters also available, no tool costs.



\*\*\* For diameters  $\geq 100.000$  inches please consult your Customer Solution Center for special part no.





Table 55: Installation dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008		$D_N$ H9	$d_1$ h9	$L_1$ +.008	
.500	.307	.087	PT1000500	<b>4.000</b>	<b>3.390</b>	<b>.248</b>	<b>PT1304000</b>
.563	.370	.087	PT1000563	4.125	3.515	.248	PT1304125
.625	.330	.126	PT1100625	<b>4.250</b>	<b>3.640</b>	<b>.248</b>	<b>PT1304250</b>
.688	.393	.126	PT1100688	4.375	3.765	.248	PT1304375
.750	.455	.126	PT1100750	<b>4.500</b>	<b>3.890</b>	<b>.248</b>	<b>PT1304500</b>
.813	.518	.126	PT1100813	4.625	4.015	.248	PT1304625
.875	.580	.126	PT1100875	<b>4.750</b>	<b>4.140</b>	<b>.248</b>	<b>PT1304750</b>
.938	.643	.126	PT1100938	4.875	4.265	.248	PT1304875
<b>1.000</b>	<b>.705</b>	<b>.126</b>	<b>PT1101000</b>	<b>5.000</b>	<b>4.390</b>	<b>.248</b>	<b>PT1305000</b>
1.063	.768	.126	PT1101063	5.125	4.515	.248	PT1305125
1.125	.830	.126	PT1101125	5.250	4.640	.248	PT1305250
1.188	.893	.126	PT1101188	5.375	4.548	.319	PT1405375
<b>1.250</b>	<b>.955</b>	<b>.126</b>	<b>PT1101250</b>	5.500	4.673	.319	PT1405500
1.313	1.018	.126	PT1101313	5.625	4.798	.319	PT1405625
1.375	1.080	.126	PT1101375	5.750	4.923	.319	PT1405750
1.438	1.143	.126	PT1101438	6.000	5.173	.319	PT1406000
<b>1.500</b>	<b>1.205</b>	<b>.126</b>	<b>PT1101500</b>	6.250	5.423	.319	PT1406250
1.563	1.268	.126	PT1101563	6.500	5.673	.319	PT1406500
1.625	1.192	.165	PT1201625	6.750	5.923	.319	PT1406750
1.688	1.255	.165	PT1201688	7.000	6.173	.319	PT1407000
<b>1.750</b>	<b>1.317</b>	<b>.165</b>	<b>PT1201750</b>	7.250	6.423	.319	PT1407250
1.813	1.380	.165	PT1201813	7.500	6.673	.319	PT1407500
1.875	1.442	.165	PT1201875	7.750	6.923	.319	PT1407750
1.938	1.505	.165	PT1201938	8.000	7.173	.319	PT1408000
<b>2.000</b>	<b>1.567</b>	<b>.165</b>	<b>PT1202000</b>	8.250	7.423	.319	PT1408250
2.125	1.692	.165	PT1202125	8.500	7.673	.319	PT1408500
<b>2.250</b>	<b>1.817</b>	<b>.165</b>	<b>PT1202250</b>	8.750	7.923	.319	PT1408750
2.375	1.942	.165	PT1202375	9.000	8.173	.319	PT1409000
<b>2.500</b>	<b>2.067</b>	<b>.165</b>	<b>PT1202500</b>	9.250	8.423	.319	PT1409250
2.625	2.193	.165	PT1202625	9.500	8.673	.319	PT1409500
<b>2.750</b>	<b>2.317</b>	<b>.165</b>	<b>PT1202750</b>	9.750	8.923	.319	PT1409750
2.875	2.442	.165	PT1202875	10.000	9.173	.319	PT1410000
<b>3.000</b>	<b>2.567</b>	<b>.165</b>	<b>PT1203000</b>	10.500	9.673	.319	PT1410500
3.125	2.692	.165	PT1203125	11.000	10.173	.319	PT1411000
<b>3.250</b>	<b>2.640</b>	<b>.248</b>	<b>PT1303250</b>	11.500	10.673	.319	PT1411500
3.375	2.765	.248	PT1303375	12.000	11.173	.319	PT1412000
<b>3.500</b>	<b>2.890</b>	<b>.248</b>	<b>PT1303500</b>	12.500	11.673	.319	PT1412500
3.625	3.015	.248	PT1303625	13.000	12.035	.319	PT1513000
<b>3.750</b>	<b>3.140</b>	<b>.248</b>	<b>PT1303750</b>	13.500	12.535	.319	PT1513500
3.875	3.265	.248	PT1303875	14.000	13.035	.319	PT1514000



<b>Bore Diameter</b>	<b>Groove Diameter</b>	<b>Groove Width</b>	<b>TSS Part No.</b>
<b>D<sub>N</sub> H9</b>	<b>d<sub>1</sub> h9</b>	<b>L<sub>1</sub> +.008</b>	
14.500	13.535	.319	<a href="#">PT1514500</a>
15.000	14.035	.319	<a href="#">PT1515000</a>
15.500	14.535	.319	<a href="#">PT1515500</a>
16.000	15.035	.319	<a href="#">PT1516000</a>
16.500	15.535	.319	<a href="#">PT1516500</a>
17.000	16.035	.319	<a href="#">PT1517000</a>
17.500	16.535	.319	<a href="#">PT1517500</a>
18.000	17.035	.319	<a href="#">PT1518000</a>
18.500	17.535	.319	<a href="#">PT1518500</a>
19.000	18.035	.319	<a href="#">PT1519000</a>
19.500	18.535	.319	<a href="#">PT1519500</a>
20.000	19.035	.319	<a href="#">PT1520000</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment). Other dimensions and all intermediate sizes up to 106 inches (2700mm) diameter can be supplied.

# Zurcon® Glyd Ring® P (ISO)



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Double-Acting

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Elastomer-Energized Zurcon® Slipper Seal

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Step Cut Sealing Element

**Material:**

Zurcon® and Elastomer

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## ■ Zurcon® Glyd Ring® P (ISO)

### ■ Description

The double-acting Zurcon® Glyd Ring® P is a combination of a Zurcon®-based slipper seal with a step cut and an energizing rectangular elastomeric ring. It is produced with an interference fit at closed step cut which together with the squeeze of the rectangular energizer ring ensures a good sealing effect even at low pressure.

At higher system pressures, the rectangular ring is energized by the fluid, pushing the Zurcon® Glyd Ring® P against the sealing face with increased force. At high peak pressures, the Zurcon® step cut seal ring can follow ballooning of the tube without losing the sealability.

Due to the Zurcon® high strength plastic material, two times bigger extrusion gaps are possible compared with Turcon® materials. The step cut in the ring is necessary for installation in closed grooves and for the flexibility of the seal ring due to the high stiffness of the material.

Since the installation groove is identical to that for the Turcon® Glyd Ring®, the seal is ideal for the standardization of cylinder construction if efficient and low cost seal elements are demanded in large quantities and the cylinder can be adapted to meet different operating conditions.

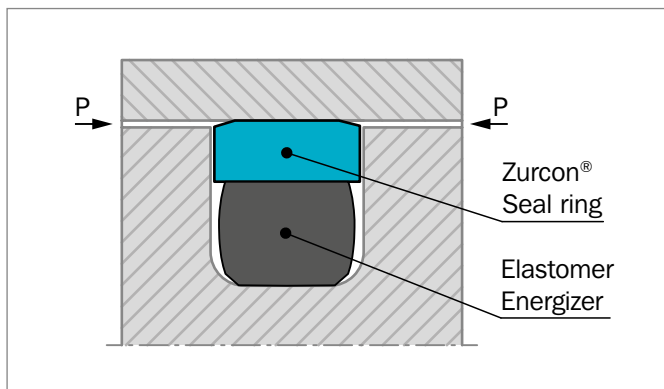


Figure 73: Zurcon® Glyd Ring® P

### STEP CUT

For easy installation on the piston and for the flexibility of the seal ring a precision step cut is produced by special tool technology.

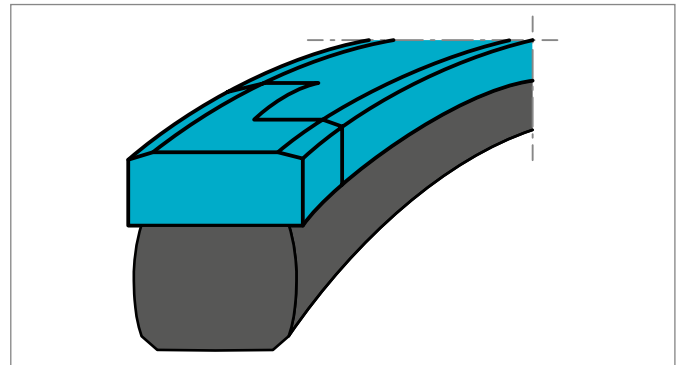


Figure 74: Step cut on Zurcon® Glyd Ring® P

### ADVANTAGES

- Easy installation on piston without special tools
- Due to large extrusion gap, safe use even with soiled media
- Installation grooves acc. to ISO 7425/1
- Simple groove design, one piece piston possible
- Increased clearance compared to Turcon® Glyd Ring® seals (approx. +50%), depending on operation conditions
- Resistent against shock loads
- High wear resistant material ensures long service life

### APPLICATION EXAMPLES

- Mobile hydraulics
- Construction machinery
- Agriculture machinery

It is particularly recommended for heavy duty applications



## TECHNICAL DATA

Operating conditions:

The Zurcon® Glyd Ring® P is recommended for reciprocating (with a length of stroke at least twice the groove width) movements where the dimensional gap between piston and tube is as big as possible or where high pressure peaks occur during operation.

<b>Pressure:</b>	7,250 psi (50 MPa) standard
<b>Velocity:</b>	Up to 3.3 ft/s (1 m/s)
<b>Temperature:</b>	-40 °F to +230 °F (-40 °C to +110 °C)
<b>Media:</b>	mineral oil-based hydraulic fluids

## 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 dependent on medium.

## MATERIALS

### Standard Application:

For hydraulic components in mineral oils or media with good lubricating performance

Seal ring: Zurcon® Z66

Energiser: NBR, 70 Shore A                      N or N7

Set reference: Z66N or Z66N7



## ■ Installation Recommendation (Inch Piston Series)

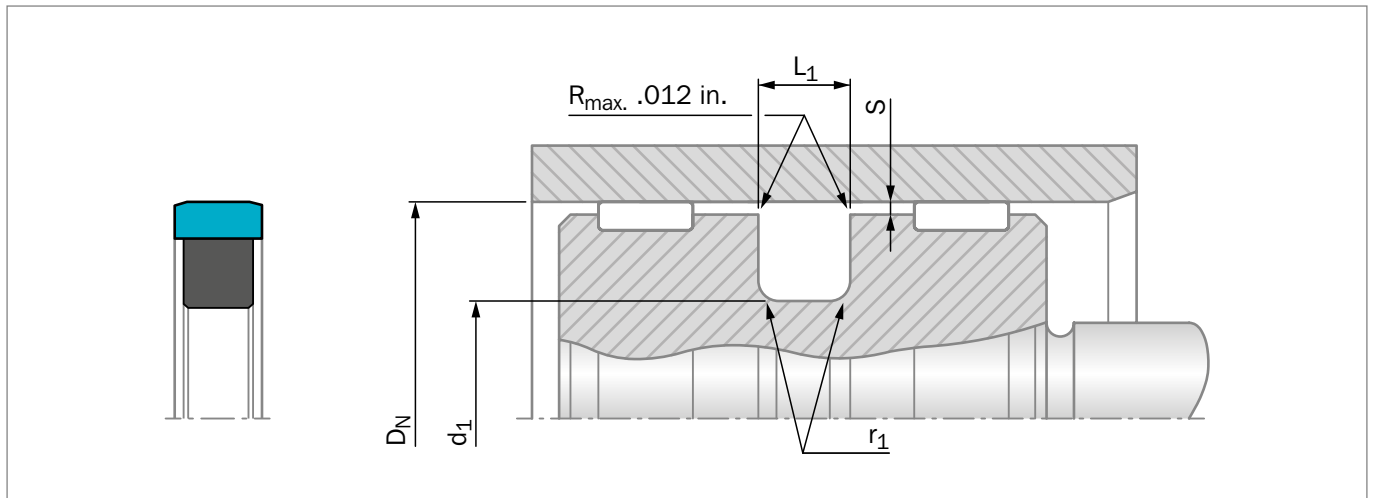


Figure 75: Installation drawing

**Table 56: Installation recommendation**

TSS Series No.	Bore Diameter	Groove Diameter	Groove Width	Radius	Radial Clearance
	$D_N$ H9	$d_1$ h9	$L_1 + .008$	$r_1$ max	$S_{max}$
PGP2	1.250 - 3.249	$D_N$ -.433	.165	.020	.014
PGP3	3.250 - 5.000	$D_N$ -.610	.248	.035	.020
PGP4	5.001 - 10.000	$D_N$ -.827	.319	.035	.030

### ORDERING EXAMPLE

Zurcon® Glyd Ring® P for ISO groove

<b>TSS Series No.:</b>	PGP2
<b>TSS Part No.:</b>	PGP200762
<b>TSS Seal Ring Material Code:</b>	Z66
<b>Energizer material code:</b>	N
<b>Set code:</b>	Z66N

<b>TSS Article No.</b>	<b>PGP 2 00762 - Z66 N</b>
TSS Series No.	PGP
Cross Section Series	2
Bore Diameter x 1000	00762
Quality Index (Standard)	-
Material Code (Seal Ring)	Z66
Material Code (O-Ring)	N

**Table 57: Installation dimensions / TSS Part No.**

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008	
<b>1.250</b>	<b>.820</b>	<b>.165</b>	<a href="#">PGP200318-Z66N</a>
<b>1.500</b>	<b>1.067</b>	<b>.165</b>	<a href="#">PGP200381-Z66N</a>
<b>1.750</b>	<b>1.317</b>	<b>.165</b>	<a href="#">PGP200445-Z66N</a>
<b>2.000</b>	<b>1.567</b>	<b>.165</b>	<a href="#">PGP200508-Z66N</a>
<b>2.250</b>	<b>1.817</b>	<b>.165</b>	<a href="#">PGP200572-Z66N</a>
<b>2.500</b>	<b>2.067</b>	<b>.165</b>	<a href="#">PGP200635-Z66N</a>
<b>2.750</b>	<b>2.317</b>	<b>.165</b>	<a href="#">PGP200700-Z66N</a>
<b>3.000</b>	<b>2.567</b>	<b>.165</b>	<a href="#">PGP200762-Z66N</a>
<b>3.250</b>	<b>2.640</b>	<b>.248</b>	<a href="#">PGP300826-Z66N</a>
<b>3.500</b>	<b>2.890</b>	<b>.248</b>	<a href="#">PGP300889-Z66N</a>
<b>3.750</b>	<b>3.140</b>	<b>.248</b>	<a href="#">PGP300953-Z66N</a>
<b>4.000</b>	<b>3.390</b>	<b>.248</b>	<a href="#">PGP301016-Z66N</a>
<b>4.250</b>	<b>3.640</b>	<b>.248</b>	<a href="#">PGP301080-Z66N</a>
<b>4.500</b>	<b>3.890</b>	<b>.248</b>	<a href="#">PGP301143-Z66N</a>
<b>4.750</b>	<b>4.140</b>	<b>.248</b>	<a href="#">PGP301207-Z66N</a>
<b>5.000</b>	<b>4.390</b>	<b>.248</b>	<a href="#">PGP301270-Z66N</a>
<b>6.000</b>	<b>5.173</b>	<b>.319</b>	<a href="#">PGP401524-Z66N</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment). Other dimensions and all intermediate sizes up to 10 inches (254mm) diameter can be supplied.



# Turcon® Glyd Ring®



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Double-Acting

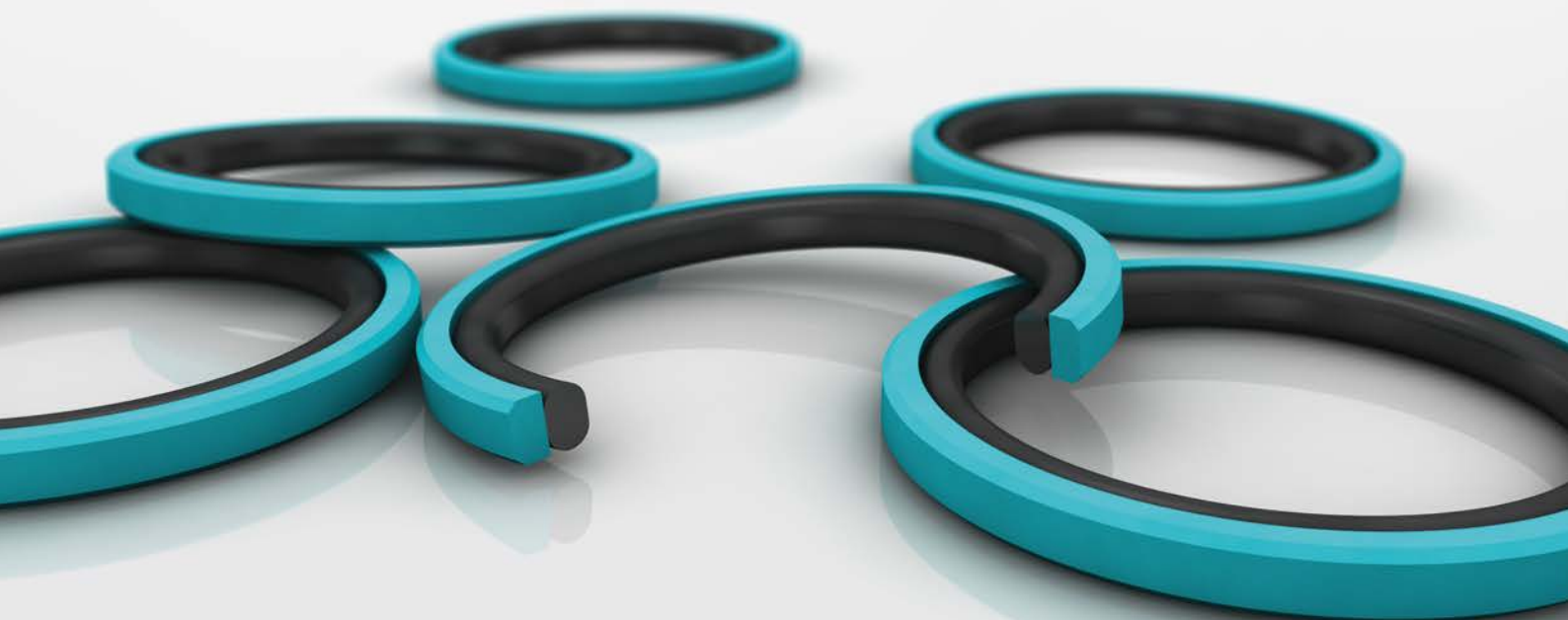
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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Glyd Ring®

### ■ Description

Successfully used for decades, the Turcon® Glyd Ring® is a very effective and reliable low frictional seal. It is particularly suitable as a piston seal in both high and low pressure systems.

The double-acting Turcon® Glyd Ring® is a combination of a Turcon®-based slipper seal and an energizing O-Ring. It is produced with an interference fit which together with the squeeze of the O-Ring ensures a good sealing effect even at low pressure. At higher system pressures, the O-Ring is energized by the fluid, pushing the Turcon® Glyd Ring® against the sealing face with increased force.

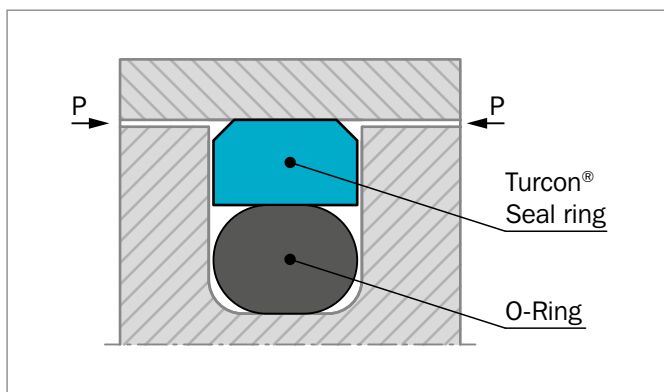


Figure 76: Turcon® Glyd Ring®

The geometry of the Turcon® Glyd Ring® ensures a good static sealing and allows the lubricating hydrodynamic oil film to be built under the seal in reciprocating applications.

Since the installation groove is identical to that of other seals, the Turcon® Glyd Ring® seal is ideal for the standardization of cylinder construction if efficient and low cost seal elements are demanded in large quantities and the cylinder can be adapted to meet different operating conditions.

### ADVANTAGES

- No stick-slip effect when starting for smooth operation
- Minimum static and dynamic friction coefficient for a minimum energy loss and lower operating temperature
- Suitable for non-lubricating fluids depending on seal material for optimum design flexibility
- High wear resistance ensures long service life
- No adhesive effect to the mating surface during long period of inactivity or storage
- Suitable for most hydraulic fluids in relation to most modern hardware materials and surface finishes depending on material selected
- Suitable for new environmentally safe hydraulic fluids
- Available for all cylinder diameters up to 106 inches (2,700mm)

### APPLICATION EXAMPLES

Over several decades the Turcon® Glyd Ring® has been successfully implemented as a double-acting piston seal for hydraulic components. Examples include:

- Mobile hydraulics
- Machine tools
- Injection molding machines
- Presses
- Valves for hydraulic & pneumatic circuits



## TECHNICAL DATA

Operating conditions:

The Turcon® Glyd Ring® is recommended for reciprocating (with a length of stroke at least twice the groove width) and helical movements.

<b>Pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Frequency:</b>	Up to 5 Hz.
<b>Temperature:</b>	-49° F to +392 °F (-45 °C to +200 °C)* (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (biological degradable oils), water, air and others. This depends on the O-Ring material compatibility.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in the Table 59 as a function of the operating pressure and functional diameter.

## 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 dependent on medium.

\* In the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact our application engineers for assistance!

## MATERIALS

### Standard Applications:

For hydraulic components in mineral oils containing zinc or medium with good lubricating performance:

Seal ring: Turcon® T46

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature

Set reference: T46N/T46N7/T46V

### Special Applications:

Short stroke movements, non-lubricating fluids or pneumatic applications require self-lubricating sealing materials.

Therefore we recommend:

Seal ring: Turcon® T29

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature

Set reference: T29N/T29N7/T29V

If low friction coefficient is required, we recommend:

Seal ring: Turcon® T05

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature  
For special requirements, other elastomers are available on request.

Set reference: T05N/T05N7/T05V

If rougher surface finish must be sealed, we recommend:

Seal ring: Zurcon® Z53

Energizer: NBR, 70 Shore A    N or N7

Set reference: Z53N or Z53N7

**Table 58: Turcon® and Zurcon® Materials for Glyd Ring®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T08</b> Very high compressive strength, very good extrusion resistance High bronze filled Color: Light to dark brown	T08	NBR-70	N/N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel Steel chrome plated	3,625
		NBR-70 Low temp.	T	-49 to +176	Cast iron	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +293	Aluminum Bronze Alloys	
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron Stainless steel	
		EPDM-70	E**	-49 to +293	Aluminium Bronze	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good slide properties, low friction. Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Turcon® T42</b> For all lubricating and non-lubricating hydraulic fluids, good chemical resistance, good dielectric properties Glass fiber filled + MoS <sub>2</sub> Color: Gray to blue	T42	NBR-70	N/N7	-22 to +212	Steel hardened	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T19</b> For all lubricating fluids and hydraulic oils without zinc, high sealing efficiency, good sliding and wear properties, mild to counter surface Mineral fiber filled Color: Dark green-gray	T19	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron Stainless steel	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temp. resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N/N7	-22 to +176	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 102 inches (2,600mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

  Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

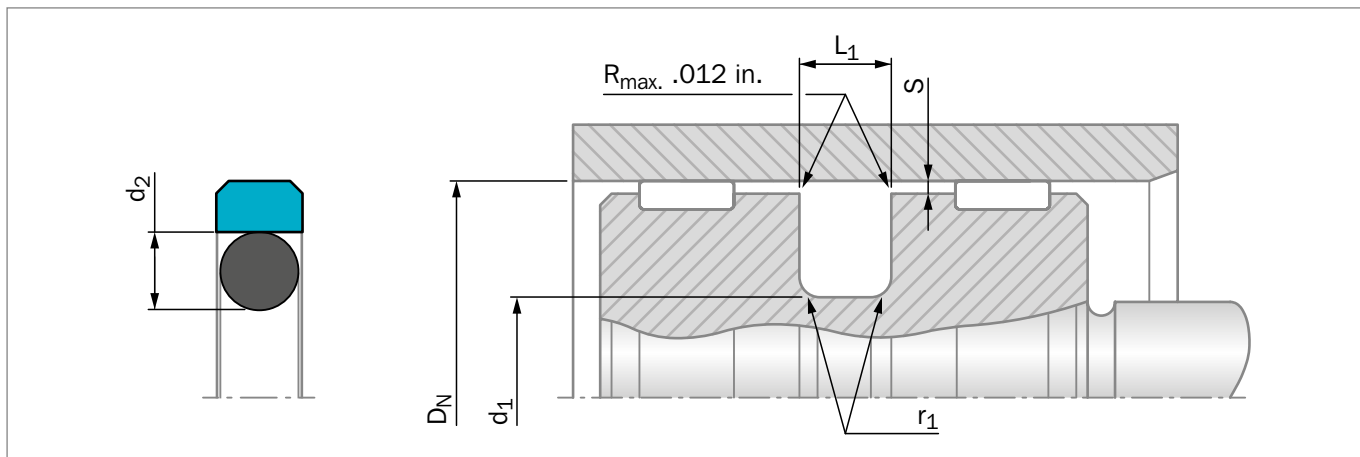


Figure 77: Installation drawing

**Table 59: Installation recommendation**

TSS Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ +.008	Radius $r_1$ max	Radial Clearance $S_{max}^*$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
PG00	.312 - .562	.625 - 1.500	-	$D_N$ -.193	.087	.015	.020	.012	.008	.070
PG01	.562 - 1.563	1.563 - 3.125	-	$D_N$ -.295	.126	.025	.024	.016	.008	.103
PG02	1.563 - 3.125	3.125 - 5.250	.562 - 1.563	$D_N$ -.433	.165	.025	.024	.016	.008	.139
PG03	3.125 - 5.250	5.250 - 12.500	1.563 - 3.125	$D_N$ -.610	.248	.035	.031	.020	.012	.210
PG04	5.250 - 12.500	12.500 - 26.000	3.125 - 5.250	$D_N$ -.827	.319	.035	.031	.020	.012	.275
PG05	12.500 - 26.000	-	5.250 - 12.500	$D_N$ -.965	.319	.035	.035	.020	.012	.275

\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal.

### ORDERING EXAMPLE

Turcon® Glyd Ring®, complete with O-Ring, standard application, Series PG02 (from Table 59)

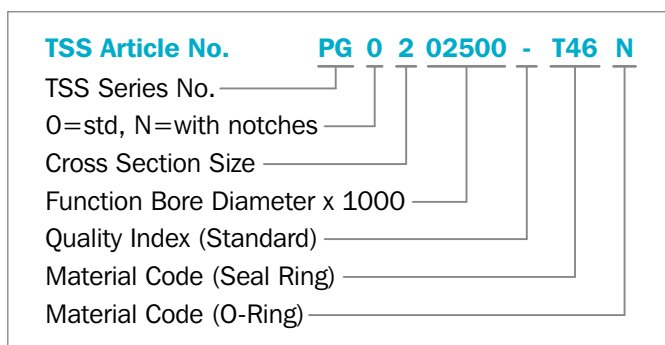
**Bore Diameter:**  $D_N = 2.500$  inches

**TSS Part No.:** PG0202500

Select the material from Table 58. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.

### NOTE

Turned - other diameters also available, no tool costs.



For diameters  $D_N \geq 100.000$  inches please consult your Customer Solution Center for custom article no.

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# Zurcon® Glyd Ring® D



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Double-acting

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Rubber-energized plastic-faced seal

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High Extrusion Resistance

**Material:**

Zurcon® and Elastomer

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## Zurcon Glyd Ring® D



### Description

Glyd Ring® D is a double-acting seal consisting of a premium polyurethane Zurcon® Z13 seal ring and an O-Ring as energizing element (Figure 78).

The innovative D-shape design optimizes contact pressure and the two special grooves incorporated keep an oil reservoir for an adequate lubrication that minimizes heat generated by friction forces. The above features give the perfect combination of sealing performance and service life.

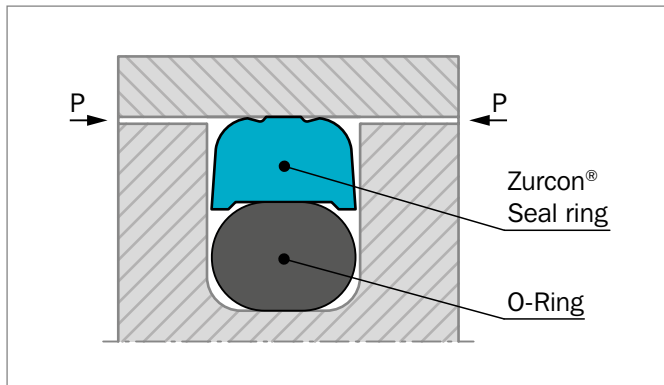


Figure 78: Zurcon® Glyd Ring® D

Zurcon® Z13 polyurethane material is the perfect partner for this innovative design. It is the latest advanced polyurethane development matching the requirements of modern hydraulic medias and cylinder bore surfaces.

Zurcon® Z13 is a 60 ShD polyurethane able to combine excellent mechanical and elastic material properties that makes it suitable to work in high pressure and temperature environment without losing performance.

It has been developed in order to have an excellent hydrolysis resistance making it compatible with a wide range of hydraulic fluids not only mineral base, but also the new environmentally friendly fluids (HEES, HEPG and HEPR) and also with fire resistant fluids both water based and water free (HFA, HFC and HFD) .

### ADVANTAGES

- Extended service life in heavy duty applications
- High static and dynamic sealing effect
- Excellent abrasion and extrusion resistance
- Simple groove design, one piece piston possible, easy installation
- Grooves according to ISO 7425-1

### APPLICATION EXAMPLES

Glyd Ring® D is the recommended element for double acting pistons of hydraulic components such as:

- Construction machinery
- Mobile hydraulic
- Truck cranes
- Fork lifts
- Accumulators

It is particularly recommended for medium and heavy duty applications.

### RECOMMENDED MATERIALS

Glyd Ring® D: Zurcon® Z13

O-Ring: NBR, 70 Shore A N or N7  
HNBR, 70 Shore A H

Set code: Z13N/Z13N7/Z13H

### OPERATING CONDITIONS

<b>Pressure:</b>	5,800 psi (40 MPa)
<b>Velocity:</b>	Up to 1.6 ft/s (0.5 m/s) 2.6 ft/s (0.8 m/s) for limited time
<b>Frequency:</b>	Up to 5 Hz
<b>Temperature:</b>	-22 °F to +230 °F (-30 °C to +110 °C)
<b>Media:</b>	Hydraulic fluids based on mineral oil, environmentally friendly and fire resistance fluids (always check O-Ring material compatibility)
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 60 as a function of the operating pressure and diameter

### IMPORTANT NOTE

The above started limits for pressure and speed are maximum values individually. Friction heat generated by the combination of pressure and speed may cause local heat built-up. Care should be taken not to apply high values for pressure and speed at the same time.



## Installation Recommendation

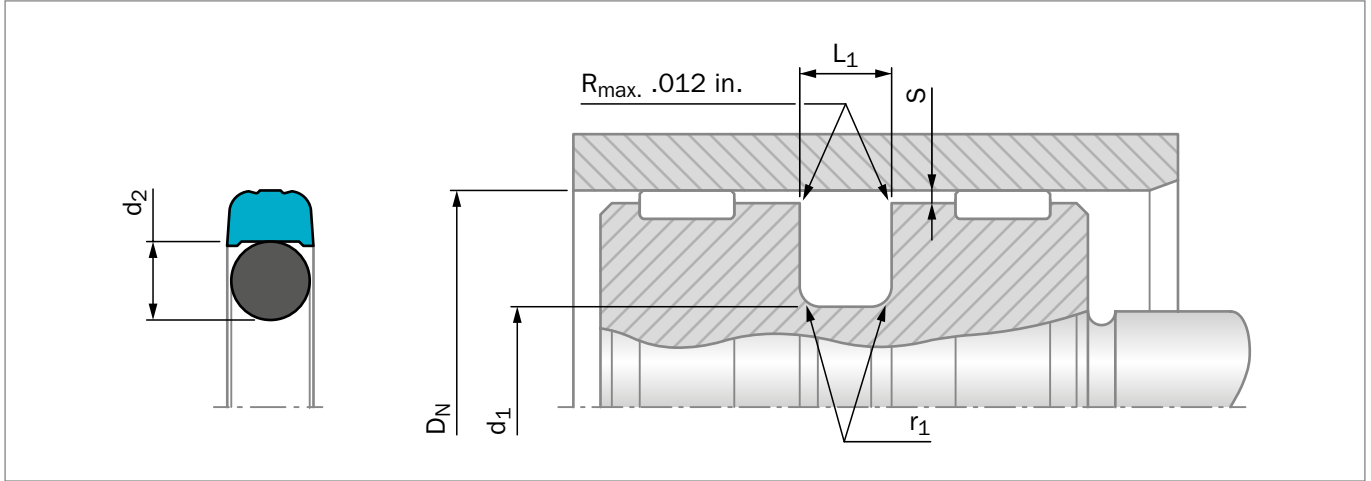


Figure 79: Installation Drawing

Table 60: Installation Dimensions – Standard Recommendations

TSS Series No.	Bore Diameter Range	Groove Diameter	Groove Width	Radius	Radial Clearance $S_{max}$ @ 230°F				O-Ring Cross-Section
	$D_N$ H9	$d_1$ h9	$L_1$ +.008	$r_1$	16 Mpa 2320 psi	26 Mpa 3750 psi	32 Mpa 4640 psi	40 Mpa 5800 psi	$d_2$
PH11	.500 - 1.562	$D_N$ - .295	.126	.025	.012	.008	-	-	.103
PH12	1.562 - 3.125	$D_N$ - .433	.165	.040	.016	.012	.008	-	.139
PH13	3.125 - 5.250	$D_N$ - .610	.248	.050	.020	.016	.012	.010	.210
PH14	5.250 - 10.000	$D_N$ - .827	.319	.070	.024	.020	.016	.014	.275

### ORDERING EXAMPLE

Turcon® Glyd Ring® D

**Series:** PH12 from Table 60

**Bore Diameter:**  $D_N$  = 3.000 inches

**TSS Part No.:** PH1203000 from Table 61

Material Z13

Material code Z13

O-Ring material code N

Set code: Z13N

**TSS Article No.** PH 12 03000 - Z13 N

TSS Series No. \_\_\_\_\_

Cross Section Series \_\_\_\_\_

Functional Bore Dia. x 1000 \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code (Seal Ring) \_\_\_\_\_

Material Code (O-Ring) \_\_\_\_\_

**Table 61: Installation Dimensions / TSS Part No.**

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008	
1.000	.705	.126	PH1101000
1.250	.955	.126	PH1101250
1.500	1.205	.126	PH1101500
1.750	1.317	.165	PH1201750
2.000	1.567	.165	PH1202000
<b>2.250</b>	<b>1.817</b>	<b>.165</b>	<b>PH1202250</b>
<b>2.500</b>	<b>2.067</b>	<b>.165</b>	<b>PH1202500</b>
<b>2.750</b>	<b>2.317</b>	<b>.165</b>	<b>PH1202750</b>
<b>3.000</b>	<b>2.567</b>	<b>.165</b>	<b>PH1203000</b>
<b>3.250</b>	<b>2.640</b>	<b>.248</b>	<b>PH1303250</b>
<b>3.500</b>	<b>2.890</b>	<b>.248</b>	<b>PH1303500</b>
<b>3.750</b>	<b>3.140</b>	<b>.248</b>	<b>PH1303750</b>
<b>4.000</b>	<b>3.390</b>	<b>.248</b>	<b>PH1304000</b>
<b>4.250</b>	<b>3.640</b>	<b>.248</b>	<b>PH1304250</b>
<b>4.500</b>	<b>3.890</b>	<b>.248</b>	<b>PH1304500</b>
<b>4.750</b>	<b>4.140</b>	<b>.248</b>	<b>PH1304750</b>
5.000	4.390	.248	PH1305000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Turcon® Glyd Ring® C



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Glyd Ring® C

### ■ Description

Successfully used for decades, the Turcon® Glyd Ring® C is a very effective and reliable low frictional seal. It is particularly suitable as a piston seal in both high and low pressure systems.

The double-acting Turcon® Glyd Ring® C is a combination of a Turcon®-based slipper seal and an energizing O-Ring. It is produced with an interference fit which, together with the squeeze of the O-Ring, ensures a good sealing effect even at low pressure. At higher system pressures, the O-Ring is energized by the fluid, pushing the Turcon® Glyd Ring® C against the sealing face with increased force.

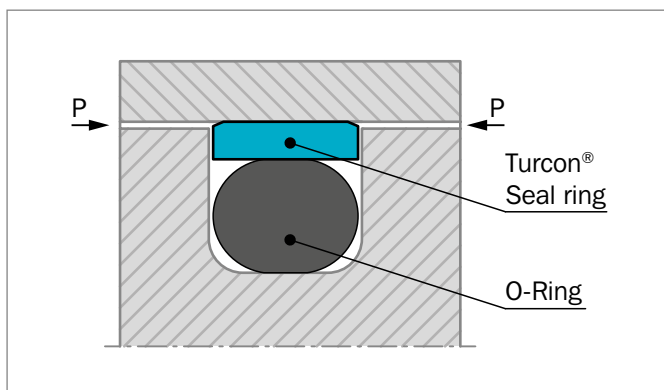


Figure 80: Turcon® Glyd Ring® C

The geometry of the Turcon® Glyd Ring® C ensures a good static sealing and allows the lubricating hydrodynamic oil film to be built under the seal in reciprocating applications.

### NOTCHES

To assure that a rapid energizing of the seal takes place at sudden changes of pressure and direction, radial notches are machined on both sides of the seal.

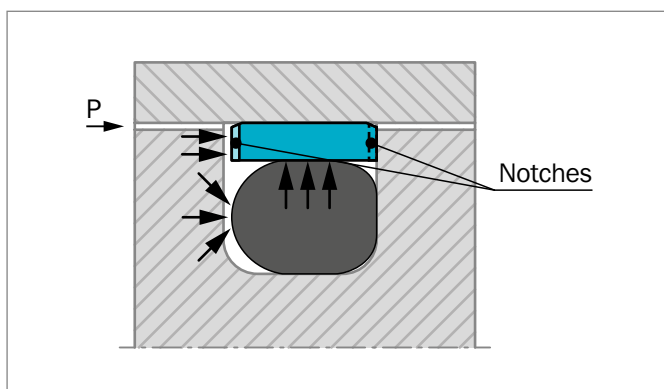


Figure 81: Turcon® Glyd Ring® C with notches on both sides

### ADVANTAGES

- No stick-slip effect when starting for smooth operation
- Minimum static and dynamic friction coefficient for minimum energy loss and operating temperature
- Suitable for non-lubricating fluids depending on seal material for optimum design flexibility
- High wear resistance ensures long service life
- No adhesive effect to the mating surface during long period of inactivity or storage
- Suitable for most hydraulic fluids in relation with most modern hardware materials and surface finishes depending on material selected
- Suitable for new environmentally safe hydraulic fluids

### APPLICATION EXAMPLES

Over several decades the Turcon® Glyd Ring® C has been successfully implemented as a double-acting piston seal for hydraulic components. Applications include:

- Machine tools
- Robotics
- Handling machinery
- Manipulators
- Valves for hydraulic & pneumatic circuits
- Fittings
- Testing machinery
- Hydraulic power steering
- Brake systems
- Brake boosters
- Low temperature hydraulics
- Chemical processing equipment
- Filling machines



## TECHNICAL DATA

Operating conditions:

The Turcon® Glyd Ring® C is recommended for reciprocating movements (with a length of stroke at least twice the groove width).

<b>Pressure:</b>	Up to 5,000 psi (35 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Frequency:</b>	Up to 5 Hz.
<b>Temperature:</b>	-49°F to +392°F (-45°C to +200°C)
<b>Media:</b>	Mineral oil-based hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (biological degradable oils), water, air and others, depending on the O-Ring material compatibility.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ , as shown in the Table 63, as a function of the operating pressure and functional diameter.

## 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 dependent on medium.

## MATERIALS

### Standard Application:

For hydraulic components in mineral oils containing or medium with good lubricating performance

Seal ring:	Turcon® T46
Energizer:	O-Ring NBR 70 shore A or FKM 70 Shore A depending on the temperature
Set code:	T46N/T46N7/T46V

### Special Application:

Short stroke movements, non-lubricating fluids or pneumatic applications require self-lubricating sealing materials. Therefore we recommend:

Seal ring:	Turcon® T40
Energizer:	NBR, 70 Shore A    N or N7 FKM, 70 Shore A    V depending on temperature
Set code:	T40N/T40N7/T40V
If low friction coefficient is required, we recommend:	
Seal ring:	Turcon® T05
Energizer:	NBR, 70 Shore A    N or N7 FKM, 70 Shore A    V depending on temperature For special requirements, other elastomers are available on request.
Set code:	T05N/T05N7/T05V
If rougher surface finish must be sealed, we recommend:	
Seal ring:	Zurcon® Z53
Energizer:	NBR, 70 Shore A    N or N7
Set code:	Z53N or Z53N7
If exposure to water is required, we recommend:	
Seal ring:	Zurcon® Z80
Energizer:	NBR, 70 Shore A    N or N7
Set code:	Z80N or Z80N7

For pneumatics applications we recommend a specific pneumatic version, the Turcon® Glyd Ring® APG, which fits the same groove dimensions. This series has a reduced O-Ring squeeze adapted to this function.

**Table 62: Turcon® and Zurcon® Materials for Glyd Ring®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	5,000
		NBR-70 Low temp	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T24</b> For all lubricating and non-lubricating hydraulic fluids, soft mating surfaces Carbon filled Color: Black	T24	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +293	Aluminum Bronze	
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good sliding properties, low friction Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel tubes	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel hardened	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, water hydraulic, soft mating surfaces. Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Cast iron Stainless steel	
		FKM-70	V	+14 to +392	Aluminum	
		EPDM-70	E**	-49 to +293	Bronze Alloys	

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Zurcon® Z53</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temperature resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N/N7	-22 to +176	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring Operation Temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany"

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

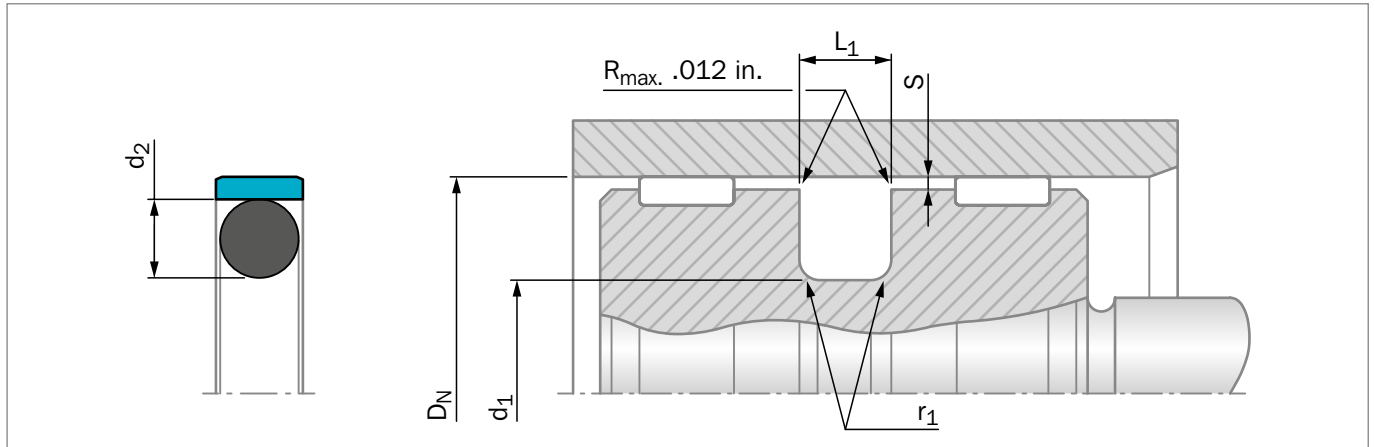


Figure 82: Installation drawing

**Table 63: Installation recommendation**

TSS Dash Sizes	Bore Diameter $D_N$ H9		Groove Diameter	Groove Width	Radius	Radial Clearance $S_{max}^*$	O-Ring Cross-Section
	Standard Application	Light Application	$d_1$ h9	$L_1$ +.008	$r_1$ max	35 Mpa 5000 psi**	$d_2$
006 - 010	.250 - .375	-	$D_N$ -.143	.079	.020	.002	.070
011 - 039	.437 - .562	.625 - 2.875	$D_N$ -.172	.079	.020	.003	.070
111 - 151	.625 - .687	.750 - 3.000	$D_N$ -.236	.112	.020	.003	.103
206 - 222	.750 - 1.750	-	$D_N$ -.300	.149	.030	.003	.139
223 - 260	-	1.875 - 6.750	$D_N$ -.363	.149	.030	.003	.139
325 - 350	1.875 - 5.000	-	$D_N$ -.491	.221	.050	.004	.210
426 - 437	5.125 - 6.500	-	$D_N$ -.593	.297	.060	.004	.275
438 - 445	6.750 - 8.500	-	$D_N$ -.718	.297	.060	.004	.275
446 - 474	9.000 - 25.500	-	$D_N$ -.968	.297	.060	.004	.275

\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal.

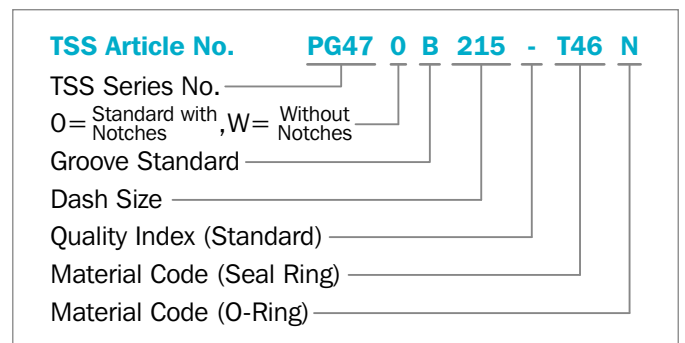
\*\* maximum pressures

### ORDERING EXAMPLE

Turcon® Glyd Ring®, complete with O-Ring, standard application, Series C

**Dash No.:** 215  
**TSS Part No.:** PG470B215-T46N

Select the material from Table 62. The corresponding code numbers are appended to the TSS Part No. Together they form the TSS Article No. All intermediate sizes not shown in Table 64 will have special TSS Part Numbers.



### NOTE

Turned - other diameters also available, no tool costs.

**Table 64: Installation dimensions / TSS Part No.**

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008		$D_N$ H9	$d_1$ h9	$L_1$ +.008	
.250	.107	.079	PG470B006	3.250	2.887	.149	PG470B234
.313	.170	.079	PG470B008	3.375	3.012	.149	PG470B235
.375	.232	.079	PG470B010	3.500	3.137	.149	PG470B236
.438	.266	.079	PG470B011	3.625	3.262	.149	PG470B237
.500	.328	.079	PG470B012	3.750	3.387	.149	PG470B238
.563	.391	.079	PG470B013	3.875	3.512	.149	PG470B239
.625	.453	.079	PG470B014	4.000	3.509	.221	PG470B342
.688	.515	.079	PG470B015	4.125	3.634	.221	PG470B343
.750	.577	.079	PG470B016	4.250	3.759	.221	PG470B344
.813	.640	.079	PG470B017	4.375	3.884	.221	PG470B345
.875	.702	.079	PG470B018	4.500	4.009	.221	PG470B346
.938	.765	.079	PG470B019	4.625	4.134	.221	PG470B347
1.000	.763	.112	PG470B117	4.750	4.259	.221	PG470B348
1.063	.826	.112	PG470B118	4.875	4.384	.221	PG470B349
1.125	.888	.112	PG470B119	5.000	4.509	.221	PG470B350
1.188	.951	.112	PG470B120	5.125	4.532	.297	PG470B426
1.250	1.013	.112	PG470B121	5.250	4.657	.297	PG470B427
1.313	1.076	.112	PG470B122	5.375	4.782	.297	PG470B428
1.375	1.138	.112	PG470B123	5.500	4.907	.297	PG470B429
1.438	1.201	.112	PG470B124	5.625	5.032	.297	PG470B430
1.500	1.263	.112	PG470B125	5.750	5.157	.297	PG470B431
1.563	1.326	.112	PG470B126	5.875	5.282	.297	PG470B432
1.625	1.388	.112	PG470B127	6.000	5.407	.297	PG470B433
1.688	1.451	.112	PG470B128	6.125	5.532	.297	PG470B434
1.750	1.513	.112	PG470B129	6.250	5.657	.297	PG470B435
1.813	1.576	.112	PG470B130	6.375	5.782	.297	PG470B436
1.875	1.638	.112	PG470B131	6.500	5.907	.297	PG470B437
1.938	1.701	.112	PG470B132	6.750	6.032	.297	PG470B438
2.000	1.763	.112	PG470B133	7.000	6.282	.297	PG470B439
2.063	1.826	.112	PG470B134	7.250	6.532	.297	PG470B440
2.125	1.888	.112	PG470B135	7.500	6.782	.297	PG470B441
2.188	1.951	.112	PG470B136	7.750	7.032	.297	PG470B442
2.250	2.013	.112	PG470B137	8.000	7.282	.297	PG470B443
2.313	2.076	.112	PG470B138	8.250	7.532	.297	PG470B444
2.375	2.138	.112	PG470B139	8.500	7.782	.297	PG470B445
2.438	2.201	.112	PG470B140	9.000	8.032	.297	PG470B446
2.500	2.263	.112	PG470B141	9.500	8.532	.297	PG470B447
2.625	2.262	.149	PG470B229	10.000	9.032	.297	PG470B448
2.750	2.387	.149	PG470B230	10.500	9.532	.297	PG470B449
2.875	2.512	.149	PG470B231				
3.000	2.637	.149	PG470B232				
3.125	2.762	.149	PG470B233				

# Turcon® AQ-Seal®



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Double-Acting

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O-Ring-Energized Slipper Seal Elastomer Contact

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® AQ-Seal®

### ■ Description

The Turcon® AQ-Seal® is a double-acting seal consisting of a seal ring of high-grade modified Turcon® material, a Quad-Ring® and an O-Ring as an energizing element.

The Turcon® seal ring and the Quad-Ring® Seal together assume the dynamic sealing function while the O-Ring performs the static sealing function.

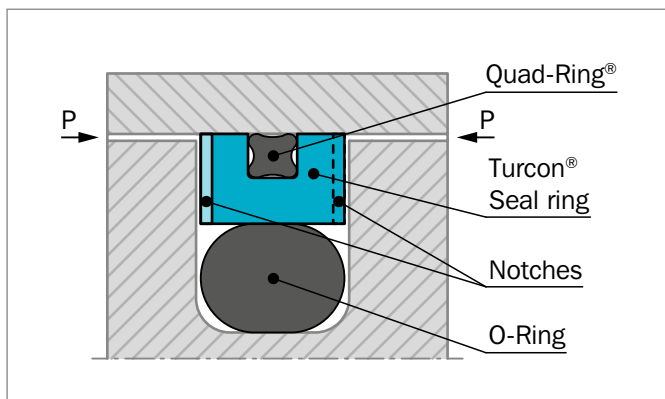


Figure 83: Turcon® AQ-Seal®

### ADVANTAGES

- High sealing effect in applications requiring media separation, e.g. fluid/fluid or fluid/gas
- Double security through the combination of low-friction special materials with elastomer seals
- Simple groove design, small installation space, interchangeable with Turcon® Glyd Ring®, Turcon® Glyd Ring® T and Turcon® Stepseal® K installation according to ISO 7425/1
- Outstanding sliding properties, no stick-slip effect

### APPLICATION EXAMPLES

The Turcon® AQ-Seal® is the recommended sealing element for double-acting pistons of accumulators and positioning and holding cylinders for:

- Machine tools
- Presses
- Accumulators
- Stabilizers
- Heavy duty suspension cylinders

### TECHNICAL DATA

<b>Operating pressure:</b>	5,800 psi (40 MPa)
<b>Velocity:</b>	Up to 6.5 ft/s (2 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C)* (depending on O-Ring and Quad-Ring® Seal material). (For applications at low temperatures below -22 °F (-30 °C), please contact us).
<b>Media:</b>	For all common hydraulic fluids, including bio-oils and gases.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 66, as a function of the operating pressure and functional diameter.

### 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.

\* In the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact our application engineers for assistance!

### MATERIALS

#### Standard Application:

For hydraulic components in mineral oils or medium with good lubricating performance. Mineral oils and gases.

Seal ring: Turcon® T46

Energizer: NBR, 70 Shore A N or N7

Set code: T46N or T46N7

#### Standard Application:

For special applications requiring other material combinations, please contact your local Customer Solution Center.



**Table 65: Turcon® Materials for Turcon® AQ-Seal®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod) Steel plated (rod)	
		FKM-70	V	+14 to +392	Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze-filled Color: grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel tubes	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Cast iron Stainless steel	
		FKM-70	V	+14 to +392	Aluminum	
		EPDM-70	E**	-49 to +293	Bronze Alloys	
<b>Turcon® T10</b> For oil hydraulic and pneumatic for all lubricating and non-lubricating fluids, high extrusion resistance, good chemical resistance BAM tested Carbon, graphite-filled Color: black	T10	NBR-70	N/N7	-22 to +212	Steel	5,800
		NBR-70 Low temp.	T	-49 to +176	Stainless steel	
		FKM-70	V	+14 to +392		
		EPDM-70	E**	-49 to +293		

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundes Anstalt Materialprüfung, Germany".

□ Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

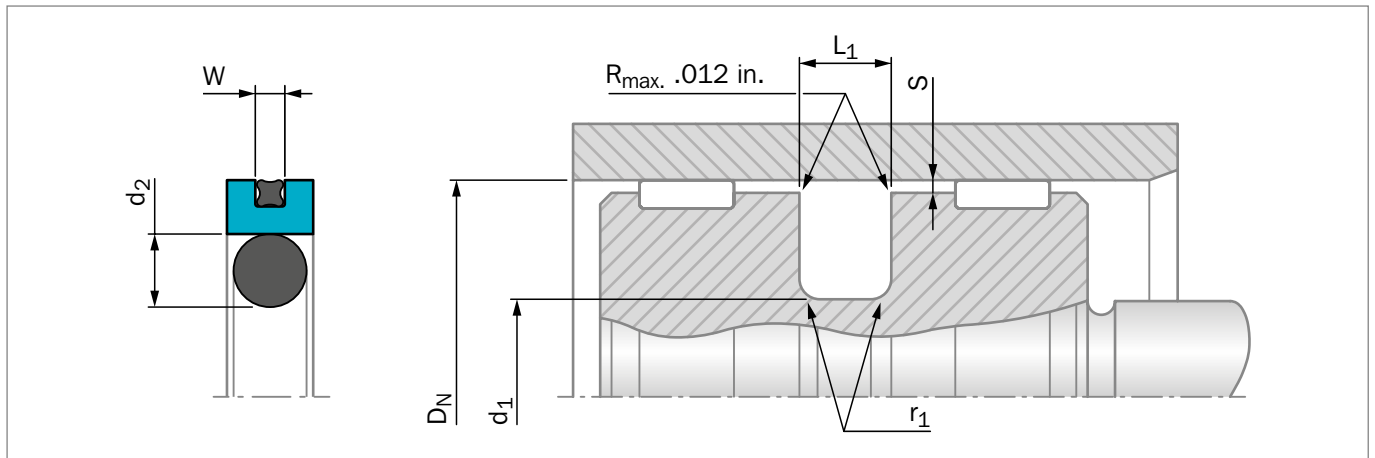


Figure 84: Installation drawing

**Table 66: Installation recommendation**

Bore Diameter $D_N$ H9				Groove Diameter	Groove Width	Radius	Radial Clearance $S_{max}$			O-Ring Cross-Section $d_2$	X-Ring Cross-Section $W$
Standard Application		Light Application					$d_1$ h9	$L_1$ +.008	$r_1$ max		
TSS Series No.	Diameter Range	TSS Series No.	Diameter Range								
PQE0	.625 - 1.563	PQE4	1.564 - 3.125	$D_N$ -.433	.165	.040	.010	.006	.004	.139	.070
PQE0	1.564 - 3.125	PQE4	3.126 - 5.250	$D_N$ -.610	.248	.050	.012	.008	.006	.210	.070
PQE1	3.126 - 5.250	PQE5	5.251 - 9.975	$D_N$ -.827	.319	.070	.012	.008	.006	.275	.103
PQE1	5.251 - 9.975	-	-	$D_N$ -.965	.319	.070	.012	.008	.006	.275	.103
PQE2	9.976 - 18.225	-	-	$D_N$ -1.102	.374	.100	.018	.012	.010	.330	.139
PQE3	18.226 - 27.500	-	-	$D_N$ -1.378	.453	.120	.022	.016	.014	.394	.139

All intermediate sizes can be supplied with special elastomers on request.

### ORDERING EXAMPLE

Turcon® AQ-Seal®, complete with O-Ring and Quad-Ring® Seal, recommended range, Series PQE4 (from Table 66)

<b>Bore Diameter:</b>	$D_N = 4.000$ inches
<b>TSS Part No.</b>	PQE404000 (from Table 67)

Select the material from Table 65. The corresponding code numbers are appended to the TSS Part No. (from Table 67). Together they form the TSS Article No. For all intermediate sizes not shown in Table 67, the TSS Article No. can be determined from the example opposite.

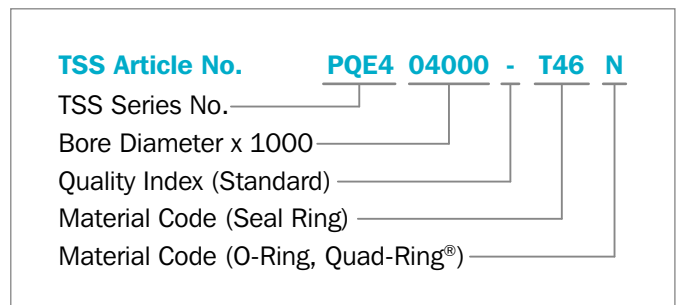




Table 67: Installation dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008		$D_N$ H9	$d_1$ h9	$L_1$ +.008	
<b>1.000</b>	<b>.567</b>	<b>.165</b>	<b>PQE001000</b>	6.500	5.673	.319	PQE506500
1.125	.692	.165	PQE001125	6.750	5.923	.319	PQE506750
<b>1.250</b>	<b>.817</b>	<b>.165</b>	<b>PQE001250</b>	7.000	6.173	.319	PQE507000
1.375	.942	.165	PQE001375	7.250	6.423	.319	PQE507250
<b>1.500</b>	<b>1.067</b>	<b>.165</b>	<b>PQE001500</b>	7.500	6.673	.319	PQE507500
1.625	1.015	.248	PQE001625	7.750	6.923	.319	PQE507750
<b>1.750</b>	<b>1.140</b>	<b>.248</b>	<b>PQE001750</b>	8.000	7.173	.319	PQE508000
1.875	1.265	.248	PQE001875	8.250	7.423	.319	PQE508250
<b>2.000</b>	<b>1.390</b>	<b>.248</b>	<b>PQE002000</b>	8.500	7.673	.319	PQE508500
2.125	1.515	.248	PQE002125	8.750	7.923	.319	PQE508750
<b>2.250</b>	<b>1.640</b>	<b>.248</b>	<b>PQE002250</b>	9.000	8.173	.319	PQE509000
2.375	1.765	.248	PQE002375	9.250	8.423	.319	PQE509250
<b>2.500</b>	<b>1.890</b>	<b>.248</b>	<b>PQE002500</b>	9.500	8.673	.319	PQE509500
2.625	2.015	.248	PQE002625	9.750	8.923	.319	PQE509750
<b>2.750</b>	<b>2.140</b>	<b>.248</b>	<b>PQE002750</b>	10.000	8.898	.374	PQE210000
2.875	2.265	.248	PQE002875	10.500	9.398	.374	PQE210500
<b>3.000</b>	<b>2.390</b>	<b>.248</b>	<b>PQE003000</b>	11.000	9.898	.374	PQE211000
3.125	2.515	.248	PQE003125	11.500	10.398	.374	PQE211500
<b>3.250</b>	<b>2.640</b>	<b>.248</b>	<b>PQE403250</b>	12.000	10.898	.374	PQE212000
3.375	2.765	.248	PQE403375	12.500	11.398	.374	PQE212500
<b>3.500</b>	<b>2.890</b>	<b>.248</b>	<b>PQE403500</b>	13.000	11.898	.374	PQE213000
3.625	3.015	.248	PQE403625	13.500	12.398	.374	PQE213500
<b>3.750</b>	<b>3.140</b>	<b>.248</b>	<b>PQE403750</b>	14.000	12.898	.374	PQE214000
3.875	3.265	.248	PQE403875	14.500	13.398	.374	PQE214500
<b>4.000</b>	<b>3.390</b>	<b>.248</b>	<b>PQE404000</b>	15.000	13.898	.374	PQE215000
4.125	3.515	.248	PQE404125	15.500	14.398	.374	PQE215500
<b>4.250</b>	<b>3.640</b>	<b>.248</b>	<b>PQE404250</b>	16.000	14.898	.374	PQE216000
4.375	3.765	.248	PQE404375	16.500	15.398	.374	PQE216500
<b>4.500</b>	<b>3.890</b>	<b>.248</b>	<b>PQE404500</b>	17.000	15.898	.374	PQE217000
4.625	4.015	.248	PQE404625	17.500	16.398	.374	PQE217500
<b>4.750</b>	<b>4.140</b>	<b>.248</b>	<b>PQE404750</b>	18.000	16.898	.374	PQE218000
4.875	4.265	.248	PQE404875	18.500	17.122	.453	PQE318500
<b>5.000</b>	<b>4.390</b>	<b>.248</b>	<b>PQE405000</b>	19.000	17.622	.453	PQE319000
5.125	4.515	.248	PQE405125	19.500	18.122	.453	PQE319500
5.250	4.640	.248	PQE405250	20.000	18.622	.453	PQE320000
5.375	4.548	.319	PQE505375				
5.500	4.673	.319	PQE505500				
5.625	4.798	.319	PQE505625				
5.750	4.923	.319	PQE505750				
6.000	5.173	.319	PQE506000				
6.250	5.423	.319	PQE506250				

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment). Other dimensions and all intermediate sizes up to 100 inches (2540mm) diameter can be supplied.

# Turcon® AQ-Seal® 5



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Double-Acting

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O-Ring-Energized Slipper Seal Elastomer Contact

**Material:**

Turcon® , Zurcon® and Elastomer

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## ■ Turcon® AQ-Seal® 5

### ■ Description

The Turcon® AQ-Seal® 5 is a patented development of the proven standard Turcon® AQ-Seal®.

The seal profile of the Turcon® ring has been redesigned on both the dynamic and static sealing surfaces. Two O-Rings are used to energize the seal instead of one.

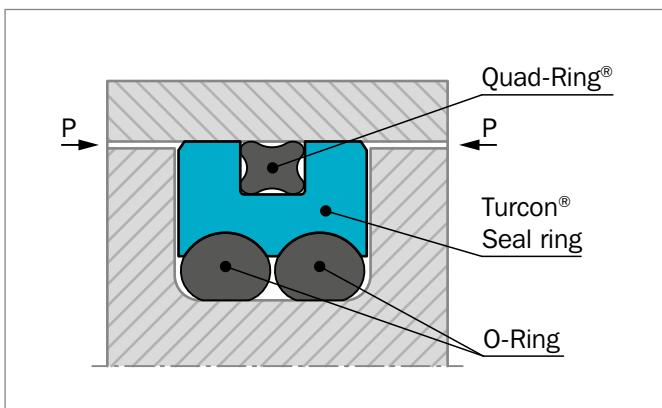


Figure 85: Turcon® AQ-Seal® 5

The AQ-Seal® 5 combines the benefits of a low-friction Turcon® slipper seal with the high sealing characteristics of an elastomeric seal by incorporating a limited foot print Quad-Ring® Seal in the dynamic sealing face. This optimizes leakage control while minimizing friction.

The unique characteristics of the AQ-Seal® 5 are the special seal profile with a defined seal edge and the use of two O-Rings as energizing elements to optimize the pressure profile and to reduce the force of attack at gas permeability.

### ADVANTAGES

- High sealing effect in applications requiring media separation, e.g. fluid/fluid or fluid/gas
- Double security through the combination of low-friction special materials with elastomer seals
- Low gas permeation rate
- Higher pressure application, higher sliding speed compared to the AQ-Seal®
- Outstanding sliding properties, no stick-slip effect

### APPLICATION EXAMPLES

The Turcon® AQ-Seal® 5 is the recommended sealing element for double acting pistons of accumulators and positioning and holding cylinders for:

- Mobil hydraulics
- Cranes
- Stabilizers
- Heavy duty suspension cylinders
- Hydro-pneumatic suspensions for heavy vehicles
- Machine tools
- Presses
- Rolling mills
- Servo hydraulics
- Offshore equipment
- Cylinders with retaining function over longer periods such as jacks and support cylinders

### TECHNICAL DATA

Operating conditions

<b>Pressure:</b>	Up to 7,250 psi (50 MPa)
<b>Velocity:</b>	Up to 10 ft/s (3 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C)** (depending on O-Ring and Quad-Ring® Seal material). (For applications at low temperatures below -22 °F (-30 °C), please contact us).
<b>Media:</b>	For all common hydraulic fluids, including bio-oils and gases.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 69, as a function of the operating pressure and functional diameter.

### 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.

\*\* In the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact our application engineers for assistance!



**MATERIALS**

**Standard Application:**

For hydraulic components in mineral oils or medium with good lubricating performance.

Mineral oils and gases.

Seal ring: Turcon® T46

Energizer: NBR, 70 Shore A N or N7

Set code: T46N or T46N7

**Special Application:**

For special applications requiring other material combinations, please contact your local Customer Solution Center.

**Table 68: Turcon® Materials for Turcon® AQ-Seal® 5**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze-filled Color: grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel tubes	7,250
		FKM-70	V	+14 to +392	Steel hardened Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	

Table continues on next page





Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® T10</b> For oil hydraulic and pneumatic for all lubricating and non-lubricating fluids, high extrusion resistance, good chemical resistance BAM tested Carbon, graphite-filled Color: black	T10	NBR-70	N/N7	-22 to +212	Steel	8,700
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +293		

\* The O-Ring operation Temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundes Anstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

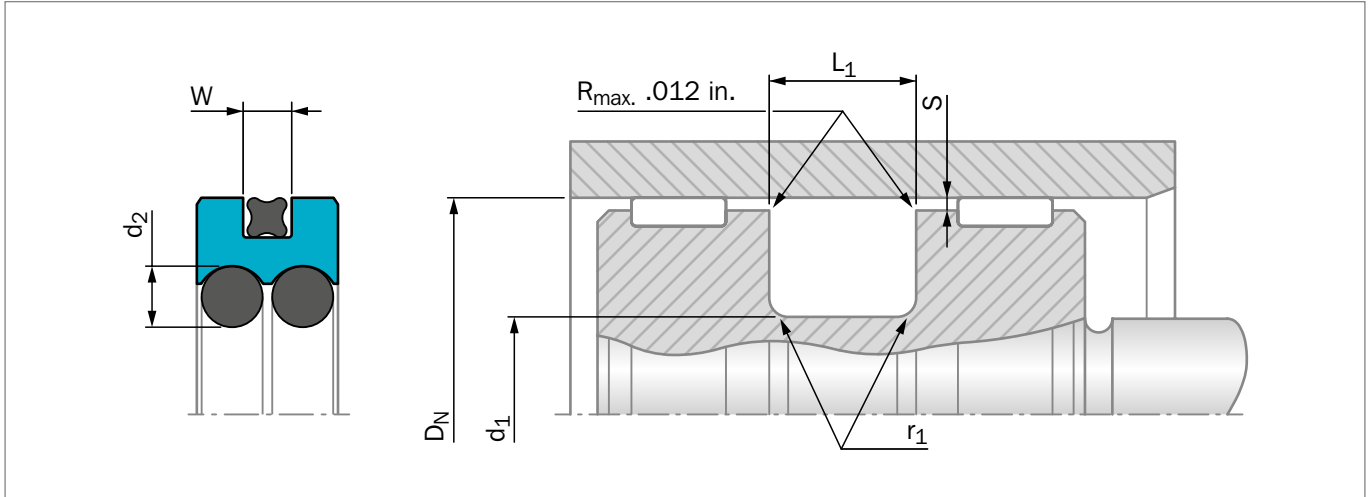


Figure 86: Installation drawing

**Table 69: Installation recommendation**

TSS Series No.	Bore Diameter	Groove Diameter	Groove Width	Radius	Radial Clearance $S_{max}$		O-Ring Cross-Section	X-Ring Cross-Section
	$D_N$ H9	$d_1$ h9	$L_1$ +.008	$r_1$ max	10 MPa 1500 psi	20 MPa 3000 psi	$d_2$	W
PQ41	.750 - 5.500	$D_N$ -.394	.248	.005	.012	.009	.103	.070
PQ42	.750 - 9.975	$D_N$ -.512	.326	.010	.013	.010	.139	.103
PQ43	1.250 - 18.000	$D_N$ -.709	.484	.015	.014	.011	.210	.139
PQ44	5.500 - 26.000	$D_N$ -1.220	.642	.015	.016	.013	.275	.210

All intermediate sizes can be supplied with special elastomers on request.

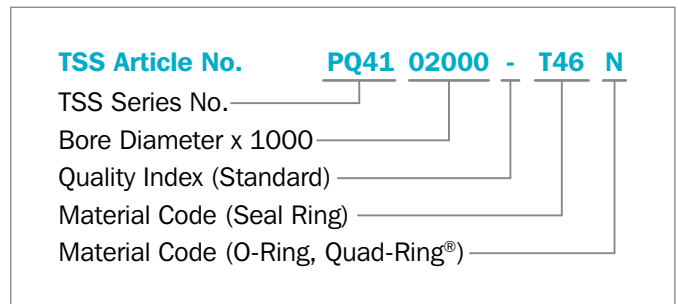
### ORDERING EXAMPLE

Turcon® AQ-Seal® 5, complete with O-Ring and Quad-Ring® Seal, recommended range, Series PQ41 (from Table 69)

**Bore Diameter:**  $D_N$  = 2.000 inches

**TSS Part No.:** PQ4102000

Select the material from Table 68. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.



For diameters  $\geq 100$  inches please consult your Customer Solution Center special part no.

# Turcon® Double Delta®



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Double-Acting

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O-Ring-Energized Turcon® Slipper Seal

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For O-Ring Grooves

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**Material:**

Turcon® and Elastomer

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## ■ Turcon® Double Delta®

### ■ Description

The Turcon® Double Delta® is a rubber-energized plastic faced seal. The seal is designed to expand and improve the service parameters of O-Rings and is installed in existing O-Ring grooves.

The Double Delta® combines the flexibility and response of O-Rings with the wear and friction characteristics of the Turcon® materials in dynamic applications.

The figure below shows the cross section of the Double Delta®.

The double-acting performance of the seal comes from the symmetrical cross section which allows the seal to respond to pressure in both directions.

Initial contact pressure is provided by radial compression of the O-Ring. When the system pressure is increased the O-Ring transforms this into additional contact pressure, the contact pressure of the seal is thereby automatically adjusted so sealing is ensured under all service conditions.

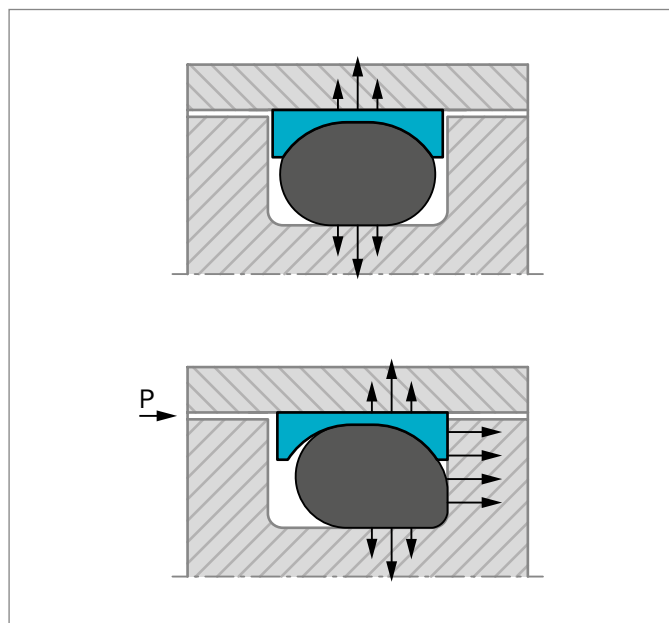


Figure 87: Turcon® Double Delta® without and with pressure

### ADVANTAGES

- Compact groove dimensions and simple installation
- Low friction without stick-slip
- Resistance against wear and extrusion
- Piston seals available for all diameters from .25 to 40 inches (5 to 999.9mm)
- Standard cross sections cover AS 568A and important metric O-Rings, other cross sections available on request

### APPLICATION EXAMPLES

The Turcon® Double Delta® is the recommended sealing element for double-acting pistons of hydraulic or pneumatic cylinders in sectors such as:

- Machine tools
- Handling devices
- Manipulators
- Valves
- Chemical processing equipment

It is particularly recommended for light duty and small diameter applications.

### TECHNICAL DATA

Operating conditions

<b>Pressure:</b>	Up to 5,000 psi (35 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s)
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (according to O-Ring material)
<b>Media:</b>	Mineral oil, non-flammable fluids, environmentally safe fluids and others according to O-Ring material.

### 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 dependent on medium.



## MATERIALS

### Standard Application:

For hydraulic components with reciprocating movement in mineral oils containing zinc or medium with good lubricating performance and hard mating surface

Seal ring: Turcon® T46

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature

Set code: T46N/T46N7/T46V

### Special Application:

Short stroke movements, poor lubricating fluids and soft mating surfaces

Seal ring: Turcon® T24

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature

Set code: T24N/T24N7/T24V

For low friction requirement in dynamic hydraulic components with good lubricating medium:

Seal ring: Turcon® T05

Energizer: NBR, 70 Shore A    N or N7  
FKM, 70 Shore A    V  
depending on temperature

Set code: T05N/T05N7/T05V

For specific applications other material combinations as listed may also be used. Please contact your local Customer Solution Center.


**Table 70: Turcon® Materials for Double Delta®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	ORing Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze-filled Color: grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel tubes	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T24</b> For all lubricating and non-lubricating hydraulic fluids, soft mating surfaces. Carbon-filled Color: black	T24	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Cast iron	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +293	Aluminium Bronze	
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good sliding properties, low friction Color: turquoise	T05	NBR-70	N/N7	-22 to +212	Steel tubes	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel hardened	
		FKM-70	V	+14 to +392		

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundes Anstalt Materialprüfung, Germany".

 Highlighted materials are standard.



## Installation Recommendation (Inch Piston Series)

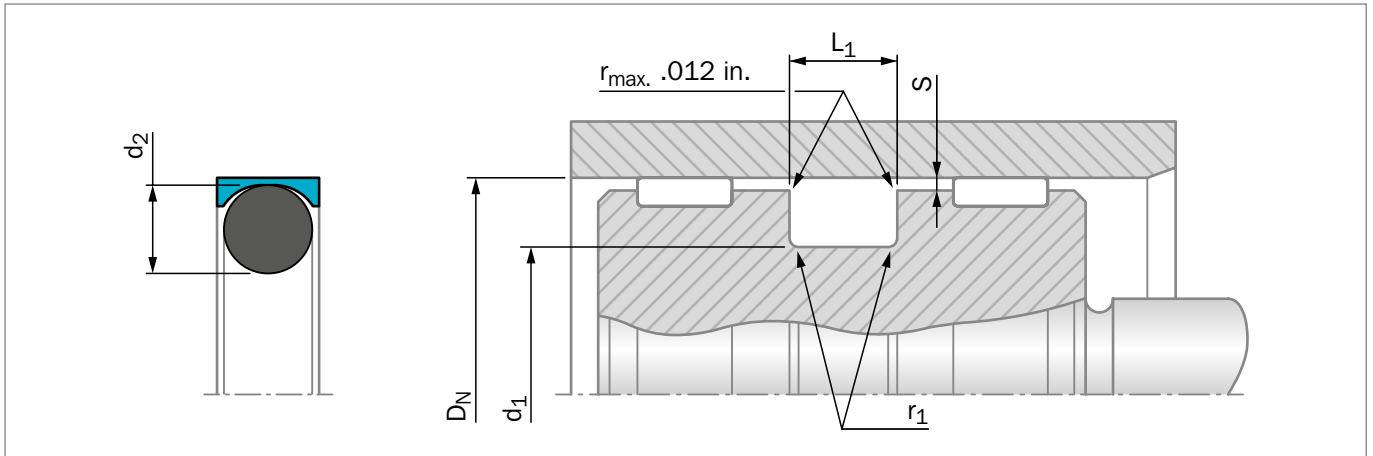


Figure 88: Installation drawing

**Table 71: Installation recommendation**

TSS Dash Sizes	Bore Diameter $D_N$ H9		Groove Diameter $d_1$ h9	Groove Width $L_1 +.008$	Groove Width $L_2 +.008$	Radius $r_1$ max	Radial Clearance $S_{max}$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application					10 MPa 1500 psi	20 MPa 3000 psi	35 MPa 5000 psi	
006 - 028	.250 - .281	.312 - 1.500	$D_N$ -.110	.093	.138	.005	.004	.003	.002	.070
104 - 149	.312 - .406	.437 - 3.000	$D_N$ -.176	.140	.171	.005	.006	.004	.003	.103
201 - 248	.437 - .750	.812 - 5.000	$D_N$ -.242	.187	.208	.010	.008	.006	.003	.139
309 - 350	.812 - 4.875	5.000	$D_N$ -.370	.281	.311	.020	.010	.008	.004	.210
425 - 460	5.000 - 16.000	-	$D_N$ -.474	.375	.408	.020	.012	.010	.006	.275

$L_1$  is for "0" Back-up groove width - PD00\_B series

$L_2$  is for "1" Back-up groove width - PD01\_B series

### ORDERING EXAMPLE

Turcon® Double Delta®, complete with O -Ring, standard range, series PD00 (from Table 71)

<b>Dash size:</b>	117
<b>TSS Part No.:</b>	PD000B117 (from Table 72)

Select the material from Table 70. The corresponding code numbers are appended to the TSS Part No. (from Table 72). Together they form the TSS Article No.

For all intermediate sizes not shown in Table 72, the TSS Article No. can be determined from the example opposite.

<b>TSS Article No.</b>	<b>PD00 0 B 117 - T05 N</b>
TSS Series No.	PD00 - 0 Back-up width groove $L_1$
	PD01 - 1 Back-up width groove $L_2$
	0=std, N=with notches
Groove Standard	
Dash Size	
Quality Index (Standard)	
Material Code (Seal Ring)	
Material Code (O-Ring)	

Notes:

- 1) Tolerances used are per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 2) The clearance stated as S in the Table 71 is for when the seal is specified with Slydring bearings. When not incorporating Slydring bearings, the diametral clearance should be reduced.





Table 72: Installation dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008		$L_2$ +.008	
.250	.140	.093	PD000B006	.138	PD010B006
.281	.171	.093	PD000B007	.138	PD010B007
.312	.202	.093	PD000B008	.138	PD010B008
.344	.234	.093	PD000B009	.138	PD010B009
.375	.265	.093	PD000B010	.138	PD010B010
.437	.327	.093	PD000B011	.138	PD010B011
.500	.390	.093	PD000B012	.138	PD010B012
.563	.452	.093	PD000B013	.138	PD010B013
.625	.515	.093	PD000B014	.138	PD010B014
.688	.577	.093	PD000B015	.138	PD010B015
.750	.640	.093	PD000B016	.138	PD010B016
.813	.702	.093	PD000B017	.138	PD010B017
.875	.765	.093	PD000B018	.138	PD010B018
.938	.827	.093	PD000B019	.138	PD010B019
1.000	.824	.140	PD000B117	.171	PD010B117
1.063	.886	.140	PD000B118	.171	PD010B118
1.125	.949	.140	PD000B119	.171	PD010B119
1.188	1.011	.140	PD000B120	.171	PD010B120
1.250	1.074	.140	PD000B121	.171	PD010B121
1.313	1.136	.140	PD000B122	.171	PD010B122
1.375	1.199	.140	PD000B123	.171	PD010B123
1.438	1.261	.140	PD000B124	.171	PD010B124
1.500	1.324	.140	PD000B125	.171	PD010B125
1.563	1.386	.140	PD000B126	.171	PD010B126
1.625	1.449	.140	PD000B127	.171	PD010B127
1.688	1.511	.140	PD000B128	.171	PD010B128
1.750	1.574	.140	PD000B129	.171	PD010B129
1.813	1.636	.140	PD000B130	.171	PD010B130
1.875	1.699	.140	PD000B131	.171	PD010B131
1.938	1.761	.140	PD000B132	.171	PD010B132
2.000	1.824	.140	PD000B133	.171	PD010B133
2.063	1.886	.140	PD000B134	.171	PD010B134
2.125	1.949	.140	PD000B135	.171	PD010B135
2.188	2.011	.140	PD000B136	.171	PD010B136
2.250	2.074	.140	PD000B137	.171	PD010B137
2.313	2.136	.140	PD000B138	.171	PD010B138
2.375	2.199	.140	PD000B139	.171	PD010B139
2.438	2.261	.140	PD000B140	.171	PD010B140
2.500	2.324	.140	PD000B141	.171	PD010B141
2.625	2.383	.187	PD000B229	.208	PD010B229



Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.008		$L_2$ +.008	
2.750	2.508	.187	PD000B230	.208	PD010B230
2.875	2.633	.187	PD000B231	.208	PD010B231
3.000	2.758	.187	PD000B232	.208	PD010B232
3.125	2.883	.187	PD000B233	.208	PD010B233
3.250	3.008	.187	PD000B234	.208	PD010B234
3.375	3.133	.187	PD000B235	.208	PD010B235
3.500	3.258	.187	PD000B236	.208	PD010B236
3.625	3.383	.187	PD000B237	.208	PD010B237
3.750	3.508	.187	PD000B238	.208	PD010B238
3.875	3.633	.187	PD000B239	.208	PD010B239
4.000	3.758	.187	PD000B240	.208	PD010B240
4.125	3.883	.187	PD000B241	.208	PD010B241
4.250	4.008	.187	PD000B242	.208	PD010B242
4.375	4.133	.187	PD000B243	.208	PD010B243
4.500	4.258	.187	PD000B244	.208	PD010B244
4.625	4.383	.187	PD000B245	.208	PD010B245
4.750	4.508	.187	PD000B246	.208	PD010B246
4.875	4.633	.187	PD000B247	.208	PD010B247
5.000	4.526	.375	PD000B425	.408	PD010B425
5.125	4.651	.375	PD000B426	.408	PD010B426
5.250	4.776	.375	PD000B427	.408	PD010B427
5.375	4.901	.375	PD000B428	.408	PD010B428
5.500	5.026	.375	PD000B429	.408	PD010B429
5.625	5.151	.375	PD000B430	.408	PD010B430
5.750	5.276	.375	PD000B431	.408	PD010B431
5.875	5.401	.375	PD000B432	.408	PD010B432
6.000	5.526	.375	PD000B433	.408	PD010B433
6.125	5.651	.375	PD000B434	.408	PD010B434
6.250	5.776	.375	PD000B435	.408	PD010B435
6.375	5.901	.375	PD000B436	.408	PD010B436
6.500	6.026	.375	PD000B437	.408	PD010B437
6.750	6.276	.375	PD000B438	.408	PD010B438
7.000	6.526	.375	PD000B439	.408	PD010B439
7.250	6.776	.375	PD000B440	.408	PD010B440
7.500	7.026	.375	PD000B441	.408	PD010B441
7.750	7.276	.375	PD000B442	.408	PD010B442
8.000	7.526	.375	PD000B443	.408	PD010B443
8.250	7.776	.375	PD000B444	.408	PD010B444
8.500	8.026	.375	PD000B445	.408	PD010B445

# Turcon® CST Seal



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Double-Acting

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Elastomer-Energized Turcon® Slipper Seal

**Material:**

Turcon® and POM

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## ■ Turcon® CST Seal

### ■ Description

The CST Seal is a high-pressure heavy-duty piston seal with excellent leakage control and superior extrusion and wear resistance

The CST seal is a combination of a Turcon®-based slipper seal energized by an elastomer profile ring and completed with two Back-up rings (Zurcon®). It is manufactured with a predefined interference fit, which together with the squeeze of the elastomer part ensures a good sealing effect even at low system pressure. At higher pressures the elastomer part is energized by the system pressure and activates the slipper seal in the radial direction.

The back-up rings prevent the slipper seal from extrusion and ensure a long service life even under harsh conditions.

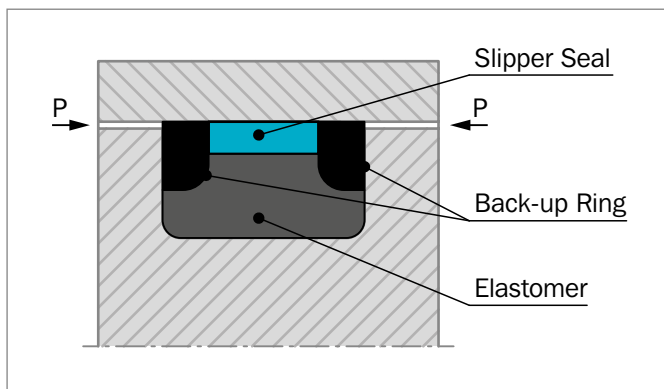


Figure 89: CST Seal

### ADVANTAGES

- Simple groove design
- No stick-slip effect when starting for smooth operation
- Minimum static and dynamic coefficient of friction
- Increased clearance possible
- Due to larger extrusion gap, safe use even with soiled media
- Long service life

### APPLICATION EXAMPLES

The CST Seal is the recommended sealing element for double-acting pistons of hydraulic cylinders working in very harsh conditions such as:

- Excavators
- Heavy duty hydraulic cylinders

### TECHNICAL DATA

Operating conditions:

<b>Pressure:</b>	Up to 7,250 psi (50 MPa)
<b>Velocity:</b>	Up to 5 ft/s (1.5 m/s)
<b>Temperature:</b>	-60 °F to +250 °F (-50 °C to +121 °C)
<b>Media:</b>	Mineral oil based hydraulic fluids, water/oil and glycol/oil emulsions.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 74, as a function of the operating pressure and functional diameter.

### MATERIALS

#### Standard Applications:

For hydraulic components:

In mineral oils or medium with good lubricating performance

Seal ring: Turcon® T46

Energizer: Turel® NP

Back-up rings: Zurcon® Z60

Material code for the set: T46NP

#### Special Applications:

For special applications requiring other material combinations, please contact your local Customer Solution Center.



**Table 73: Turcon® Materials for Turcon® CST Seal®**

Material, Applications, Properties	Code	Energiser Material Shore A	Code	Energiser Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-75	NP	-60 to +176	Steel Steel hardened Steel chrome plated (rod) Steel plated (rod) Cast iron Stainless steel Titanium	7,250
		NBR-70 Low temp.	T	-49 to +176		
		FKM-70	V	+14 to +392		
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze-filled Color: Grayish to dark brown	T46	NBR-75	NP	-60 to +176	Steel tube Steel hardened Cast iron	7,250
		NBR-70 Low temp.	T	-49 to +176		
		FKM-70	V	+14 to +392		
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber-filled Color: Gray	T29	NBR-75	NP	-60 to +176	Steel Cast iron Stainless steel Aluminium Bronze	7,250
		NBR-70 Low temp.	T	-49 to +176		
		FKM-70	V	+14 to +392		
		EPDM-70	E**	-49 to +293		
<b>Turcon® T42</b> For all lubricating and non-lubricating hydraulic fluids, good chemical resistance, good dielectric properties Glass fiber-filled + MoS2 Color: Gray to blue	T42	NBR-75	NP	-60 to +176	Steel tube Steel hardened Cast iron	5,800
		NBR-70 Low temp.	T	-49 to +176		
		FKM-70	V	+14 to +392		

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundes Anstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

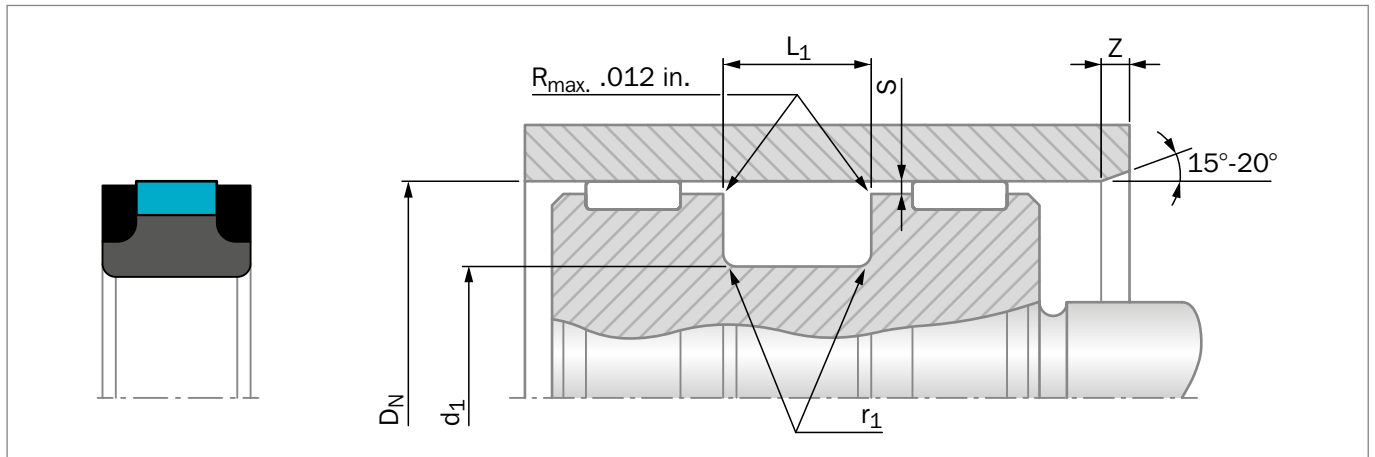


Figure 90: Installation drawing

- 1) The bore diameter H9 tolerance is recommended per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 2) The groove diameter h9 tolerance is recommended per ISO-286; ISO System of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 3) The clearances stated as S in the above table are for the Turcon® CST Seal when specified with Slydring® bearings. When not incorporating Slydring® bearings, the diametral clearance should be reduced.
- 4) To determine minimum piston diameter D, subtract diametral clearance ( $2 \times S_{max}$ ) from the maximum bore.
- 5) Consult your Customer Solution Center for diameters that exceed those listed in the below table.

**Table 74: Installation recommendation**

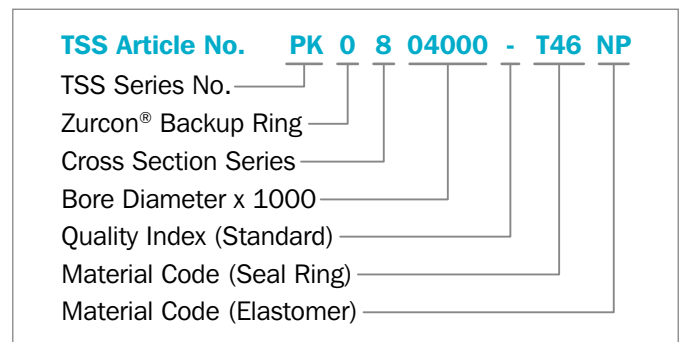
TSS Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ +.010	Radius $r_1$ max	Radial Clearance $S_{max}$ *	
	Standard	Light Application	Heavy Duty				35 MPa 5000 psi	45 MPa 6500 psi
PK07	1.000 - 2.999	-	-	$D_N$ -.373	.424	.020	.012	.009
PK08	3.000 - 4.999	-	-	$D_N$ -.478	.579	.025	.018	.010
PK09	5.000 - 20.000	-	-	$D_N$ -.726	.750	.035	.019	.012

\* At pressures >40 MPa (5.800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal.

### ORDERING EXAMPLE

Turcon® CST Seal, complete

<b>Bore Diameter:</b>	$D_N = 4.000$ inches
<b>TSS Part No.:</b>	PK0804000
<b>Seal:</b>	Turcon® T46
<b>Energizer:</b>	Turel® NP
<b>Back-up ring:</b>	Zurcon® Z60
<b>Material set-code:</b>	T46NP



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# Turcon® Stepseal® 2K



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Single-Acting

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O-Ring-Energized Turcon® Slipper Seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Stepseal® 2K\*

### ■ Description

Stepseal® 2K is a single-acting seal element consisting of a seal ring of high-grade Turcon® or Zurcon® materials and an O-Ring as energizing element.

Stepseal® 2K was originally developed and patented by Trelleborg Sealing Solutions as a rod seal. Due to its outstanding properties it is well suited as a single-acting piston seal where high demands are made on positional accuracy and free movement.

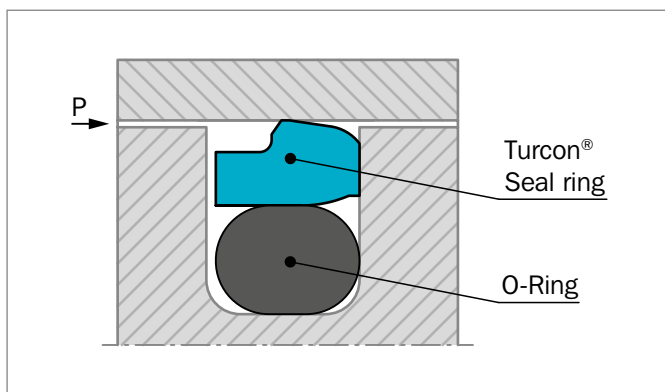


Figure 91: Turcon® Stepseal® 2K

### ADVANTAGES

- High static and dynamic sealing effect
- Stick-slip-free operation for precise control
- High abrasion resistance and high resistance to extrusion
- Long service life
- Simple groove design, one-piece piston possible
- Wide range of application temperatures and high resistance to chemicals, depending on the choice of O-Ring material
- Simple installation without seal edge deformation
- Available for all diameters up to 106 inches (2,700mm)
- Low friction

\* Patented and patent pending geometry

### APPLICATION EXAMPLES

The Turcon® Stepseal® 2K is the recommended sealing element for single-acting pistons in hydraulic components for:

- Injection molding machines
- Machine tools
- Presses

It is particularly recommended in floating piston accumulators as the primary seal on the oil side in combination with AQ-Seal® and AQ-Seal® 5.

### TECHNICAL DATA

Operating conditions

<b>Pressure:</b>	Up to 8,700 psi (60 MPa)
<b>Velocity:</b>	Up to 50 ft/s (15 m/s), frequency up to 5 Hz.
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C)**
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water, air and others, depending on the O-Ring material (see Table 75)
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 76, as a function of the operating pressure and functional diameter.

### 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 dependent on medium.

\*\* In the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact our application engineers for assistance!



## MATERIALS

### Standard Application:

For hydraulic components in mineral oils containing zinc or medium with good lubricating performance

Seal ring: Turcon® T46

Energizer: NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on temperature

Set reference: T46N/T46N7/T46V

### Special Application:

Non-lubricating fluids or pneumatic applications require self-lubricating sealing materials. Therefore we recommend:

Seal ring: Turcon® T29

Energizer: NBR, 70 Shore A N or N7  
FKM, 70 Shore A V  
depending on temperature

Set reference: T29N/T29N7/T29V

Rough mating surface finish and improved leakage control

Seal ring: Zurcon® Z53

Energizer: NBR, 70 Shore A N or N7

Set reference: Z53N or Z53N7

**Table 75: Turcon® and Zurcon® materials for Stepseal® 2K**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and additives filled Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod) Steel plated (rod)	
		FKM-70	V	+14 to +392	Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics, high compressive strength, good sliding and wear properties, good extrusion resistance BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T08</b> Very high compressive strength, very good extrusion resistance High bronze filled Color: Light to dark brown	T08	NBR-70	N/N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392	Stainless steel Aluminum Bronze Alloys	
		EPDM-70	E**	-49 to +293		
<b>Turcon® T29</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, soft mating surfaces, good extrusion resistance Surface texture not suitable for gases High carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392	Stainless steel Aluminium Bronze	
		EPDM-70	E**	-49 to +293		

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI Max.
<b>Turcon® T05</b> For all lubricating hydraulic fluids, hard mating surfaces, very good slide properties, low friction. Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Turcon® T42</b> For all lubricating and non-lubricating hydraulic fluids, good chemical resistance, good dielectric properties Glass fiber filled + MoS <sub>2</sub> Color: Gray to blue	T42	NBR-70	N/N7	-22 to +212	Steel hardened	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T19</b> For all lubricating fluids and hydraulic oils without zinc, high sealing efficiency, good sliding and wear properties, mild to counter surface Mineral fiber filled Color: Dark green-gray	T19	NBR-70	N/N7	-22 to +212	Steel	5,000
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron Stainless steel	
<b>Zurcon® Z53***</b> For lubricating hydraulic fluids, high abrasion resistance, high extrusion resistance, limited chemical resistance Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron Ceramic coating Stainless steel	
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temp. resistance Ultra high molecular weight polyethylene Color: White to off-white	Z80	NBR-70	N/N7	-22 to +176	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Stainless steel Aluminum Bronze Ceramic coating	

\* The O-Ring Operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

\*\*\* max. Ø 90 inches (2,300mm).

BAM: Tested by "Bundes Anstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Piston Series)

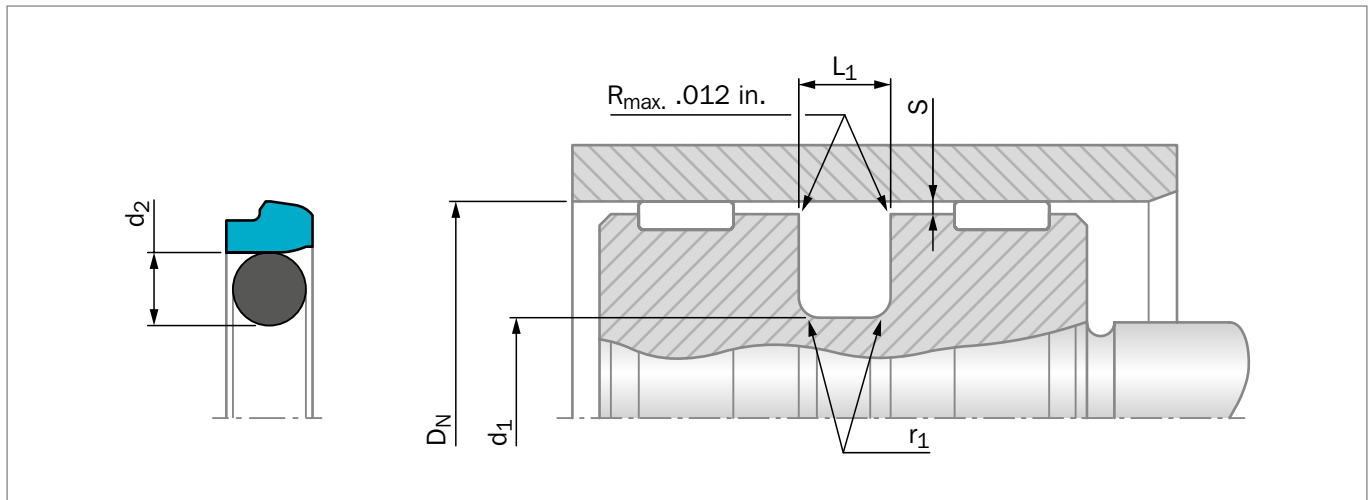


Figure 92: Installation drawing

**Table 76: Installation recommendation**

TSS Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ $+.008$	Radius $r_1$ max	Radial Clearance $S_{max}^*$			O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy-Duty Application				10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5800 psi	
PSF0	.313 - .749	.750 - 1.000	-	$D_N$ -.193	.087	.020	.012	.009	.007	.070
PSF1	.750 - 1.499	1.500 - 2.500	-	$D_N$ -.287	.126	.020	.016	.012	.008	.103
PSF2	1.500 - 2.499	2.500 - 8.000	.625 - 1.499	$D_N$ -.421	.165	.025	.016	.012	.009	.139
PSF3	2.500 - 7.999	8.000 - 10.000	1.00 - 2.499	$D_N$ -.594	.248	.030	.020	.014	.010	.210
PSF4	8.000 - 9.999	10.000 - 26.000	3.125 - 7.999	$D_N$ -.807	.319	.035	.024	.017	.012	.275
PSF5	10.000 - 26.000	-	5.250 - 9.999	$D_N$ -.945	.319	.035	.024	.017	.012	.275

\* At pressures >40 MPa (5.800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal.

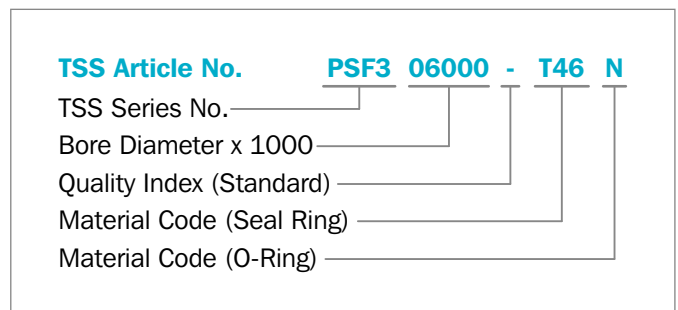
### ORDERING EXAMPLE

Turcon® Stepseal® 2K, complete with O-Ring, standard application, Series PSF3 (from Table 76).

**Piston diameter:**  $D_N = 6.000$  inches

**TSS Part No.:** PSF306000

Select the material from Table 75. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The Article Number can be determined following the example opposite.



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# Turcon® Stepseal® V



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Single-acting

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Rubber-energized plastic-faced seal

**Material:**

Turcon®, Zurcon® and Elastomer

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## ■ Turcon® Stepseal® V\*



### ■ Introduction

First invented by Trelleborg Sealing Solutions, a build-in check valve function eliminates pressure trap between seals in tandem sealing systems.

Stepseal® V has the efficient seal performance of the Turcon® Stepseal® range and the reliable prevention of pressure build-up brought by a refined check valve function. In dynamic applications Stepseal® V brings efficient, reliable sealing performance under even the most demanding service conditions.

Stepseal® V offers a uniform, low friction characteristic of the sealing system throughout its whole life, by preventing undefined pressurization of the secondary seal element.

### CHARACTERISTICS

- Primary seal with hydrostatic ventilation
- Check valve function
- Hydrodynamic back-pumping
- Stabilised position in the groove
- Prolonged seal life
- Increased leakage control
- Only usable with a secondary seal

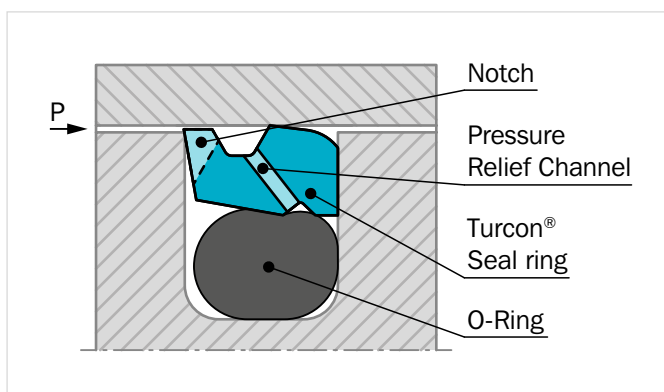


Figure 93: Turcon® Stepseal® V with tight axial groove fit

\* Patent DE 9654357; 24. 2. 996

### DESCRIPTION

Stepseal® V is a new generation primary seal designed for use in seal systems based on the dynamic, unidirectional Stepseal® sealing concept. Applied as a piston seal, Stepseal® V is preferably used with a double-acting seal from the Turcon® range of piston seals. Under extreme performance requirements Stepseal® V offers improved leakage control, extended service life and increased reliability.

The sealing performance of the patented Stepseal® V design – Figure 93 – results from a combination of the hydrodynamic properties of the seal and the O-Ring and the hydrostatic pressure relief check valve function.

The classic Stepseal® operation ensures a controlled pressure gradient that minimizes fluid adherence to the cylinder bore during the stroke, and enables residual fluid film on the bore to be returned under the seal on the return stroke.

The O-Ring check valve function controls the operation of the pressure relief channel: When the seal is pressurized by the system pressure the O-Ring keeps the channel closed to ensure that the hydraulic fluid is not passing through the channel and further between the groove wall and the Turcon® Seal Ring.

If the pressure is higher than the actual system pressure, appears between Stepseal® V and the secondary seal, the O-Ring opens the relief groove and the inter-seal pressure is immediately relieved.

Stepseal® V is available in high-grade Turcon® or Zurcon® materials with outstanding sliding and wear resistance properties.



**ADVANTAGES:**

- No pressure build-up on secondary sealing element and Excluder®
- Check valve function of O-Ring eliminates risk of fluid bypassing the seal during pressure loading when pressurised
- Independent of any speed relation of counter surface
- Independent of stroke length
- High tolerance to hardware non-concentricity and radial play
- Minimum contribution of friction of secondary sealing element
- Minimum wear of secondary sealing element
- Increased leakage control
- Prolonged seal life
- Increased operational reliability
- Fits standard Turcon® Stepseal® 2K groove dimensions as well as ISO 7425-1 seal housings

**APPLICATION EXAMPLES**

- Piston accumulators
- Single acting hydraulic cylinders
- Pistons with tandem sealing system
- Mobile crane boom cylinders
- Hydro plant cylinders
- Storm barrier cylinders
- Long stroke cylinders
- Gas spring suspension
- Piling Barges
- Theater hydraulics
- Safety systems

**OPERATING CONDITIONS**

<b>Pressure:</b>	Up to 7,250 psi (50 MPa) (Turcon® M12) Up to 8,700 psi (60 MPa) (Turcon® T08 and Zurcon® Z53)
<b>Speed:</b>	Up to 50 ft/s (15 m/s) with linear movements, frequency up to 15 Hz
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) depending on seal and O-Ring material

<b>Media:</b>	Mineral oil based hydraulic fluids, flame retardant hydraulic fluids, environmentally friendly hydraulic fluids (bio-oils), phosphate ester, water and others, depending on the seal and O-Ring material compatibility - see Table 78.
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 79, as a function of the operating pressure and functional diameter.

**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.

\* In the case of unpressurized applications in temperatures below 32 °F (0 °C) please contact your local Customer Solution Center for more information!

**SERIES**

Different cross section sizes are recommended as a function of the seal diameters.

Table 77 shows the relationship between the series number according to the seal diameter range and the different application class sizes:

Standard application:	General applications without exceptional operating conditions.
Light application:	Applications with demands for reduced friction or for smaller grooves.
Heavy-duty application:	For exceptional operating loads such as high pressures, pressure peaks, etc.

**Table 77: Available Range**

Series No.	Piston Diameter D <sub>N</sub> H9
PSVC	.625 - 7.874
PSVD	1.000 - 9.999
PSVE	2.375 - 25.999
PSVF	7.875 - 39.999
PSVG	10.000 - 106.000*
PSVH	26.000 - 106.000*

\*Sizes above 99.999 inches will reform to a metric part number

For the recommended Standard Application range see Table 79

### REDUNDANT SEALING SYSTEM

In many applications a secondary seal is needed e.g. for safety requirements. Figure 94 shows such a tandem configuration with Stepseal® V.

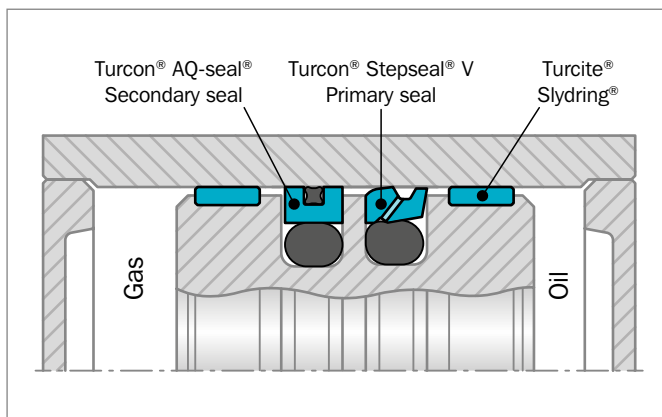


Figure 94: Tandem Turcon® Stepseal® V and Turcon® AQ-Seal® configuration in piston accumulator

When utilizing Stepseal® V, with valve function, there will be no pressure trap between the primary and secondary seals and no extra space between them is required to accumulate hydraulic fluid.

### INSTALLATION INSTRUCTIONS

Stepseal® V is installed according to information on page 145 to page 147.

Closed groove installation according to dimensions in Table 48 page 147.

### RECOMMENDED MATERIALS

The following material combinations have proven effective for hydraulic applications:

#### Turcon® Stepseal® V in Turcon® M12

All round material for light to heavy hydraulic applications with linear, short stroke or helical movements in mineral oils, flame retardant hydraulic fluids, phosphate ester, bio-oils or fluids having low lubricating properties:

O-Ring: NBR 70 Shore A N or N7  
FKM 70 Shore A V

Set code: M12N/M12N7/M12V

#### Turcon® Stepseal® V in Turcon® T46

For medium to heavy applications with linear movements in mineral oils and other media with good lubrication:

O-Ring: NBR 70 Shore A N or N7  
FKM 70 Shore A V

Set code: T46N/T46N7/T46V

For specific applications, all Turcon® materials are available.

Other material combinations are listed in Table 78.



**Table 78: Turcon® and Zurcon® Materials for Stepseal® V**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI max. Dynamic
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T05</b> For lubricating fluids Ideal for gas service Very low friction Very good sliding and sealing properties Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel	2,900
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392		
<b>Turcon® T08</b> For lubricating fluids and linear motion Very high compressive strength and extrusion resistance Hard counter surfaces are recommended Bronze filled Color: Light to dark brown, which may have variations in shading	T08	NBR-70	N/N7	-22 to +212	Steel hardened	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T10</b> For hydraulic and pneumatic applications For lubricating and non-lubricating fluids High extrusion resistance Good chemical resistance Not for electrically conducting fluids BAM tested Carbon, graphite filled Color: Black	T10	NBR-70	N/N7	-22 to +212	Steel	5,800
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +176		
<b>Turcon® T29</b> For lubricating and non-lubricating fluids Good extrusion resistance Surface texture is not suitable for gas sealing Not for electrically conducting fluids Carbon fiber filled Color: Gray	T29	NBR-70	N/N7	-22 to +212	Steel	4,350
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +176	Stainless steel	




Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	PSI max. Dynamic
<b>Turcon® T40</b> For lubricating and non-lubricating fluids High frequency and short strokes Water hydraulics Surface texture is not suitable for gas sealing Carbon fiber filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	3,625
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +176	Stainless steel Aluminum	
<b>Turcon® T46</b> For lubricated hydraulics in linear motion High compressive strength High extrusion resistance Very good sliding and wear properties BAM tested Bronze filled Color: Light to dark brown, which may have variations in shading	T46	NBR-70	N/N7	-22 to +212	Steel hardened	7,250
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Cast iron	
<b>Zurcon® Z53***</b> For mineral oil based fluids Very high abrasion and extrusion resistance For counter surface with rougher surface finish Limited chemical resistance Max. working temperature +230 °F Color: Yellow to light-brown	Z53	NBR-70	N/N7	-22 to +212	Steel	8,700
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Ceramic coating	
<b>Zurcon® Z80</b> For lubricating and non-lubricating fluids Water based fluids, air and gases Dry air pneumatics High abrasion and extrusion resistance For service in abrasive conditions and media with particles Good chemical resistance Limited temperature capability (-76 to +176 °F) UHMWPE (Ultra High Molecular Weight Polyethylene) Color: White to off-white	Z80	NBR-70	N/N7	-22 to +212	Steel	5,075
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		EPDM-70	E**	-49 to +176	Stainless steel Aluminum Ceramic coating	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil (except EPDM).

\*\* Material not suitable for mineral oils.

\*\*\* Max. diameter 90 inches (2,300 mm).

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

 Highlighted materials are recommended.



## ■ Installation Recommendation

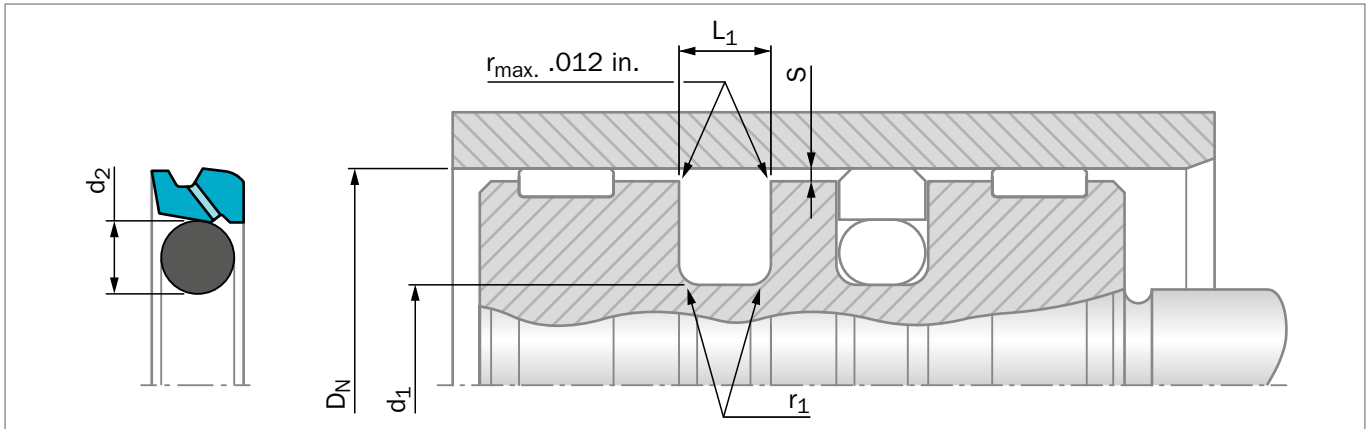


Figure 95: Installation Drawing

**Table 79: Installation Dimensions – Standard Recommendations**

TSS Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ $+.008$	Radius $r_1$	Radial Clearance $S_{max}^*$			O-Ring Cross Section $d_2$
	Standard Application	Light Application	Heavy Duty Application				10 Mpa 1500 psi	20 Mpa 3000 psi	40 Mpa 5800 psi	
PSVC	1.000 - 2.374	2.375 - 7.874	.625 - .999	$d_N - .421$	.165	.025	.020	.012	.008	.139
PSVD	2.375 - 7.874	7.875 - 9.999	1.000 - 2.374	$d_N - .594$	.248	.030	.028	.016	.010	.210
PSVE	7.875 - 9.999	10.000 - 25.999	2.375 - 7.874	$d_N - .807$	.319	.035	.031	.024	.014	.275
PSVF	10.000 - 25.999	26.000 - 39.999	7.875 - 9.999	$d_N - .945$	.319	.035	.035	.028	.016	.275
PSVG	26.000 - 39.999	$\geq 40.000$	10.000 - 25.999	$d_N - 1.075$	.374	.040	.039	.031	.020	.331
PSVH	$\geq 40.000$	-	26.000 - 39.999	$d_N - 1.496$	.543	.050	.047	.035	.024	.472

\* At pressures > 5,800 psi (40 MPa) use diameter tolerance H8/f8 (bore/piston) in the area behind seal or consult your local Customer Solution Center for alternative material or profiles.

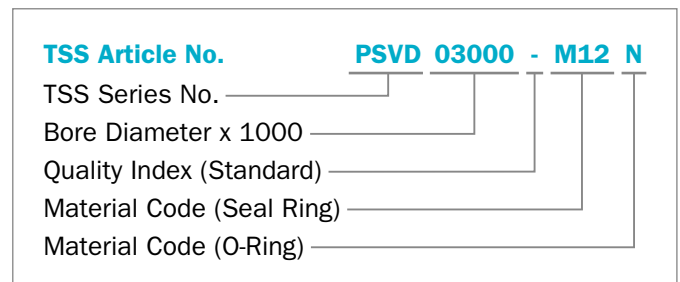
Slydring® / Wear Rings are not applicable at very small radial clearances please consult the Slydring® section in this catalog.

### ORDERING EXAMPLE

Turcon® Stepseal® V complete with O-Ring, standard application:

<b>Series:</b>	PSVD from Table 79
<b>Bore Diameter:</b>	$D_N = 3.000$ inches
<b>TSS Part No.:</b>	PSVD03000

Select the material from Table 78. The corresponding code numbers are appended to the TSS Part No. Together these form the TSS Article Number. The TSS Article Number for all intermediate sizes can be determined by following the example:





# Zurcon® Loaded U-Cup



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Single-acting U-Cup

---

Rubber Energized

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**Material:**

Zurcon® + NBR

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## Loaded U-Cup



### Description

In certain scenarios, conventional U-Cups can be prone to leakage at low pressure and temperature due to lack of loading on the sealing lips. The Zurcon® Loaded U-Cup is a strong choice for these situations as it can retrofit most common U-Cup grooves. The integrated O-Ring improves the performance in low pressure and low temperature applications. Polyurethane (Zurcon® Z06) is a proven material for U-cups due to its good mechanical properties. The Loaded U-Cup is a symmetrical seal that can be used as either a rod or piston seal.

### LOADED U-CUP

The Loaded U-Cup can be installed as a single seal for low to medium duty applications. In piston applications, it should only be used as a uni-directional seal in single acting cylinders.

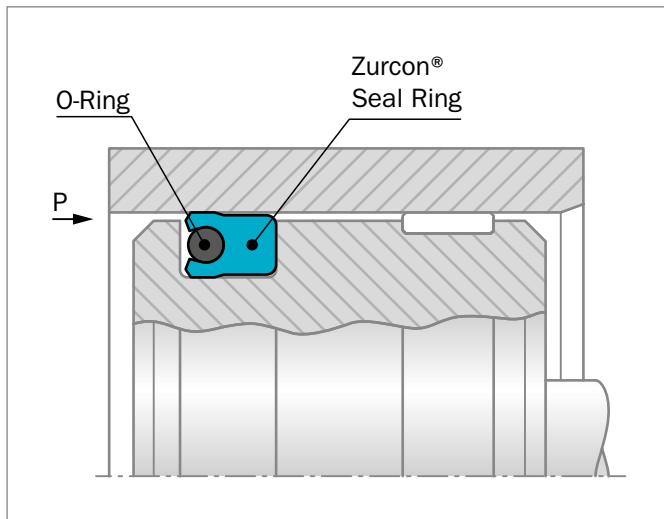


Figure 96: U-Cup, type RU6

### METHOD OF OPERATION

The sealing effect of the Loaded U-Cup comes from the intrinsic preload of the seal body and from the compression of the seal lip and the O-Ring during installation. In operating conditions, the radial contact forces are superimposed by the system pressure.

Due to the special design and the integrated O-Ring the Loaded U-Cup has excellent sealing behavior with and without pressure activation.

### ADVANTAGES

- Very good low pressure/temperature sealability
- Simple installation
- Very low compression set due to O-Ring
- Good fluid film breaking ability
- Good stability in groove

### - APPLICATION EXAMPLES

- General hydraulic cylinders
- Injection molding machines
- Lift trucks
- Agricultural and Construction Machinery

### OPERATING CONDITIONS

<b>Pressure:</b>	Max. 5,000 psi (as single element)
<b>Speed:</b>	Up to 1.5 ft/s
<b>Temperature:</b>	Use in mineral oils: -22 °F to +194 °F
<b>Media:</b>	Mineral oil-based hydraulic fluids.

### 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.

### CLEARANCE

**Table 80: Radial Clearance Loaded U-Cup**

Operating Pressure PSI max.	Radial Clearance $S_{max}$
1,500	.015
3,000	.010
5,000	.005

The values for  $S_{max}$  given in this table apply to the low-pressure side of the U-Cup. They are designed for an operating temperature of 140 °F (for harsh conditions and high side loads the gap must be reduced by 50%).



## MATERIAL

The thermoplastic polyurethane material Zurcon® Z06 has very good abrasion resistance, a low compression set and exhibits good resistance to clearance extrusion. The integrated O-Ring is a 70 shore A NBR material with a very low compression set.

U-Cup: Polyurethane 93 shore A  
Material code Z06

O-Ring: NBR 70 Shore A  
Material code N7

Set code: Z06N7

**Table 81: Materials**

Material Code	Material Description	Temp. Range	Application
Zurcon® Z06	Standard Polyurethane grade for hydraulic applications; 93 Shore A	-22 °F to +194 °F	Very good abrasion and extrusion resistance, minimal swelling in mineral oil, acceptable hydrolysis resistance.



## Installation Recommendation

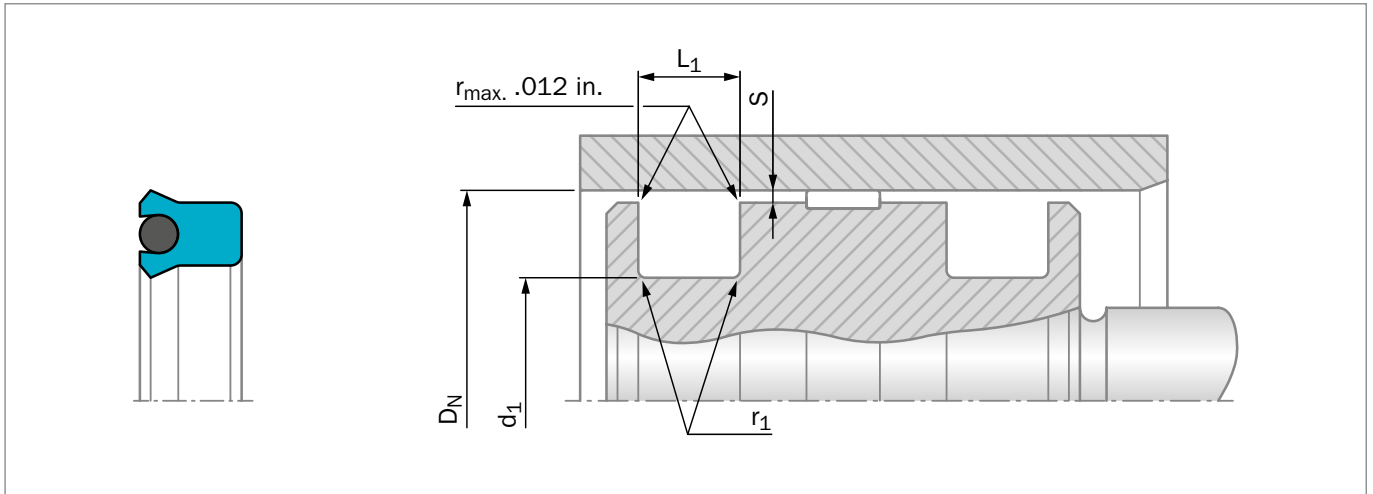


Figure 97: Installation Drawing

### ORDERING EXAMPLE

Loaded U-Cup

<b>Bore Diameter:</b>	$D_N = 3.000$ inches
<b>Groove Diameter*:</b>	$d_1 = 2.500$ inches
<b>Groove Width:</b>	$L_1 = .413$ inches
<b>TSS Part No.:</b>	RUL3E2500
<b>Compound code seal:</b>	Z06 blue-grey
<b>Compound code O-Ring:</b>	N7
<b>Material set code:</b>	Z06N7

<b>TSS Article No.</b>	<b>RUL 3E 2500 - Z06N7</b>
TSS Series No.	RUL
Cross Section Series	3E
Groove Diameter x 1000*	2500
Quality Index (Standard)	-
Material Code	Z06N7

\* The Loaded U-Cup is a symmetrical seal, and the part number scheme is based on the rod orientation.

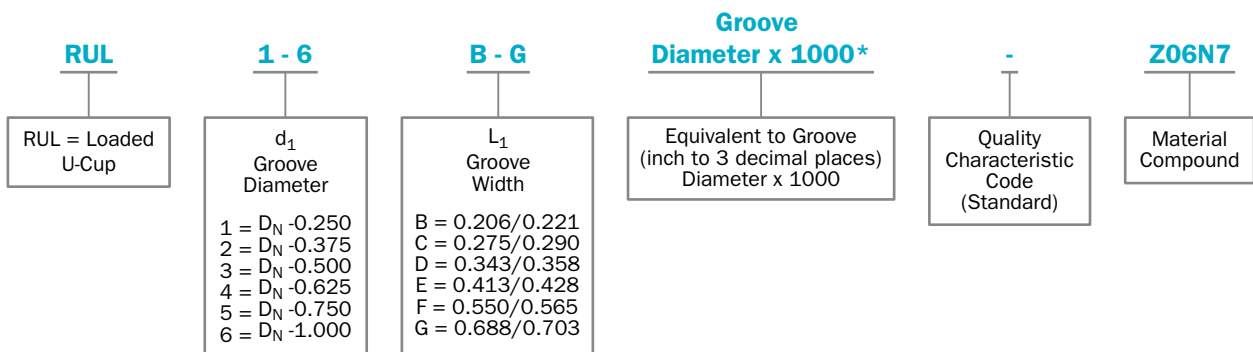




Table 82: Installation Dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.015		$D_N$ H9	$d_1$ h9	$L_1$ +.015	
.375	.125	.206	RUL1B0125	<b>4.000</b>	<b>3.500</b>	<b>.413</b>	<b>RUL3E3500</b>
.437	.187	.206	RUL1B0187	4.125	3.625	.413	RUL3E3625
.500	.250	.206	RUL1B0250	<b>4.250</b>	<b>3.750</b>	<b>.413</b>	<b>RUL3E3750</b>
.562	.312	.206	RUL1B0312	4.375	3.875	.413	RUL3E3875
.625	.375	.206	RUL1B0375	<b>4.500</b>	<b>4.000</b>	<b>.413</b>	<b>RUL3E4000</b>
.687	.437	.206	RUL1B0437	4.625	4.125	.413	RUL3E4125
<b>.750</b>	<b>.500</b>	<b>.206</b>	<b>RUL1B0500</b>	<b>4.750</b>	<b>4.250</b>	<b>.413</b>	<b>RUL3E4250</b>
.812	.562	.206	RUL1B0562	4.875	4.375	.413	RUL3E4375
<b>.875</b>	<b>.625</b>	<b>.275</b>	<b>RUL1C0625</b>	<b>5.000</b>	<b>4.500</b>	<b>.413</b>	<b>RUL3E4500</b>
.937	.687	.275	RUL1C0687	5.125	4.625	.413	RUL3E4625
<b>1.000</b>	<b>.750</b>	<b>.275</b>	<b>RUL1C0750</b>	5.250	4.750	.413	RUL3E4750
1.062	.812	.275	RUL1C0812	5.375	4.875	.413	RUL3E4875
<b>1.125</b>	<b>.875</b>	<b>.275</b>	<b>RUL1C0875</b>	5.500	5.000	.413	RUL3E5000
1.187	.937	.275	RUL1C0937	5.875	5.125	.688	RUL5G5125
<b>1.375</b>	<b>1.000</b>	<b>.343</b>	<b>RUL2D1000</b>	<b>6.000</b>	<b>5.250</b>	<b>.688</b>	<b>RUL5G5250</b>
1.437	1.062	.343	RUL2D1062	6.125	5.375	.688	RUL5G5375
<b>1.500</b>	<b>1.125</b>	<b>.343</b>	<b>RUL2D1125</b>	6.250	5.500	.688	RUL5G5500
1.562	1.187	.343	RUL2D1187	6.375	5.625	.688	RUL5G5625
<b>1.625</b>	<b>1.250</b>	<b>.343</b>	<b>RUL2D1250</b>	6.500	5.750	.688	RUL5G5750
1.687	1.312	.343	RUL2D1312	6.750	6.000	.688	RUL5G6000
<b>1.750</b>	<b>1.375</b>	<b>.343</b>	<b>RUL2D1375</b>	7.000	6.250	.688	RUL5G6250
1.812	1.437	.343	RUL2D1437	7.125	6.375	.688	RUL5G6375
<b>1.875</b>	<b>1.500</b>	<b>.413</b>	<b>RUL2E1500</b>	7.250	6.500	.688	RUL5G6500
1.937	1.562	.413	RUL2E1562	7.375	6.625	.688	RUL5G6625
<b>2.000</b>	<b>1.625</b>	<b>.413</b>	<b>RUL2E1625</b>	7.500	6.750	.688	RUL5G6750
2.062	1.687	.413	RUL2E1687	7.750	7.000	.688	RUL5G7000
<b>2.125</b>	<b>1.750</b>	<b>.413</b>	<b>RUL2E1750</b>	8.000	7.250	.688	RUL5G7250
<b>2.250</b>	<b>1.875</b>	<b>.413</b>	<b>RUL2E1875</b>	8.125	7.375	.688	RUL5G7375
2.312	1.937	.413	RUL2E1937	8.250	7.500	.688	RUL5G7500
<b>2.500</b>	<b>2.000</b>	<b>.413</b>	<b>RUL3E2000</b>	8.500	7.750	.688	RUL5G7750
2.625	2.125	.413	RUL3E2125				
<b>2.750</b>	<b>2.250</b>	<b>.413</b>	<b>RUL3E2250</b>				
2.875	2.375	.413	RUL3E2375				
<b>3.000</b>	<b>2.500</b>	<b>.413</b>	<b>RUL3E2500</b>				
3.062	2.562	.413	RUL3E2562				
<b>3.125</b>	<b>2.625</b>	<b>.413</b>	<b>RUL3E2625</b>				
<b>3.250</b>	<b>2.750</b>	<b>.413</b>	<b>RUL3E2750</b>				
3.375	2.875	.413	RUL3E2875				
<b>3.500</b>	<b>3.000</b>	<b>.413</b>	<b>RUL3E3000</b>				
3.625	3.125	.413	RUL3E3125				
<b>3.750</b>	<b>3.250</b>	<b>.413</b>	<b>RUL3E3250</b>				
3.875	3.375	.413	RUL3E3375				

# Turcon® Variseal® M2



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Single-Acting

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Spring-Energized Turcon® U-Cup

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**Material:**

Turcon® or Zurcon®

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## ■ Turcon® Variseal® M2

### ■ Description

The Turcon® Variseal® M2 is a single-acting seal consisting of a U-shaped seal jacket and a V-shaped corrosion-resistant spring.

The Variseal® M2 has an asymmetric seal profile. The heavy profile of its dynamic lip with an optimized front angle offers good leakage control, reduced friction and long service life.

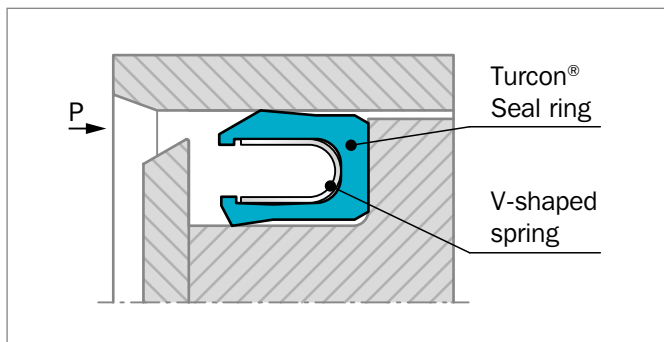


Figure 98: Turcon® Variseal® M2

At low and zero pressure, the metal spring provides the primary sealing force. As the system pressure increases, the main sealing force is achieved by the system pressure and ensures a tight seal from zero to high pressure.

The possibility of matching suitable materials for the seal and the spring allows use in a wide range of applications going beyond the field of hydraulics, e.g. in the chemical, pharmaceutical and foodstuffs industries.

The Variseal® M2 can be sterilized and is available in a special Hi-Clean version where the spring cavity is filled with a silicone gel preventing contaminants from being entrapped in the seal. This design also works well in applications involving mud, slurries or adhesives to keep grit from packing into the seal cavity and inhibiting the spring action.

For applications with highly viscous media, please contact your local Customer Solution Center.

Variseal® M2 seals can be installed in grooves to AS4716 and ISO 3771. The seals can only be installed to a limited extent in closed grooves. For installation instructions, see Table 50.

### ADVANTAGES

- Resistant to most fluids and chemicals
- Low coefficients of friction
- Stick-slip-free operating for precise control
- High abrasion resistance and dimensional stability
- Can handle rapid changes in temperature
- No contamination in contact with foodstuffs, pharmaceutical and medicinal fluids
- Sterilizable
- Unlimited shelf life

### APPLICATION EXAMPLES

The Turcon® Variseal® M2 is the recommended sealing element for all applications requiring stick-slip-free operation as well as chemical resistance against almost all media.

Some applications include:

- Valves
- Pumps
- Separators
- Actuators
- Dosing devices

It requires a mating surface of high quality to avoid high wear rates.

### TECHNICAL DATA

#### Operating conditions

<b>Pressure:</b>	For static loads: 5,800 psi (40 MPa) For dynamic loads: 2,900 psi (20 MPa)
<b>Speed:</b>	Reciprocating up to 50 ft/s (15 m/s) Rotating up to 4.2 ft/s (1.3 m/s)
<b>Temperature:</b>	-94 °F to +572 °F (-70 °C to +300 °C) For specific applications at lower temperatures, please contact your local Customer Solution Center.
<b>Media:</b>	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 dependent on medium.



**MATERIALS**

All materials used are physiologically safe. They have no odor or taste-affecting substances.

The following material combination has proved effective for most fluid applications:

Seal ring: Turcon® T40  
 Spring: Stainless steel, Material No. AISI 301  
 Material code S

For gas applications use:

Seal ring: T05 or Z80

For use in accordance with the demands of the Food and Drug Administration, suitable materials are available on request.

**Table 83: Turcon® and Zurcon® Materials for Variseal® M2**

Material, Applications, Properties	Code	Spring Material	Code	Operating Temp.* °F	Mating Surface Material	PSI Max.
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids, hydraulic oils without zinc, water hydraulic, hard mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: gray	T40	AISI 301	S	-94 to +500	Steel Cast iron Stainless steel Aluminium Bronze Alloys	5,800
<b>Turcon® T05</b> For all lubricating hydraulic fluids, soft mating surfaces, very good sliding properties, low friction Color: turquoise	T05	AISI 301	S	-94 to +500	Steel hardened	2,900
<b>Zurcon® Z80</b> For lubricating and non-lubricating hydraulic fluids, high abrasion resistance, very good chemical resistance, limited temperature resistance FDA compliance Ultra high molecular weight polyethylene Color: white to off-white	Z80	AISI 301	S	-94 to +176	Steel Stainless steel Aluminium Bronze Ceramic coating	5,800
<b>Zurcon® Z48</b> For tight sealing with long wear life, in applications without high temperatures or corrosive chemicals Colour: black	Z48	AISI 301	S	-76 to +266	Steel Steel chrome plated Cast iron Stainless steel Aluminium Bronze Alloys Ceramic coating	5,800

\* Depending on media.  
 Highlighted materials are standard.



## SPRING MATERIALS

The standard spring material for Turcon® Variseal® is stainless steel (spring code S).

**Table 84: Spring Material**

Media	Spring materials	Spring order code
<b>For General use e.g.</b> Oil Grease Air Water, steam Solvents Food, drugs Gas	<b>Stainless steel</b> DIN Mat No. 1.4310/1.4319 AISI 301/302 UNS 30100	S (Standard spring material)
<b>For use in corrosive media e.g.</b> Acids Caustics Seawater	<b>Hastelloy® C-276</b> DIN Mat No. 2.4819 UNS N10276	H
<b>For petrochemical use e.g.</b> Crude oil Sour gas	<b>Elgiloy® 1)</b> DIN Mat No. 2.4711 UNSR30003	E

- Hastelloy is a registered trademark of Haynes International, Inc.
- Elgiloy is a registered trademark of the Elgiloy Specialty Metals  
Alternative brand may be used.
- 1) NACE-approval

## Groove Design

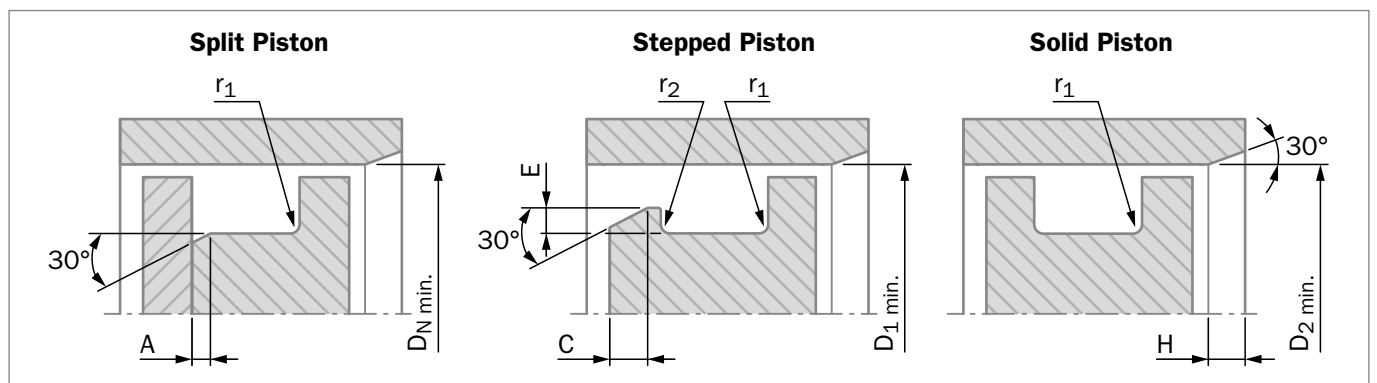


Figure 99: Variseal Groove Configurations

Installation lead-in chamfers and steps to include blend radii and are to be polished.

**Table 85: Dimensions for Groove Designs**

Series	Piston Diameter Recommendations		
	Split Groove Ø D <sub>N</sub> Minimum	Stepped Groove Ø D <sub>1</sub> Minimum	Solid Groove Ø D <sub>2</sub> Minimum
000	.236	.453	1.375
100	.394	.689	2.000
200	.630	.787	2.750
300	1.102	1.102	4.125
400	1.772	1.772	5.500
500	3.937	3.937	10.000



## ■ Installation Recommendation (Inch Piston Series)

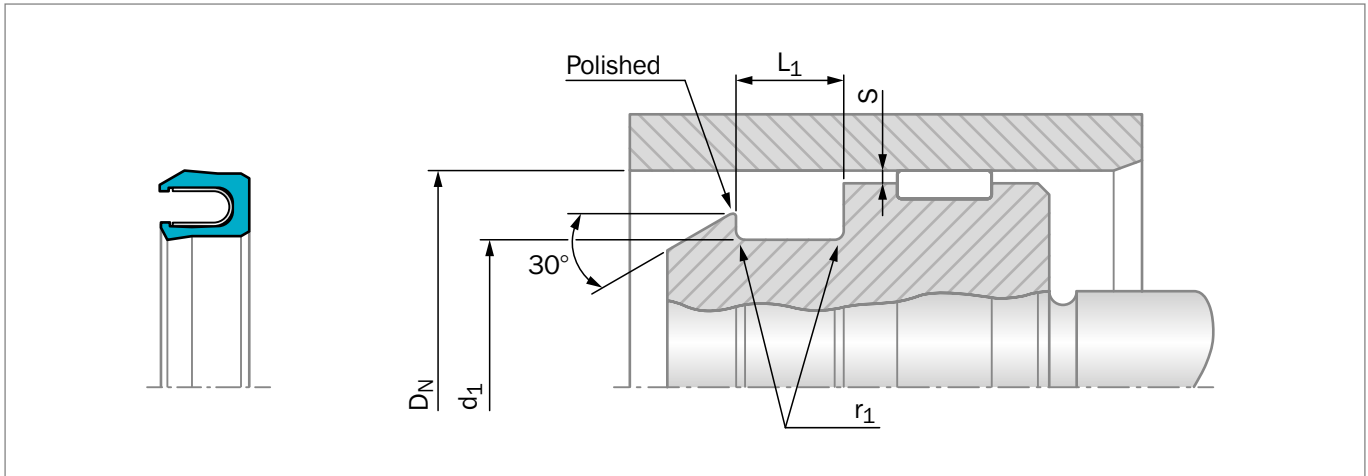


Figure 100: Installation drawing

**Table 86: Installation recommendation**

TSS Series No.	Groove Depth $(D_N - d_1)/2$ (Ref)	Groove Width $L_1$ +.010	Radius $r_1$ max	Radial Clearance $S_{max}^*$			
				2 MPa 300 psi	10 MPa 1500 psi	20 MPa 3000 psi	40 MPa 5000 psi
PVAA	.062	.094	.010	.008	.004	.003	.002
PVAB	.093	.141	.015	.010	.006	.004	.003
PVAC	.125	.188	.015	.014	.008	.006	.003
PVAD	.187	.281	.015	.020	.010	.008	.004
PVAE	.250	.375	.020	.024	.012	.010	.005
PVAG	.375	.591	.020	.030	.015	.012	.006

\* At pressures >40 MPa (5,800 psi) use diameter tolerance H8/f8 (bore/piston) in area of the seal.

### ORDERING EXAMPLE

Turcon® Variseal® M2, standard range, Series PVAD  
(from Table 86)

**Bore Diameter:**  $D_N = 2.500$  inches

**TSS Part No.:** PVADNB330 (from Table 87)

Select the material from Table 83. The corresponding code numbers are appended to the TSS Part No. (from Table 86). Together they form the TSS Article No.

For all intermediate sizes not shown in Table 86, the TSS Article No. can be determined from the example opposite.

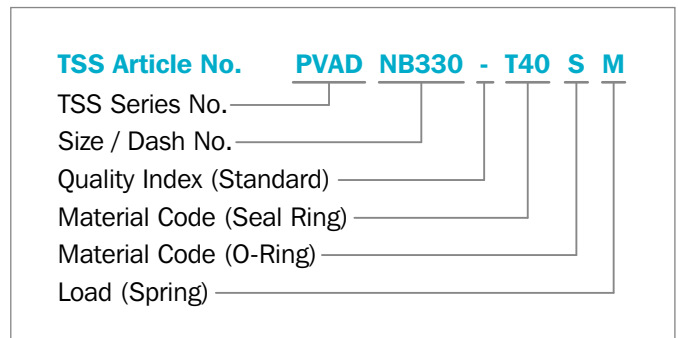




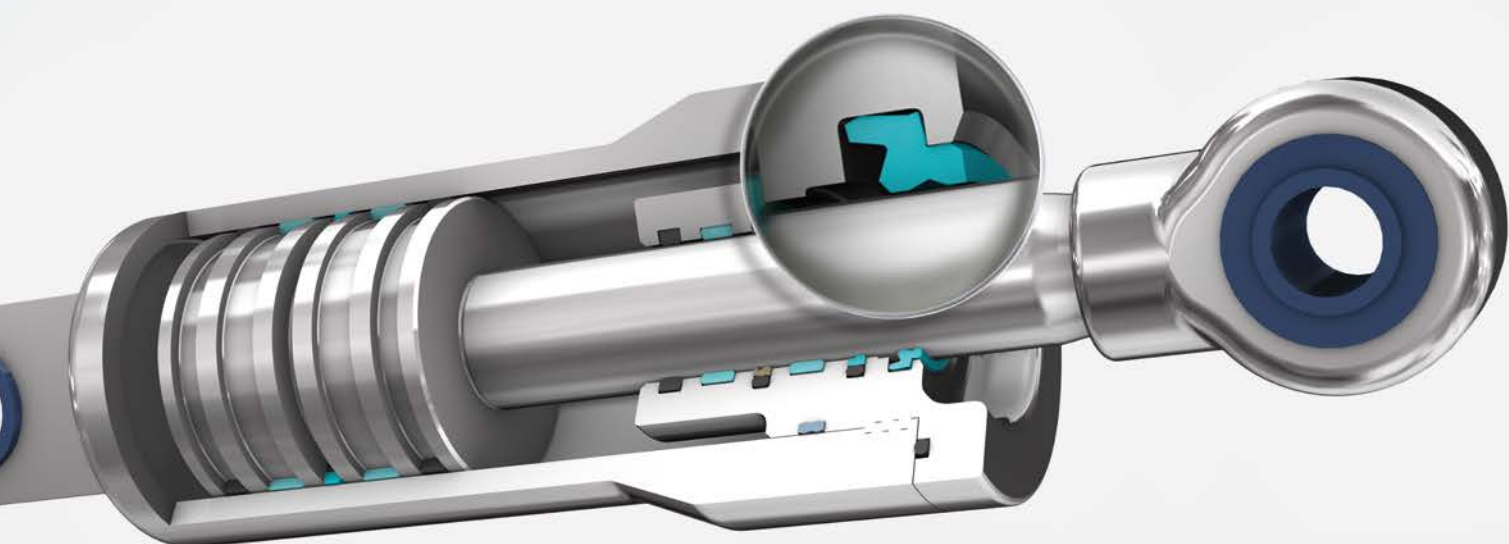
Table 87: Installation dimensions / TSS Part No.

Bore Diameter	Groove Diameter	Groove Width	TSS Part No.	Bore Diameter	Groove Diameter	Groove Width	TSS Part No.
$D_N$ H9	$d_1$ h9	$L_1$ +.010		$D_N$ H9	$d_1$ h9	$L_1$ +.010	
.250	.125	.094	PVAANB006	4.125	3.750	.281	PVADNB343
.313	.188	.094	PVAANB008	4.250	3.875	.281	PVADNB344
.375	.187	.141	PVABNB106	4.375	4.000	.281	PVADNB345
.438	.250	.141	PVABNB108	4.500	4.125	.281	PVADNB346
.500	.312	.141	PVABNB109	4.625	4.125	.375	PVAENB422
.563	.375	.141	PVABNB110	4.750	4.250	.375	PVAENB423
.625	.437	.141	PVABNB111	4.875	4.375	.375	PVAENB424
.688	.500	.141	PVABNB112	5.000	4.500	.375	PVAENB425
.750	.500	.188	PVACNB206	5.125	4.625	.375	PVAENB426
.813	.563	.188	PVACNB207	5.250	4.750	.375	PVAENB427
.875	.625	.188	PVACNB208	5.375	4.875	.375	PVAENB428
.938	.688	.188	PVACNB209	5.500	5.000	.375	PVAENB429
1.000	.750	.188	PVACNB210	5.625	5.125	.375	PVAENB430
1.063	.813	.188	PVACNB211	5.750	5.250	.375	PVAENB431
1.125	.875	.188	PVACNB212	6.000	5.500	.375	PVAENB433
1.188	.938	.188	PVACNB213	6.250	5.750	.375	PVAENB435
1.250	1.000	.188	PVACNB214	6.500	6.000	.375	PVAENB437
1.313	1.063	.188	PVACNB215	6.750	6.250	.375	PVAENB438
1.375	1.125	.188	PVACNB216	7.000	6.500	.375	PVAENB439
1.438	1.188	.188	PVACNB217	7.250	6.750	.375	PVAENB440
1.500	1.125	.281	PVADNB320	7.500	7.000	.375	PVAENB441
1.625	1.250	.281	PVADNB322	7.750	7.250	.375	PVAENB442
1.750	1.375	.281	PVADNB324	8.000	7.500	.375	PVAENB443
1.875	1.500	.281	PVADNB325	8.500	8.000	.375	PVAENB445
2.000	1.625	.281	PVADNB326	9.000	8.500	.375	PVAENB446
2.125	1.750	.281	PVADNB327	9.500	9.000	.375	PVAENB447
2.250	1.875	.281	PVADNB328	10.000	9.500	.375	PVAENB448
2.375	2.000	.281	PVADNB329	10.500	10.000	.375	PVAENB449
2.500	2.125	.281	PVADNB330	11.000	10.500	.375	PVAENB450
2.625	2.250	.281	PVADNB331	11.500	11.000	.375	PVAENB451
2.750	2.375	.281	PVADNB332	12.000	11.500	.375	PVAENB452
2.875	2.500	.281	PVADNB333	12.500	12.000	.375	PVAENB453
3.000	2.625	.281	PVADNB334	13.000	12.500	.375	PVAENB454
3.125	2.750	.281	PVADNB335	13.500	13.000	.375	PVAENB455
3.250	2.875	.281	PVADNB336	14.000	13.500	.375	PVAENB456
3.375	3.000	.281	PVADNB337	14.500	14.000	.375	PVAENB457
3.500	3.125	.281	PVADNB338	15.000	14.500	.375	PVAENB458
3.625	3.250	.281	PVADNB339	15.500	15.000	.375	PVAENB459
3.750	3.375	.281	PVADNB340				
3.875	3.500	.281	PVADNB341				
4.000	3.625	.281	PVADNB342				

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# Scrapers



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## Contents

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**250**    **Choice of the Scraper Element**

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**253**    **Zurcon® Scraper DA 22**

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**259**    **Zurcon® Scraper DA 24**

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**265**    **Zurcon® Scraper WAE**

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**271**    **Zurcon® Scraper SWP**

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**277**    **Turcon® Excluder® 2**

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**287**    **Turcon® Excluder® 5**

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## ■ Choice of the Scraper Element

Scrapers are installed in hydraulic cylinders to wipe any dirt, foreign particles, chips, moisture, etc. from the rod as it is retracted into the system. This prevents contamination of the hydraulic fluid, which would damage wear rings, seals and other components.

Single and double-acting scrapers are available, depending on the application and the sealing system. Single-acting scrapers are designed to keep out contamination from the outside; double-acting scrapers have the additional function of regulating the fluid film to avoid any external leakage.

In order to satisfy both the different technical and economic demands, there is a complete range of scrapers with optimized geometries made with high-quality materials.

Before selecting the scraper and the material, it is essential to know all the desired functional parameters. The table on the following pages allows a preliminary choice of the scraper type and material, according to the specific requirements of the application.

Further application information together with specific design and installation instructions for the particular scraper type and material can be found in this catalog.

## NOTES ON ORDERING







All multi-element standard scrapers are supplied as a complete set. The supply includes the scraper and energizing element.

Designs of scrapers no longer contained in this catalog continue to be available.

The sizes contained in this catalog are generally available from stock and can be supplied on short notice. We reserve the right to modify our article structure without prior notice.

Please do not hesitate to contact your local Customer Solution Center for further information on specific applications and special technical questions.

Table 88: Selection Criteria for Scrapers

Scraper		Application			Size Range	Groove Type	Action		Technical Data*		Recommended Scraper Material
Type	Page	Field of Application			Inch	Inch	Single	Double	Temp. Range**	Velocity	
			Light	Medium					Heavy	°F	
Zurcon® Scraper DA 22 	253	ISO standard cylinder	•	•	•	.250 - 7	Split <.709 Closed >.709	•	-30/+212	3.3	Zurcon® Z201
		Industrial hydraulic cylinders	•	•	•						
Zurcon® Scraper DA 24 	259	Mobile hydraulics	•	•	•	.500 - 10.000	Closed	•	-30/+212	3.3	Zurcon® Z201
		Construction machinery	•	•	•						
		Agriculture machinery	•	•	•						
Zurcon® Scraper WAE 	265	Agriculture machinery	•	•	.250 - 8	Split <.515 Closed >.515	•	-30/+212	3.3	Zurcon® Z06	
		Mobile hydraulic machinery	•	•							
Zurcon® Scraper SWP 	271	Construction machinery		•	•	.650 - 6	Open	•	-30/+212	3.3	Zurcon® Z201 + Metal
		Link pin seals		•	•						
Turcon® Excluder® 2 	277	Industrial hydraulics	•	•	•	.250 - 102	Split <1.181 Closed >1.181	•	-49/+392	50	Turcon® M12
		Machine Tools	•	•	•						
		Injection molding machines	•	•	•						Turcon® T46
		Servo hydraulic cylinders	•	•	•						
		Robotics	•	•	•						
Turcon® Excluder® 5 	287	Heavy duty mobile and industrial hydraulics	•	•	•	.750 - 102	Split <1.181 Closed >1.181	•	-49/+392	50	Turcon® M12
		Presses	•	•	•						Turcon® T46
		Steel mills	•	•	•						.750 - 86

\* The data above are maximum values and cannot be used at the same time.

\*\* Temperature range depends on choice of elastomer material and media.

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# Zurcon® Scraper DA 22



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Double-Acting

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**Material:**  
Zurcon® Polyurethane

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## ■ Zurcon® Scraper DA 22

### ■ Description

The DA 22 is a double-acting polyurethane scraper for closed groove installation. Significant improvements are achieved in profile geometry and material used if compared with conventional elastomeric scrapers.

The scraper lip is designed so that it effectively removes dirt while leaving only the oil film which is required for correct operation. The radial squeeze is sufficient to remove particles, dust and water.

The sealing lip, which faces inward, assumes a sealing function even under low pressure. The static seal is achieved by a tight radial fit between the scraper body and the groove.

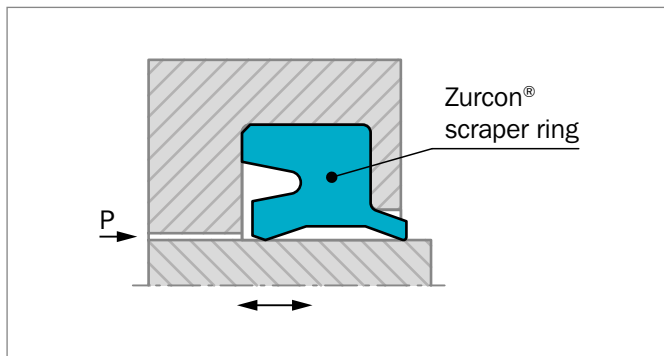


Figure 101: Scraper DA 22

### ADVANTAGES

- Good scraping effect
- Wear resistant, long service life
- Retaining residual oil film
- Standard elements for standardized installation grooves

### APPLICATION EXAMPLES

Due to the outstanding wiping capacities, the DA22 scraper is recommended wherever there are dusty and humid conditions, especially for the following applications:

- ISO standard cylinders
- Industrial hydraulic cylinders
- Agriculture machinery

### TECHNICAL DATA

#### Operating conditions

<b>Pressure</b>	Atmospheric pressure
<b>Scraper Side:</b>	
<b>Seal Side:</b>	Pressures up to 290 psi (2 MPa) A relief port must be provided with higher pressures.
<b>Velocity:</b>	Up to 3.3 ft/s (1 m/s)
<b>Temperature:</b>	-30 °F to +212 °F (-35 °C to +100 °C)
<b>Media:</b>	Mineral oils and greases
<b>Groove Type:</b>	Closed

### 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 dependent on medium.

### MATERIALS

Standard application:

Zurcon® Polyurethane:	92 Shore A
Material Code:	Z201
Color:	Turquoise
Standard:	6195 Type C



## ■ Installation Recommendation (Inch Series)

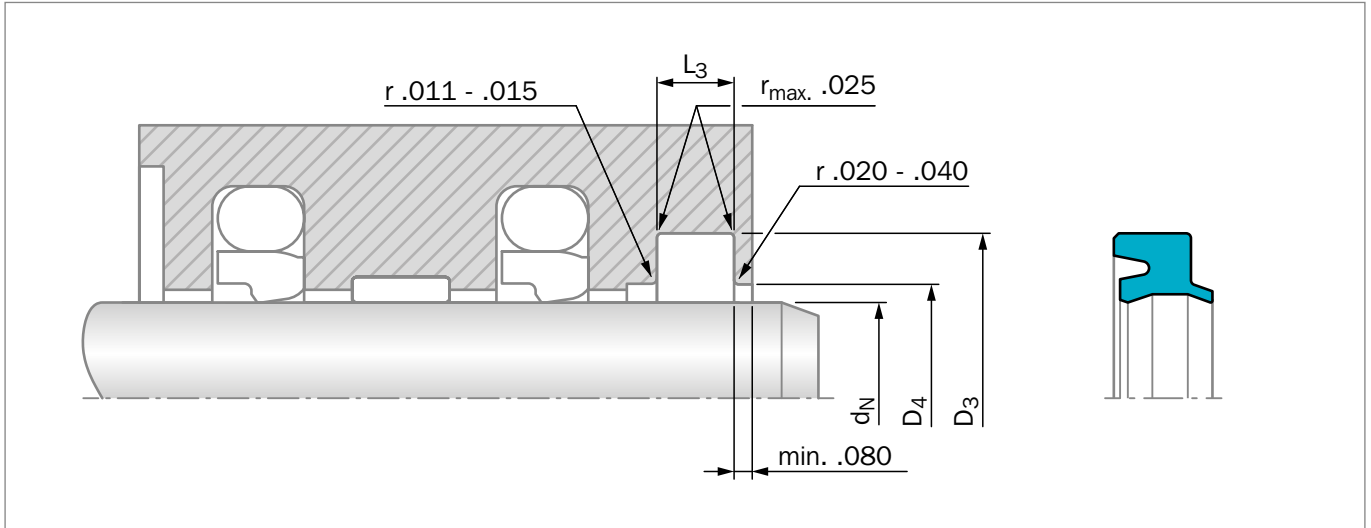


Figure 102: Installation drawing

**Table 89: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9	Groove Diameter	Relief Diameter	Groove Width	Radius
	Standard Application	$D_3$ H9	$D_4$ H11	$L_3$ +.008	$r_{max}$
WDE1	.250 - .812	$d_N + .302$	$d_N + .120$	.203	.025
WDE2	.813 - 2.499	$d_N + .365$	$d_N + .135$	.218	.025
WDE3	2.500 - 7.000	$d_N + .495$	$d_N + .195$	.281	.025

### ORDERING EXAMPLE

Zurcon® Scraper DA 22

<b>Rod Diameter:</b>	$d_N = 2.000$ inches
<b>TSS Part No.:</b>	WDE202000
<b>Material Code:</b>	Z201

**TSS Article No.** WDE2 02000 - Z201

TSS Series No. \_\_\_\_\_

Rod Diameter x 1000 \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code \_\_\_\_\_





Table 90: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	Bore Diameter	TSS Part No.
$d_N$ f8/h9	$D_3$ H9	$L_3$ +.008	$D_4$ h11	
<b>.500</b>	<b>.802</b>	<b>.203</b>	<b>.620</b>	<b>WDE100500</b>
<b>.625</b>	<b>.927</b>	<b>.203</b>	<b>.745</b>	<b>WDE100625</b>
<b>.750</b>	<b>1.052</b>	<b>.203</b>	<b>.870</b>	<b>WDE100750</b>
<b>.875</b>	<b>1.240</b>	<b>.218</b>	<b>1.010</b>	<b>WDE200875</b>
<b>1.000</b>	<b>1.365</b>	<b>.218</b>	<b>1.135</b>	<b>WDE201000</b>
<b>1.125</b>	<b>1.490</b>	<b>.218</b>	<b>1.260</b>	<b>WDE201125</b>
<b>1.250</b>	<b>1.615</b>	<b>.218</b>	<b>1.385</b>	<b>WDE201250</b>
<b>1.375</b>	<b>1.740</b>	<b>.218</b>	<b>1.510</b>	<b>WDE201375</b>
<b>1.500</b>	<b>1.865</b>	<b>.218</b>	<b>1.635</b>	<b>WDE201500</b>
<b>1.625</b>	<b>1.990</b>	<b>.218</b>	<b>1.760</b>	<b>WDE201625</b>
<b>1.750</b>	<b>2.115</b>	<b>.218</b>	<b>1.885</b>	<b>WDE201750</b>
<b>1.875</b>	<b>2.240</b>	<b>.218</b>	<b>2.010</b>	<b>WDE201875</b>
<b>2.000</b>	<b>2.365</b>	<b>.218</b>	<b>2.135</b>	<b>WDE202000</b>
2.125	2.490	.218	2.260	WDE202125
<b>2.250</b>	<b>2.745</b>	<b>.281</b>	<b>2.445</b>	<b>WDE302250</b>
2.375	2.870	.281	2.570	WDE302375
<b>2.500</b>	<b>2.995</b>	<b>.281</b>	<b>2.695</b>	<b>WDE302500</b>
<b>2.750</b>	<b>3.245</b>	<b>.281</b>	<b>2.945</b>	<b>WDE302750</b>
<b>3.000</b>	<b>3.495</b>	<b>.281</b>	<b>3.195</b>	<b>WDE303000</b>
3.250	3.745	.281	3.445	WDE303250
3.500	3.995	.281	3.695	WDE303500
3.750	4.245	.281	3.945	WDE303750
4.000	4.495	.281	4.195	WDE304000
4.250	4.745	.281	4.445	WDE304250
4.500	4.995	.281	4.695	WDE304500
4.750	5.245	.281	4.945	WDE304750
5.000	5.495	.281	5.195	WDE305000
5.250	5.745	.281	5.445	WDE305250
5.500	5.995	.281	5.695	WDE305500
5.750	6.245	.281	5.945	WDE305750
6.000	6.495	.281	6.195	WDE306000
6.500	6.995	.281	6.695	WDE306500
7.000	7.495	.281	7.195	WDE307000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).  
Up to .7 inches (18mm) diameter we recommend a split groove.

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# Zurcon® Scraper DA 24



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Double-Acting

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**Material:**

Zurcon® Polyurethane

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## ■ Zurcon® Scraper DA 24

### ■ Description

The DA 24 is a double-acting scraper made of polyurethane. It is ideal for severe operating conditions and heavy attack of dirt.

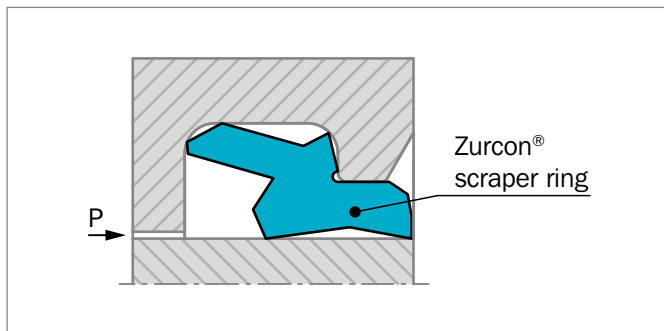


Figure 103: Scraper DA 24

The special design of the inward-facing sealing lip contributes to an optimum contact pressure resulting in a very high scraper effect of the residual oil film.

The outward-facing scraper lip leans against the housing. This ensures an optimum sealing force and prevents the penetration of dirt and water across the groove bottom. Also in heavily contaminated environments and high piston rod offset, the scraping effect remains stable. The polyurethane material ensures a high service life, even under demanding conditions, and ensures against installation damage.

### ADVANTAGES

- Very good scraper effect of the outward lip
- Very good sealing effect of the inward lip
- Reliable at side steering of the piston rod
- Sturdy and wear-resistant
- Simple installation

### APPLICATION EXAMPLES

The scraper DA 24 is especially suitable for applications in:

- Construction machinery
- Agriculture and forestry machinery
- Mobile hydraulics
- High attack of dirt
- Side steering of piston rod

Scraper DA 24 is used in connection with our rod seal system Zurcon® RU-9 and Zurcon® Buffer seal.

### TECHNICAL DATA

Operating conditions:

<b>Pressure:</b>	Max. 725 psi (5 MPa)
<b>Velocity:</b>	Up to 3.3 ft/s (1 m/s) For applications at high strokes and higher speed, please contact your local Customer Solution Center.
<b>Temperature:</b>	-30 °F to +212 °F (-35 °C to +100 °C)
<b>Media:</b>	Mineral oil-based hydraulic fluids

### 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 dependent on medium.

### MATERIAL

The scraper DA 24 consists of Zurcon® polyurethane material with high wearability, low deformation and high resistance to extrusion.

Standard application:

Zurcon® Polyurethane:	92 Shore A
Material Code:	Z201
Color:	Turquoise



## ■ Installation Recommendation (Inch Series)

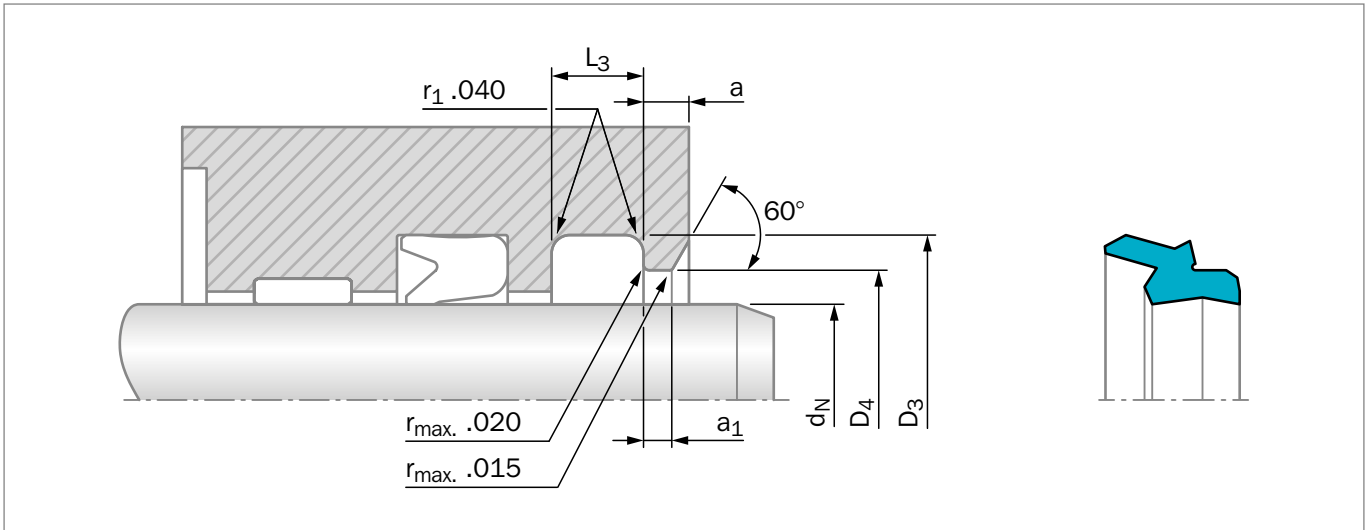


Figure 104: Installation drawing

**Table 91: Installation recommendation**

TSS Series No.	Rod Diameter	Groove Diameter	Relief Diameter	Groove Width	Step Width	Step Width
	$d_N$ f8/h9	$D_3$ H9	$D_4$ H9	$L_3$ +.008	$a$ min.	$a_1$ min.
WDG0	.500 - 1.499	$d_N + .299$	$d_N + .150$	.165	.118	.063
WDG1	1.500 - 2.749	$d_N + .346$	$d_N + .173$	.248	.125	.080
WDG2	2.750 - 4.500	$d_N + .480$	$d_N + .236$	.319	.160	.100
WDG3	4.501 - 10.000	$d_N + .630$	$d_N + .315$	.374	.195	.120

### ORDERING EXAMPLE

Zurcon® Scraper DA 24

**Rod diameter:**  $d_N = 2.500$  inches

**TSS Part No.:** WDG102500

**Material Code:** Z201

**TSS Article No.** WDG1 02500 - Z201

TSS Series No. \_\_\_\_\_

Rod Diameter x 1000 \_\_\_\_\_

Quality Index (Standard) \_\_\_\_\_

Material Code \_\_\_\_\_

### NOTES:

- 1) Tolerances used are per ISO-286 ISO System Of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.



Table 92: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	Relief Diameter	Step Width	Step Width	TSS Part No.
$d_N$ f8/h9	$D_3$ H9	$L_3$ +.008	$D_4$ H9	a min.	$a_1$ min.	
<b>.750</b>	<b>1.049</b>	<b>.165</b>	<b>.900</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG000750</a>
<b>.875</b>	<b>1.174</b>	<b>.165</b>	<b>1.025</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG000875</a>
<b>1.000</b>	<b>1.299</b>	<b>.165</b>	<b>1.150</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG001000</a>
<b>1.125</b>	<b>1.424</b>	<b>.165</b>	<b>1.275</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG001125</a>
<b>1.250</b>	<b>1.549</b>	<b>.165</b>	<b>1.400</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG001250</a>
<b>1.375</b>	<b>1.674</b>	<b>.165</b>	<b>1.525</b>	<b>.118</b>	<b>.063</b>	<a href="#">WDG001375</a>
<b>1.500</b>	<b>1.846</b>	<b>.248</b>	<b>1.673</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG101500</a>
<b>1.750</b>	<b>2.096</b>	<b>.248</b>	<b>1.923</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG101750</a>
<b>2.000</b>	<b>2.346</b>	<b>.248</b>	<b>2.060</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG102000</a>
<b>2.250</b>	<b>2.596</b>	<b>.248</b>	<b>2.310</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG102250</a>
<b>2.500</b>	<b>2.846</b>	<b>.248</b>	<b>2.560</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG102500</a>
<b>2.750</b>	<b>3.230</b>	<b>.319</b>	<b>2.810</b>	<b>.125</b>	<b>.080</b>	<a href="#">WDG202750</a>
<b>3.000</b>	<b>3.480</b>	<b>.319</b>	<b>3.080</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG203000</a>
<b>3.250</b>	<b>3.730</b>	<b>.319</b>	<b>3.330</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG203250</a>
<b>3.500</b>	<b>3.980</b>	<b>.319</b>	<b>3.580</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG203500</a>
<b>3.750</b>	<b>4.230</b>	<b>.319</b>	<b>3.830</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG203750</a>
<b>4.000</b>	<b>4.480</b>	<b>.319</b>	<b>4.080</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG204000</a>
<b>4.500</b>	<b>4.980</b>	<b>.319</b>	<b>4.580</b>	<b>.160</b>	<b>.100</b>	<a href="#">WDG204500</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment). Other dimensions and all intermediate sizes up to 10 inches (250mm) diameter can be supplied.

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# Zurcon® Scraper WAE



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Single-Acting

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**Material:**  
Zurcon® Polyurethane

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## ■ Zurcon® Scraper WAE

### ■ Description

The WAE is a single-acting polyurethane scraper.

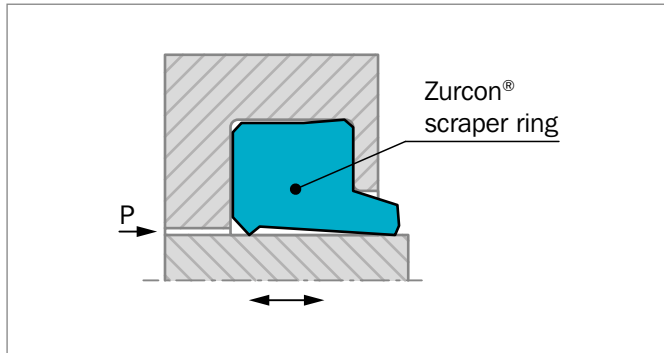


Figure 105: Scraper WAE

The special feature of this scraper is an additional support on the inner surface. It prevents tilting or twisting of the scraper in the groove. At the same time this support improves the firm seating in the groove, preventing the penetration of impurities via the back of the scraper. This represents a technical improvement compared to similar scraper types.

### ADVANTAGES

- Simple groove design
- Very good scraping effect, wear-resistant
- No tilting or twisting in the groove
- Simple installation
- Flush fitting with the outer surface

### TECHNICAL DATA

<b>Velocity:</b>	Up to 3.3 ft/s (1 m/s)
<b>Temperature:</b>	-22 °F to +194 °F (-30 °C to +90 °C)
<b>Media:</b>	Mineral oil-based hydraulic fluids

### 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 dependent on medium.

### MATERIAL

Standard application:

Zurcon® Polyurethane: 93 Shore A

Material Code: Z06

Color: Blue-Grey



## ■ Installation Recommendation (Inch Series)

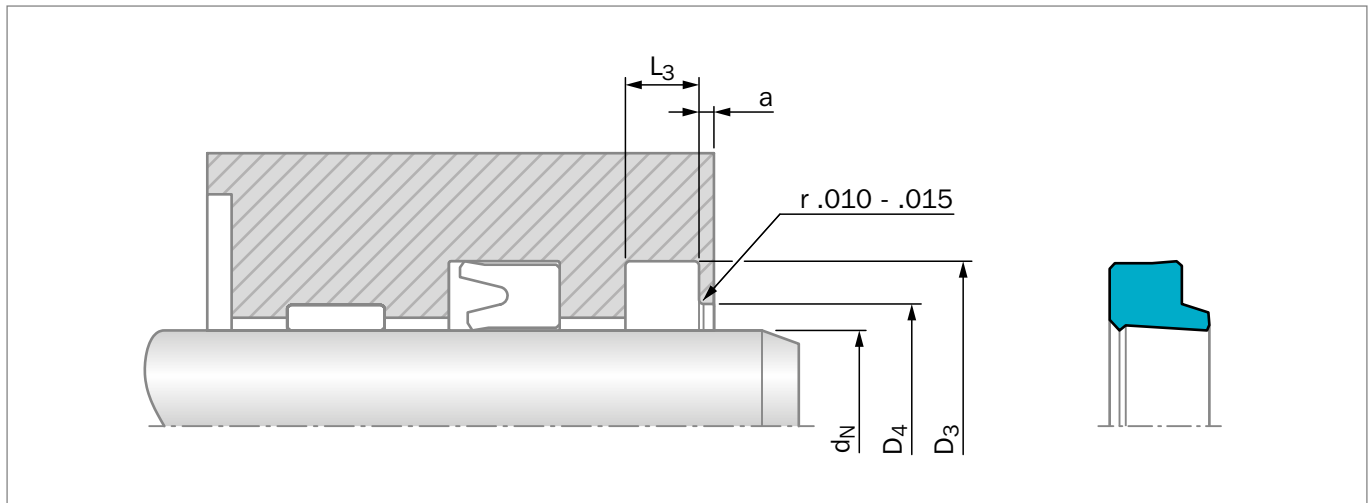


Figure 106: Installation drawing

**Table 93: Installation recommendation**

TSS Series No.	Rod Diameter	Groove Diameter	Relief Diameter	Groove Width
	$d_N$ f8/h9	$D_3$ H9	$D_4$ H11	$L_3$ +.015
WAE1	.250 - .687	$d_N + .250$	$d_N + .160$	.125
WAE2	.688 - 1.999	$d_N + .375$	$d_N + .240$	.187
WAE3	2.000 - 4.375	$d_N + .500$	$d_N + .325$	.250
WAE4	3.625 - 4.375	$d_N + .625$	$d_N + .405$	.312
WAE5	4.376 - 8.000	$d_N + .750$	$d_N + .485$	.375
WAE6	7.000 - 10.000	$d_N + 1.000$	$d_N + .650$	.500

### ORDERING EXAMPLE

Zurcon® Scraper WAE

<b>Rod diameter:</b>	$d_N = 2.500$ inches
<b>TSS Part No.:</b>	WAE302500 (from Table 94)
<b>Material:</b>	Z06

<b>TSS Article No.</b>	<b>WAE3 02500 - Z06</b>
TSS Series No.	WAE3
Rod Diameter x 1000	02500
Quality Index (Standard)	
Material Code	Z06

### NOTES:

- 1) Tolerances used are per ISO-286 ISO System Of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.
- 2) Grooves are ISO 6195 Type D to the nearest inch size and typical to industry standards



Table 94: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	Relief Diameter	Step Width	TSS Part No.
$d_N$ f8/h9	$D_3$ H9	$L_3$ +.008	$D_4$ H11	$a$ min.	
.250	.500	.125	.410	.079	WAE100250
<b>.312</b>	<b>.562</b>	<b>.125</b>	<b>.472</b>	<b>.079</b>	<b>WAE100312</b>
.375	.625	.125	.535	.079	WAE100375
.437	.687	.125	.597	.079	WAE100437
<b>.500</b>	<b>.750</b>	<b>.125</b>	<b>.660</b>	<b>.079</b>	<b>WAE100500</b>
<b>.625</b>	<b>.875</b>	<b>.125</b>	<b>.785</b>	<b>.079</b>	<b>WAE100625</b>
<b>.750</b>	<b>1.125</b>	<b>.187</b>	<b>.995</b>	<b>.079</b>	<b>WAE200750</b>
<b>.875</b>	<b>1.250</b>	<b>.187</b>	<b>1.120</b>	<b>.079</b>	<b>WAE200875</b>
<b>1.000</b>	<b>1.375</b>	<b>.187</b>	<b>1.245</b>	<b>.079</b>	<b>WAE201000</b>
<b>1.125</b>	<b>1.500</b>	<b>.187</b>	<b>1.370</b>	<b>.079</b>	<b>WAE201125</b>
<b>1.250</b>	<b>1.625</b>	<b>.187</b>	<b>1.497</b>	<b>.079</b>	<b>WAE201250</b>
<b>1.375</b>	<b>1.750</b>	<b>.187</b>	<b>1.622</b>	<b>.079</b>	<b>WAE201375</b>
<b>1.500</b>	<b>1.875</b>	<b>.187</b>	<b>1.747</b>	<b>.079</b>	<b>WAE201500</b>
<b>1.625</b>	<b>2.000</b>	<b>.187</b>	<b>1.872</b>	<b>.079</b>	<b>WAE201625</b>
<b>1.750</b>	<b>2.125</b>	<b>.187</b>	<b>1.997</b>	<b>.079</b>	<b>WAE201750</b>
<b>1.875</b>	<b>2.250</b>	<b>.187</b>	<b>2.122</b>	<b>.079</b>	<b>WAE201875</b>
<b>2.000</b>	<b>2.500</b>	<b>.250</b>	<b>2.327</b>	<b>.079</b>	<b>WAE302000</b>
<b>2.125</b>	<b>2.625</b>	<b>.250</b>	<b>2.452</b>	<b>.079</b>	<b>WAE302125</b>
<b>2.250</b>	<b>2.750</b>	<b>.250</b>	<b>2.577</b>	<b>.079</b>	<b>WAE302250</b>
2.375	2.875	.250	2.702	.079	WAE302375
<b>2.500</b>	<b>3.000</b>	<b>.250</b>	<b>2.827</b>	<b>.079</b>	<b>WAE302500</b>
2.625	3.125	.250	2.952	.079	WAE302625
<b>2.750</b>	<b>3.250</b>	<b>.250</b>	<b>3.077</b>	<b>.079</b>	<b>WAE302750</b>
2.875	3.375	.250	3.202	.079	WAE302875
<b>3.000</b>	<b>3.500</b>	<b>.250</b>	<b>3.327</b>	<b>.079</b>	<b>WAE303000</b>
3.250	3.750	.250	3.577	.079	WAE303250
<b>3.500</b>	<b>4.000</b>	<b>.250</b>	<b>3.827</b>	<b>.079</b>	<b>WAE303500</b>
3.750	4.250	.250	4.077	.079	WAE303750
3.875	4.375	.250	4.202	.079	WAE303875
4.000	4.500	.250	4.327	.079	WAE304000
4.250	4.750	.250	4.577	.079	WAE304250
4.500	5.250	.375	4.993	.079	WAE504500
4.750	5.500	.375	5.243	.079	WAE504750
5.000	5.750	.375	5.493	.079	WAE505000
5.250	6.000	.375	5.743	.079	WAE505250
5.500	6.250	.375	5.993	.079	WAE505500
5.750	6.500	.375	6.243	.079	WAE505750
6.000	6.750	.375	6.493	.079	WAE506000
6.250	7.000	.375	6.743	.079	WAE506250
6.500	7.250	.375	6.993	.079	WAE506500



<b>Rod Diameter</b>	<b>Groove Diameter</b>	<b>Groove Width</b>	<b>Relief Diameter</b>	<b>Step Width</b>	<b>TSS Part No.</b>
<b><math>d_N</math></b> f8/h9	<b><math>D_3</math></b> H9	<b><math>L_3</math></b> +.008	<b><math>D_4</math></b> H11	<b>a</b> min.	
6.750	7.500	.375	7.243	.079	WAE506750
7.000	7.750	.375	7.493	.079	WAE507000
7.500	8.250	.375	7.993	.079	WAE507500
8.000	8.750	.375	8.493	.079	WAE508000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment). Other dimensions and all intermediate sizes up to 10 inches (250mm) diameter can be supplied. A split groove is required up to 0.600 inches (14mm) diameter.

# Zurcon® Scraper SWP



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Single-Acting

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Metal-Encased Wiper

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For Open Groove Assembly

**Material:**

Zurcon® Polyurethane and Metal

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## ■ Zurcon® Scraper SWP

### ■ Description

The SWP is a polyurethane single-lipped scraper with integrated metal reinforcement for open groove assembly. It is typically used in severe applications where there is abrasion due to solid matter on the rod surface.

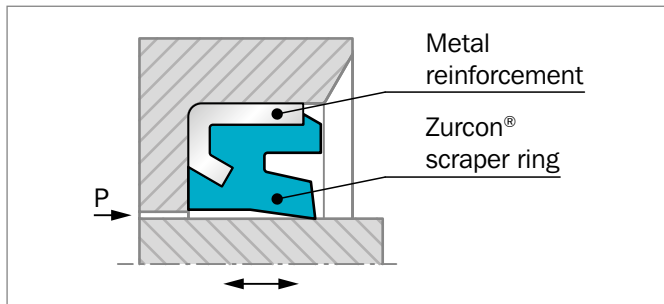


Figure 107: Scraper SWP

### ADVANTAGES

- Space-saving construction
- Simple small installation groove
- Firm fit in the groove due to metallic press fit
- At regreasing of drag bearing, the scraper lip opens at low overpressure; old grease can escape
- High wear resistance / long life

### APPLICATION EXAMPLES

Due to their outstanding wiping capacities SWP scrapers are recommended wherever there are dusty and humid conditions and especially for the following applications:

- Mobile hydraulic machinery
- Construction machinery
- Link pin seals
- Lift trucks
- Truck cargo cranes
- Agriculture machinery

### TECHNICAL DATA

Operating conditions

<b>Velocity:</b>	Up to 3.3 ft/s (1 m/s)
<b>Temperature:</b>	-30 °F to +212 °F (-35 °C to +100 °C)
<b>Media:</b>	Mineral oil based hydraulic fluids
<b>Groove Type:</b>	Open

### 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.

### MATERIALS

Standard application

Zurcon® Polyurethane:	92 Shore A
Color:	Turquoise
Metal case:	Non alloyed steel
Material set code:	Z2022



## ■ Installation Recommendation (Inch Series)

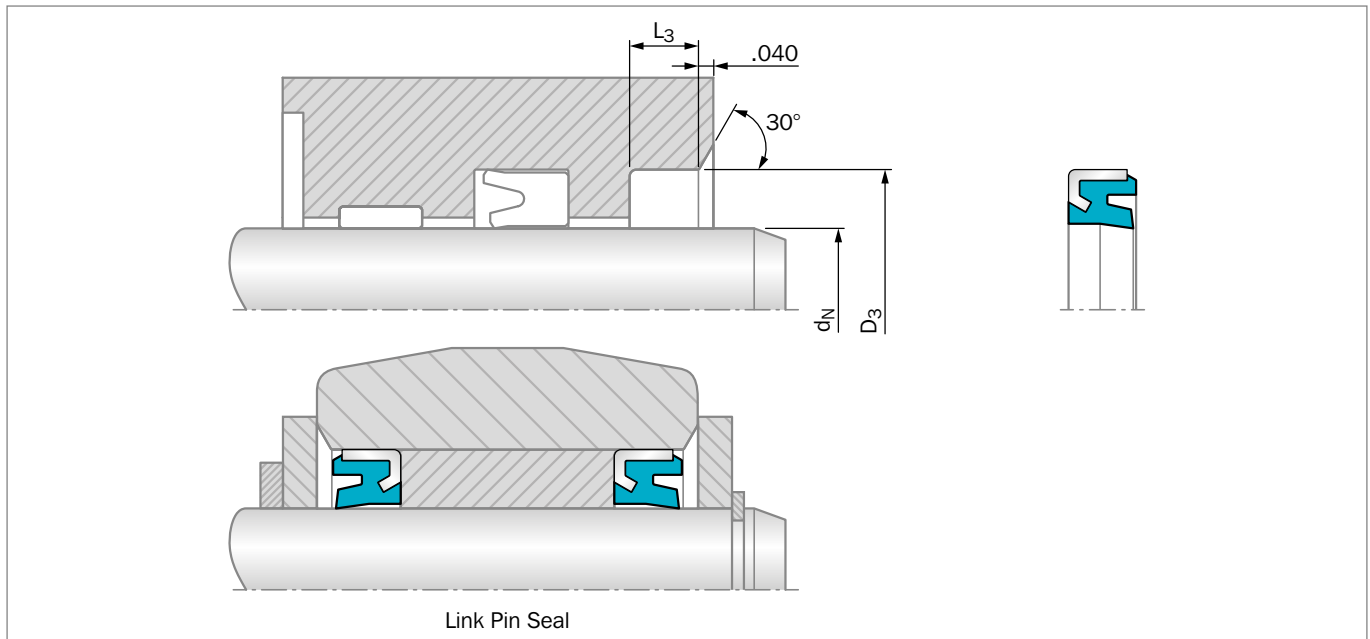


Figure 108: Installation drawing

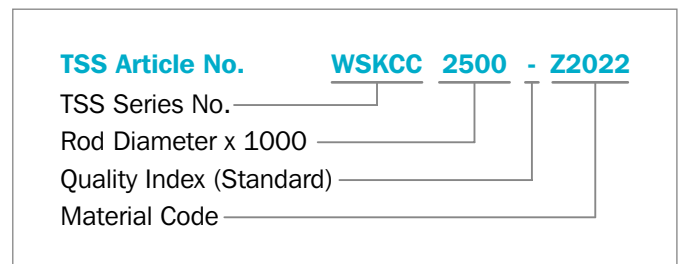
**Table 95: Installation recommendation**

TSS Series	Rod Diameter	Groove Diameter	Groove Width
	$d_N$ f8/h9	$D_3$ H9	$L_3$ +.015
WSKCB	.625 - 2.000	$d_N$ +.500	.250
WSKCC	.625 - 3.000	$d_N$ +.500	.313
WSKDC	2.500 - 5.250	$d_N$ +.625	.313
WSKDD	3.000 - 6.000	$d_N$ +.625	.375
WSKED	4.000 - 6.000	$d_N$ +.750	.375
WSKFF	5.000 - 6.000	$d_N$ +1.000	.500

### ORDERING EXAMPLE

Zurcon® Scraper SWP

<b>Rod Diameter:</b>	$d_N$ = 2.500 inches
<b>Groove Diameter:</b>	$D_3$ = 3.000 inches
<b>TSS Part No.:</b>	WSKCC2500
<b>Material Set-Code:</b>	Z2022 (standard)



### NOTES:

- 1) Tolerances used are per ISO-286 ISO System Of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.

**Table 96: Installation dimensions / TSS Part No.**

Rod Diameter	Groove Diameter	Groove Width	TSS Part No.
$d_N$	$D_3$	$L_3$	
f8/h9	H9	+.015	
<b>.625</b>	<b>1.125</b>	<b>.313</b>	<a href="#">WSKCC0625-Z2022</a>
<b>.750</b>	<b>1.250</b>	<b>.313</b>	<a href="#">WSKCC0750-Z2022</a>
<b>.875</b>	<b>1.375</b>	<b>.313</b>	<a href="#">WSKCC0875-Z2022</a>
<b>1.000</b>	<b>1.500</b>	<b>.313</b>	<a href="#">WSKCC1000-Z2022</a>
<b>1.125</b>	<b>1.625</b>	<b>.313</b>	<a href="#">WSKCC1125-Z2022</a>
<b>1.250</b>	<b>1.750</b>	<b>.313</b>	<a href="#">WSKCC1250-Z2022</a>
<b>1.375</b>	<b>1.875</b>	<b>.313</b>	<a href="#">WSKCC1375-Z2022</a>
<b>1.500</b>	<b>2.000</b>	<b>.313</b>	<a href="#">WSKCC1500-Z2022</a>
<b>1.625</b>	<b>2.125</b>	<b>.313</b>	<a href="#">WSKCC1625-Z2022</a>
<b>1.750</b>	<b>2.250</b>	<b>.313</b>	<a href="#">WSKCC1750-Z2022</a>
<b>1.875</b>	<b>2.375</b>	<b>.313</b>	<a href="#">WSKCC1875-Z2022</a>
<b>2.000</b>	<b>2.500</b>	<b>.313</b>	<a href="#">WSKCC2000-Z2022</a>
<b>2.250</b>	<b>2.750</b>	<b>.313</b>	<a href="#">WSKCC2250-Z2022</a>
<b>2.500</b>	<b>3.000</b>	<b>.313</b>	<a href="#">WSKCC2500-Z2022</a>
<b>2.750</b>	<b>3.250</b>	<b>.313</b>	<a href="#">WSKCC2750-Z2022</a>
<b>3.000</b>	<b>3.500</b>	<b>.313</b>	<a href="#">WSKCC3000-Z2022</a>
3.500	4.125	.313	<a href="#">WSKDC3500-Z2022</a>
3.750	4.375	.313	<a href="#">WSKDC3750-Z2022</a>
4.000	4.625	.313	<a href="#">WSKDC4000-Z2022</a>
4.250	4.875	.313	<a href="#">WSKDC4250-Z2022</a>
4.500	5.125	.313	<a href="#">WSKDC4500-Z2022</a>
5.000	5.625	.375	<a href="#">WSKDD5000-Z2022</a>
5.250	5.875	.375	<a href="#">WSKDD5250-Z2022</a>
5.500	6.125	.375	<a href="#">WSKDD5500-Z2022</a>
6.000	6.625	.375	<a href="#">WSKDD6000-Z2022</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Turcon® Excluder® 2



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Double-Acting

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O-Ring-Energized Scraper

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**Material:**

Turcon® , Zurcon® and Elastomer

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## Turcon® Excluder® 2

### Description

The Turcon® Excluder® 2 is a double-acting scraper with two geometrically different scraper lips which are installed back-to-back. The Excluder® 2 is installed together with an elastic O-Ring in one groove. The scraper function is performed by the Excluder® 2. The O-Ring maintains the pressure of the scraper lips against the sliding surface and can compensate for any deflections of the piston rod.

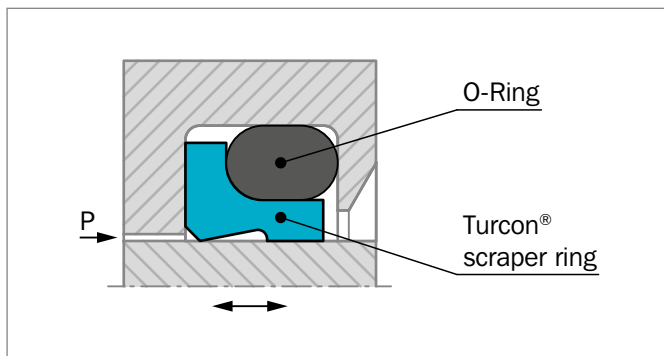


Figure 109: Turcon® Excluder® 2

The Excluder® 2 has two functions:

- Scrape contaminants from the retracting piston rod
- Hold back the residual oil film on the extending piston rod on the medium side

The Excluder® 2 is used with the Turcon® Stepseal® 2K, i.e. seals with a hydrodynamic back-pumping function.

### ADVANTAGES

- Outstanding sliding properties
- Stick-slip-free
- Can compensate for deflections of the piston rod or plunger
- Space-saving construction
- Very good scraping effect against outside contaminants, even with firmly adhered dirt, etc.
- Very good scraping effect from the inside against the residual oil film adhering to the surface of the piston rod
- Very high resistance to hydraulic media
- Available for all diameters up to 102.000 inches (2,600mm) (Turcon®) and up to 86.000 inches (2,200mm) (Zurcon®)

### TECHNICAL DATA

<b>Velocity:</b>	Up to 50 ft/s (15 m/s) for Turcon® materials Up to 6.5 ft/s (2 m/s) for Zurcon® materials
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water, air and others, depending on the O-Ring material.

### 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 dependent on medium.

### MATERIALS

The following material combination has proven effective for most applications:

Excluder® :	Turcon® T46
O-Ring:	NBR, 70 Shore A N or N7
Set Code:	T46N or T46N7
Standard:	6195 Type D

For other applications, other material combinations as listed in Table 97, may also be used.

### DESIGN AND INSTALLATION INSTRUCTIONS

Excluder® 2 scrapers can be installed in split and closed grooves (For installation dimensions, see Table 98). Installation in closed grooves depends on the rod diameter, profile cross-section of the scraper and on the cord cross section of the corresponding O-Ring.



**Table 97: Turcon® and Zurcon® Materials for Excluder® 2**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	Speed Ft/s max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	50
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod)	
		FKM-70	V	+14 to +392	Steel plated (rod) Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics High compressive strength Good sliding and wear properties BAM tested Bronze filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	50
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids Hydraulic oils without zinc Water hydraulic, soft mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	50
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392	Cast iron	
		EPDM-70	E**	-49 to +293	Stainless steel Aluminum Bronze Alloys	
<b>Turcon® T05</b> For all lubricating hydraulic fluids Hard mating surfaces Very good slide properties Low friction Color: Turquoise	T05	NBR-70	N/N7	-22 to +212	Steel hardened	50
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		

Table continues on next page





Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	Speed Ft/s max.
<b>Zurcon® Z54</b> For lubricating hydraulic fluids High abrasion resistance Color: Turquoise	Z54	NBR-70	N/N7	-22 to +212	Steel	6.5
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated Cast iron Stainless steel Ceramic coating Aluminium Bronze Alloys	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are standard.



## ■ Installation Recommendation (Inch Series)

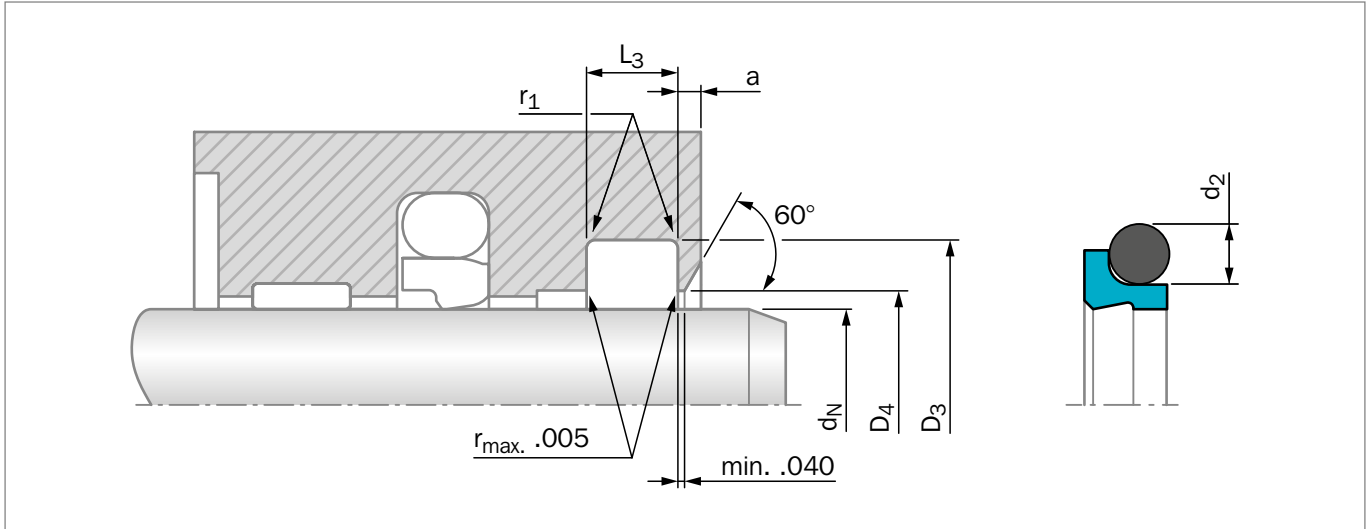


Figure 110: Installation drawing

**Table 98: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_3$ H9	Relief Diameter $D_4$ H11	Groove Width $L_3$ +.008	Radius $r_1$ max	O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application					
WE20	.313 - .499	.500 - 5.125	-	$d_N + .190$	$d_N + .060$	.146	.015	.070
WE21	.500 - 2.499	2.500 - 9.625	.375 - .499	$d_N + .270$	$d_N + .060$	.196	.015	.103
WE22	2.500 - 9.999	10.000 - 15.750	1.000 - 2.499	$d_N + .345$	$d_N + .060$	.236	.015	.139
WE23	10.000 - 16.999	17.000 - 25.750	1.625 - 9.999	$d_N + .480$	$d_N + .080$	.332	.035	.210
WE24	17.000 - 19.999	20.000 - 25.750	4.375 - 16.999	$d_N + .630$	$d_N + .080$	.434	.035	.275

For diameters >15.7 inches (400mm) we recommend the use of Turcon® Excluder® 5.

### ORDERING EXAMPLE

Turcon® Excluder® 2 with O-Ring, NBR

**Rod diameter:**  $d_N = 2.500$  inches

**Series:** WE22 (from Table 98)

**TSS Part No.:** WE2202500 (from Table 99)

**TSS Article No.** WE22 02500 - T46 N

TSS Series No. WE22

Rod Diameter x 1000 02500

Quality Index (Standard) - T46

Material Code (Scraper) - N

Material Code (O-Ring)

### NOTES:

- 1) Tolerances used are per ISO-286 ISO System Of Limits and Fits. The tolerances are converted from metric and rounded to the nearest three place decimal.



Table 99: Installation dimensions / TSS Part No.

Rod Diameter	Groove Diameter	Groove Width	Relief Diameter	Step Width	TSS Part No.
$d_N$ f8/h9	$D_3$ H9	$L_3$ +.008	$D_4$ H11	a min	
.500	.690	.196	.560	.079	<a href="#">WE2100500</a>
.625	.815	.196	.685	.079	<a href="#">WE2100625</a>
.750	.940	.196	.810	.079	<a href="#">WE2100750</a>
.875	1.065	.196	.935	.079	<a href="#">WE2100875</a>
1.000	1.190	.196	1.060	.079	<a href="#">WE2101000</a>
1.125	1.315	.196	1.185	.079	<a href="#">WE2101125</a>
1.250	1.440	.196	1.310	.079	<a href="#">WE2101250</a>
1.375	1.565	.196	1.435	.079	<a href="#">WE2101375</a>
1.500	1.770	.196	1.560	.079	<a href="#">WE2101500</a>
1.563	1.833	.196	1.623	.079	<a href="#">WE2101563</a>
1.625	1.895	.196	1.685	.079	<a href="#">WE2101625</a>
1.688	1.958	.196	1.748	.079	<a href="#">WE2101687</a>
1.750	2.020	.196	1.810	.079	<a href="#">WE2101750</a>
1.813	2.083	.196	1.873	.079	<a href="#">WE2101812</a>
1.875	2.145	.196	1.935	.079	<a href="#">WE2101875</a>
1.938	2.208	.196	1.998	.079	<a href="#">WE2101938</a>
2.000	2.270	.196	2.060	.079	<a href="#">WE2102000</a>
2.125	2.395	.196	2.185	.079	<a href="#">WE2102125</a>
2.250	2.520	.196	2.310	.079	<a href="#">WE2102250</a>
2.375	2.645	.196	2.435	.079	<a href="#">WE2102375</a>
2.500	2.845	.236	2.560	.118	<a href="#">WE2202500</a>
2.625	2.970	.236	2.685	.118	<a href="#">WE2202625</a>
2.750	3.095	.236	2.810	.118	<a href="#">WE2202750</a>
2.875	3.220	.236	2.935	.118	<a href="#">WE2202875</a>
3.000	3.345	.236	3.060	.118	<a href="#">WE2203000</a>
3.125	3.470	.236	3.185	.118	<a href="#">WE2203125</a>
3.250	3.595	.236	3.310	.118	<a href="#">WE2203250</a>
3.375	3.720	.236	3.435	.118	<a href="#">WE2203375</a>
3.500	3.845	.236	3.560	.118	<a href="#">WE2203500</a>
3.625	3.970	.236	3.685	.118	<a href="#">WE2203625</a>
3.750	4.095	.236	3.810	.118	<a href="#">WE2203750</a>
3.875	4.220	.236	3.935	.118	<a href="#">WE2203875</a>
4.000	4.345	.236	4.060	.118	<a href="#">WE2204000</a>
4.125	4.470	.236	4.185	.118	<a href="#">WE2204125</a>
4.250	4.595	.236	4.310	.118	<a href="#">WE2204250</a>
4.375	4.720	.236	4.435	.118	<a href="#">WE2204375</a>
4.500	4.845	.236	4.560	.118	<a href="#">WE2204500</a>
4.625	4.970	.236	4.685	.118	<a href="#">WE2204625</a>
4.750	5.095	.236	4.810	.118	<a href="#">WE2204750</a>
4.875	5.220	.236	4.935	.118	<a href="#">WE2204875</a>



Rod Diameter	Groove Diameter	Groove Width	Relief Diameter	Step Width	TSS Part No.
$d_N$ f8/h9	$D_3$ H9	$L_3$ +.008	$D_4$ H11	$a$ min	
5.000	5.345	.236	5.060	.118	WE2205000
5.125	5.470	.236	5.185	.118	WE2205125
5.250	5.595	.236	5.310	.118	WE2205250
5.375	5.720	.236	5.435	.118	WE2205375
5.500	5.845	.236	5.560	.118	WE2205500
5.625	5.970	.236	5.685	.118	WE2205625
5.750	6.095	.236	5.810	.118	WE2205750
6.000	6.345	.236	6.060	.118	WE2206000
6.250	6.595	.236	6.310	.118	WE2206250
6.500	6.845	.236	6.560	.118	WE2206500
6.750	7.095	.236	6.810	.118	WE2206750
7.000	7.345	.236	7.060	.118	WE2207000
7.250	7.595	.236	7.310	.118	WE2207250
7.500	7.845	.236	7.560	.118	WE2207500
7.750	8.095	.236	7.810	.118	WE2207750
8.000	8.345	.236	8.060	.150	WE2208000
8.250	8.595	.236	8.310	.150	WE2208250
8.500	8.845	.236	8.560	.150	WE2208500
8.750	9.095	.236	8.810	.150	WE2208750
9.000	9.345	.236	9.060	.150	WE2209000
9.250	9.595	.236	9.310	.150	WE2209250
9.500	9.845	.236	9.560	.150	WE2209500
9.750	10.095	.236	9.810	.150	WE2209750
10.000	10.480	.332	10.080	.150	WE2310000
10.500	10.980	.332	10.580	.150	WE2310500
11.000	11.480	.332	11.080	.150	WE2311000
11.500	11.980	.332	11.580	.150	WE2311500
12.000	12.480	.332	12.080	.150	WE2312000
12.500	12.980	.332	12.580	.150	WE2312500
13.000	13.480	.332	13.080	.150	WE2313000
13.500	13.980	.332	13.580	.150	WE2313500
14.000	14.480	.332	14.080	.150	WE2314000
14.500	14.980	.332	14.580	.150	WE2314500
15.000	15.480	.332	15.080	.150	WE2315000
15.500	15.980	.332	15.580	.150	WE2315500
16.000	16.480	.332	16.080	.150	WE2316000
16.500	16.980	.332	16.580	.150	WE2316500
17.000	17.630	.434	17.080	.150	WE2417000
17.500	18.130	.434	17.580	.150	WE2417500
18.000	18.630	.434	18.080	.150	WE2418000
18.500	19.130	.434	18.580	.150	WE2418500
19.000	19.630	.434	19.080	.150	WE2419000



<b>Rod Diameter</b>	<b>Groove Diameter</b>	<b>Groove Width</b>	<b>Relief Diameter</b>	<b>Step Width</b>	<b>TSS Part No.</b>
<b><math>d_N</math></b> f8/h9	<b><math>D_3</math></b> H9	<b><math>L_3</math></b> +.008	<b><math>D_4</math></b> H11	<b>a</b> min	
19.500	20.130	.434	19.580	.150	<a href="#">WE2419500</a>
20.000	20.630	.434	20.080	.150	<a href="#">WE2420000</a>

Other dimensions and all intermediate sizes up to 102 inches (2,600mm) diameter can be supplied.  
The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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# Turcon® Excluder® 5



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Double-Acting

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O-Ring-Energized Scraper

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**Material:**

Turcon®, Zurcon® and Elastomer

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## Turcon® Excluder® 5

### Description

The Turcon® Excluder® 5 is a patented double-acting scraper with two geometrically different scraper lips which are installed back-to-back. The scraper is installed together with an O-Ring as the elastic energizing element in one groove. The scraper function is performed by the Excluder® 5. The O-Ring maintains the pressure of the scraper lips against the sliding surface and can compensate for deflections of the piston rod.

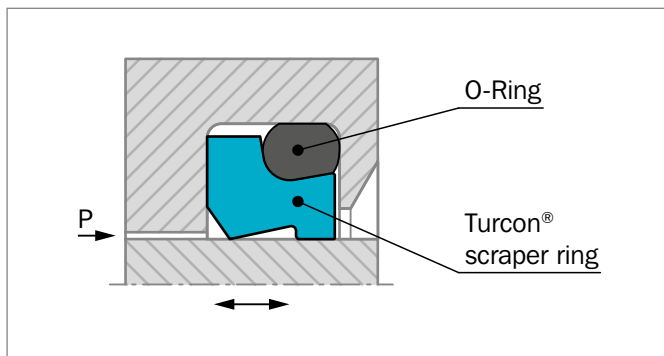


Figure 111: Turcon® Excluder® 5

The Excluder® 5 has two functions:

- Scrape contaminants from the retracting piston rod
- Hold back the residual oil film on the extending piston rod on the medium side

Excluder® 5 is preferably used with the Turcon® Stepseal® 2K, our rod seal with a hydrodynamic back-pumping function. In contrast to the Excluder® 2, the Excluder® 5 is used for heavy duty applications such as construction machinery, presses, etc.

### ADVANTAGES

- Outstanding sliding properties
- Stick-slip-free (Turcon® material)
- Tough scraper for heavy-duty operation
- Can compensate for deflections of the piston rod or plunger
- Very good scraping effect even against firmly adhered dirt, etc.
- Very good scraping effect from the inside against the residual oil film adhering to the surface of the piston rod
- Very high resistance to hydraulic media
- Available for all diameters up to 102.000 inches (2,600mm) (Turcon®), up to 86.000 inches (2,200mm) (Zurcon®)

### TECHNICAL DATA

<b>Velocity:</b>	50 ft/s (15 m/s) for Turcon® materials 6.5 ft/s (2 m/s) for Zurcon® materials
<b>Temperature:</b>	-49 °F to +392 °F (-45 °C to +200 °C) (Turcon®) -49 °F to +230 °F (-45 °C to +110 °C) (Zurcon®) (depending on O-Ring material)
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), water, air and others, depending on the scraper and O-Ring material.

### 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 dependent on medium.

### MATERIALS

The following material combination has proven effective for most applications:

Excluder® :	Turcon® T46
O-Ring:	NBR, 70 Shore A    N or N7
Set Code:	T46N or T46N7
Standard:	6195 Type D

For other applications, other material combinations as listed in Table 100 may also be used.

### DESIGN AND INSTALLATION INSTRUCTIONS

Excluder® 5 scrapers can be installed in split and closed grooves (For installation dimensions, see Table 101).

Installation in closed grooves is depends on the rod diameter, profile cross-section of the scraper and on the cross section of the corresponding O-Ring.



**Table 100: Turcon® and Zurcon® Materials for Excluder® 5**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °F	Mating Surface Material	Speed Ft/s max.
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new and updated applications For all commonly used hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface Mineral fiber and additives fillers Color: Dark gray	M12	NBR-70	N/N7	-22 to +212	Steel	50
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated (rod) Steel plated (rod)	
		FKM-70	V	+14 to +392	Cast iron Stainless steel Titanium	
<b>Turcon® T46</b> Standard material for hydraulics High compressive strength Good sliding and wear properties BAM tested Bronze-filled Color: Grayish to dark brown	T46	NBR-70	N/N7	-22 to +212	Steel hardened	50
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated	
		FKM-70	V	+14 to +392		
<b>Turcon® T40</b> For all lubricating and non-lubricating hydraulic fluids Hydraulic oils without zinc Water hydraulic Soft mating surfaces Surface texture not suitable for gases Carbon fiber-filled Color: Gray	T40	NBR-70	N/N7	-22 to +212	Steel	50
		NBR-70 Low temp.	T	-49 to +176	Steel chrome plated Cast iron	
		FKM-70	V	+14 to +392	Stainless steel	
		EPDM-70	E**	-49 to +293	Aluminum Bronze Alloys	
<b>Zurcon® Z54</b> For lubricating hydraulic fluids High abrasion resistance Color: Turquoise	Z54	NBR-70	N/N7	-22 to +212	Steel	6.5
		NBR-70 Low temp.	T	-49 to +176	Steel hardened Steel chrome plated Cast iron Stainless steel Ceramic coating Aluminium Bronze Alloys	

\* The O-Ring operation temperature is only valid in mineral hydraulic oil.

\*\* Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

□ Highlighted materials are standard.



## ■ Installation Recommendation (Inch Series)

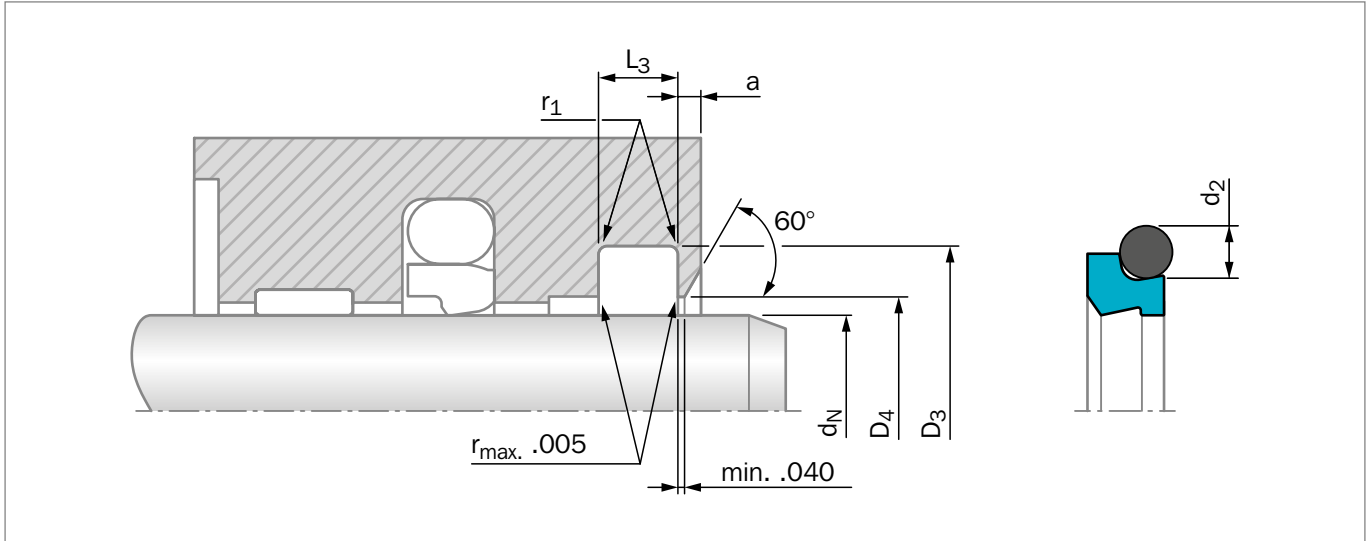


Figure 112: Installation drawing

**Table 101: Installation recommendation**

TSS Series No.	Rod Diameter $d_N$ f8/h9			Groove Diameter $D_3$ H9	Relief Diameter $D_4$ H11	Groove Width $L_3$ +.008	Radius $r_1$ max	O-Ring Cross-Section $d_2$
	Standard Application	Light Application	Heavy Duty Application					
WEE1	1.500 - 2.749	2.750 - 7.750	1.188 - 1.499	$d_N + .346$	$d_N + .060$	.248	.015	.103
WEE2	2.750 - 5.499	5.500 - 13.750	-	$d_N + .480$	$d_N + .080$	.319	.015	.139
WEE3	5.500 - 15.749	15.750 - 25.500	4.000 - 5.499	$d_N + .630$	$d_N + .100$	.374	.035	.210
WEE4	15.750 - 25.500	-	7.875 - 15.749	$d_N + .945$	$d_N + .100$	.551	.035	.275

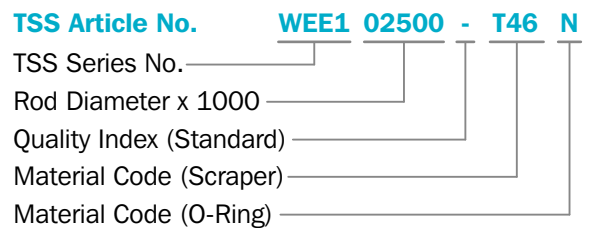
### ORDERING EXAMPLE

Turcon® Excluder® 5 with O-Ring in NBR

**Rod diameter:**  $d_N = 2.500$  inches

**Series:** WEE1 (from Table 101)

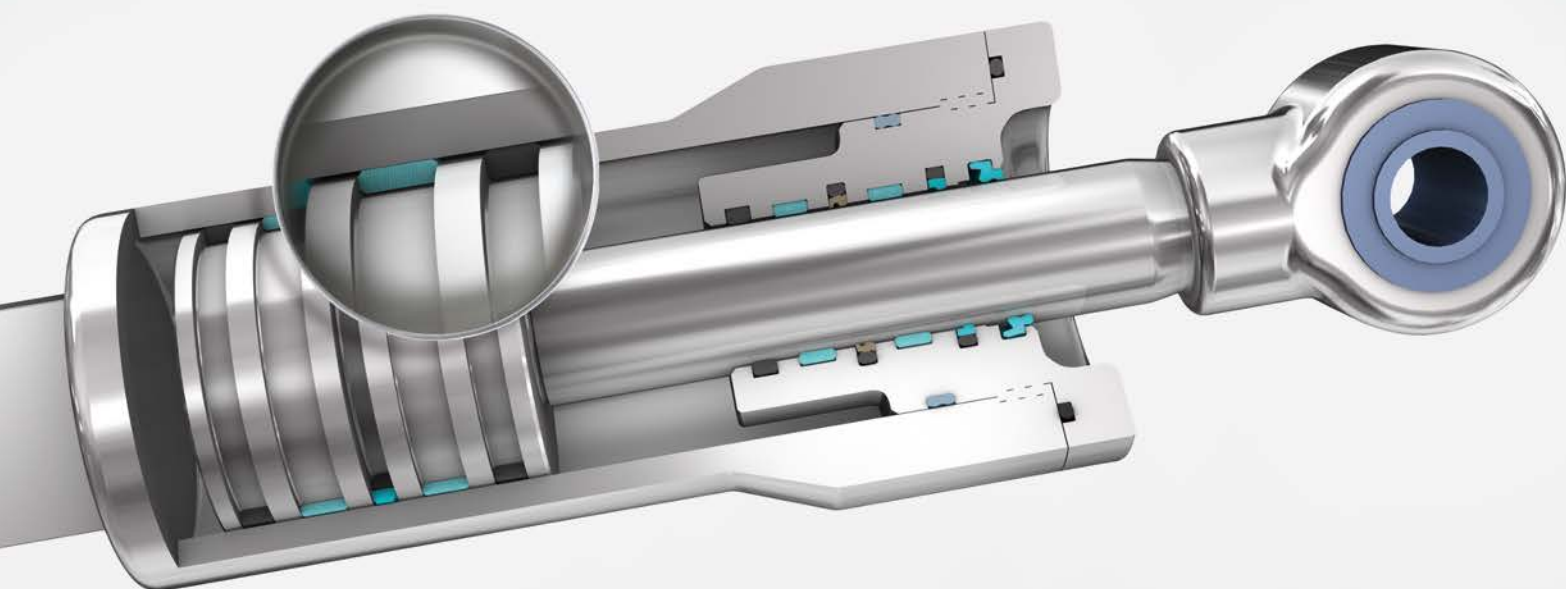
**TSS Part No.:** WEE102500



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# Slydring® Wear Rings



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## ■ Choice of Slydring®

The function of Slydring® is to absorb the sideload forces which occur in the piston and/or rod of a hydraulic cylinder or other devices. At the same time they eliminate metallic contact between the sliding parts of the cylinder, e.g. piston and cylinder barrel or rod and cylinder head. Non-metallic guide rings offer major benefits compared with the traditional metallic guides:

- Cost efficient production
- High load bearing capacity
- Eliminates local stress concentrations
- Wear-resistant, long service life
- Metal/plastic pairing eliminates fretting and seizure
- Favourable friction behaviour
- Damping of mechanical vibrations
- Good wiping effect, embedding of foreign particles possible
- Protection of the seal against “dieseling“
- Free choice of material of the metal components as guiding properties are no longer required
- Eliminates hydrodynamic pressure problems in the guide system
- Simple closed groove, easy installation
- Low service costs

## MATERIALS

In view of the different specific demands made on piston and rod guides, various Slydring® materials are available:

- Turcite® materials are highly wear-resistant, low friction, specially modified materials for low to medium duty with limited radial forces
- HiMod® materials with friction-reducing fillers for medium to heavy duty radial forces
- Orkot® fabric composite materials for heavy duty and high radial forces

In order to choose the most suitable Slydring®, it is first necessary to know all the required functional parameters. Table 102 can be used to make an initial preselection of the Slydring® and the materials to meet the demands of the application.

Before the final choice of Slydring® and material is made, the details and information must be checked in the relevant data sheets of Slydring® materials.

In principle, piston Slydring® and rod Slydring® are interchangeable if the difference in size is taken into consideration, e.g. piston Slydring®, diameter 2.500 x .125 thick can be used as a rod Slydring® diameter 2.250 x .125 thick.

## TOLERANCES

Depending on the material and dimensions of the Slydring®, the thickness tolerance is in the range from +0.000/-0.003.

Please do not hesitate to contact our Technical Department for further information on specific applications and special technical questions.





**Table 102: Selection Criteria for Slydring®**

Slydring®		Application				Installation	Recommended Slydring® Material	
Type	Page	Field of Application			Mating Surface	Size Range (Inch)		
			Light	Medium				Heavy
Turcite® / Zurcon® Slydring® 	301	Mobile hydraulics	•			Steel	Turcite® T47	
		Standard cylinders	•	•		Steel hardchromed		
		Machine tools	•	•		Steel hardened		
		Valves	•	•		Cast iron	Rings up to 100 inches diameter	Turcite® T51
		Rotary manifolds	•	•		Mild steel		
		Gas equipment	•	•		Steel		
		Pneumatics	•			Stainless steel		
		Wind Power	•	•		Aluminum		
		Off-road vehicles	•	•		Mild steel		Turcite® M12
		Injection molding machines	•	•		Steel hardchromed		
		Automotive industry	•	•		Cast iron		
		Foodstuff industry	•	•		Stainless steel	Rings up to 100 inches diameter	Zurcon® Z80 UHMWPE
		Water hydraulics	•	•		Aluminum		
		Dry application	•	•		Steel		
Pneumatics	•	•		Mild steel				
HiMod® Slydring® 	303	Mobile hydraulics	•	•	•	Steel	HiMod® HM803 PA/Glass fiber	
		Standard cylinders	•	•	•	Steel hardchromed		
		Agricultural machinery	•	•	•	Cast iron		
		Injection molding machines	•	•	•		Rings up to 36 inches diameter	HiMod® HM852 PA/Glass fiber + PTFE
		Mobile hydraulics	•	•		Steel		
		Standard cylinders	•	•		Steel hardchromed		
		Agricultural machinery	•	•		Cast iron		
		Injection molding machines	•	•			HiMod® HM861 POM/Glass fiber	
		Mobile hydraulics	•	•		Steel		
		Standard cylinders	•	•		Steel hardchromed		
Agricultural machinery	•	•		Cast iron				
Orkot® Slydring® 	305	Mobile hydraulics		•	•	Steel	Orkot® C320	
		Standard cylinders	•	•	•	Steel hardchromed		
		Presses	•	•	•	Cast iron		
		Mobile hydraulics		•	•		Rings up to 60 inches diameter	Orkot® C380
		Standard cylinders	•	•	•	Steel		
		Water hydraulics	•	•	•	Steel hardchromed		
		Shipping and marine engineering	•	•	•	Cast iron		
		Presses	•	•	•		Rings up to 12 inches diameter	Orkot® C932
		Mobile hydraulics		•	•	Steel		
		Standard cylinders	•	•	•	Steel hardchromed		
Presses	•	•	•	Cast iron				



## FORMS OF SUPPLY

Two characteristics must be observed:

### 1. Design Type

Slydring® has a rectangular cross-section with rounded or chamfered edges, thus preventing edge forces from becoming too high in the corner radii of the grooves. Chamfers also facilitate installation. Slydring® is supplied with the gap necessary (dimension Z or Z<sub>1</sub>) for their function. The ring ends are finished as standard with an angle cut. Depending on the material, Slydring® is supplied as split rings or as strip material. Strip material is available in rolls or precut to size as listed in Table 102.

**Table 103: Forms of Supply for Slydring®**

Material	Ring Diameter (Inches)	Cut Strip for Diameter (Inches)
Turcite® T47/T51	.500 to 99	1 - 96
Zurcon® Z80	.500 to 20	3 - 96
Orkot® C320	.750 to 60	12 - 80
Orkot® C380	.750 to 60	-
Orkot® C932	.750 to 60	-
HiMod® HM803	*	-
HiMod® HM852	.500 to 36	-
HiMod® HM861	.500 to 36	-

\*See HiMod® Slydring® section

### 2. Type of Cut

Figure 113 shows the commonly used angle cut. Rings with other types of cut are available on request.

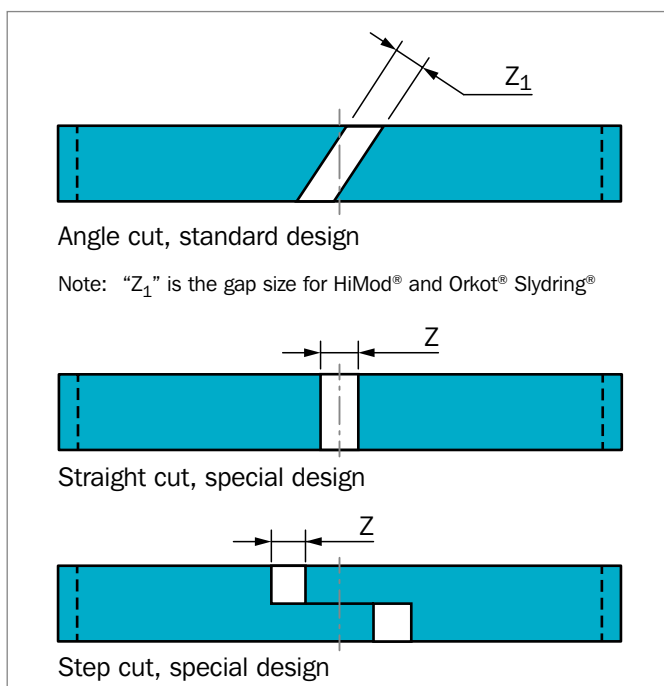


Figure 113: Type of cut

Slydring® has a tightly controlled thickness to maximize its load carrying capability and extend the life of the seals. A precision wall thickness tolerance of .002" is achieved on our standard product in this catalog. Our HiMod® Slydring® HM803 is available in either a precision wall tolerance of 0.002 inch (HiMod® Slydring® HP) or in a wide tolerance of 0.120 – 0.125 inches (HiMod® Slydring® HC).

Wall thicknesses and sizes not mentioned in this catalog are available. Contact you local Customer Solution Center for further information.

**Table 104: Radial Clearance**

Bore Diameter	min.	max.
.200 - .799	.008	.012
.800 - 3.999	.010	.016
4.000 - 9.999	.012	.024
10.000 - 19.999	.016	.032
20.000 - 39.999	.020	.044
>40.000	.024	.048

\*Radial Clearance is in reference to the S1 dimension shown in Figure 115 and Figure 116.

**Table 105: Surface Roughness**

Parameter	Mating Surface µin		Groove Surface
	Turcite® Materials	Zurcon®, HiMod® and Orkot® Materials	
R <sub>max</sub>	25 - 160	40 - 160	<630
R <sub>z</sub> DIN	16 - 100	25 - 100	<400
R <sub>a</sub>	2 - 16	4 - 16	<100

Slydring® also allows foreign particles to be wiped away rather than being squeezed between the metal components. The slot 'Z<sub>1</sub>' allows fluid to pass across the ring thus preventing fluid pressure buildup which might cause extrusion of the guide ring. To ensure the ring cannot escape out of the groove it is recommended to observe the following radial gap sizes as maximum:

- .020 for .060 thickness
- .035 for .125 thickness

### IMPORTANT NOTE

The above stated limits for pressure and speed are maximum values individually. Friction heat generated by the combination of pressure and speed may cause local heat buildup. Care should be taken not to apply high values for pressure and speed at the same time.



## ■ Design Instructions

### SELECTION OF SLYDRING®

An initial choice can be made for various applications by checking the Selection Criteria for Slydring® in Turcite®, Zurcon®, HiMod® or Orkot®, see Table 102 and the pages 303 through 305.

The values for the load on the Slydring® are valid for a load distribution as illustrated in Figure 114. The flexibility of the materials ensures a relatively constant specific load, irrespective of the size of the radial forces F, as with increasing radial loading, the guide surface subjected to the load increases also.

The radial forces which occur can vary within wide ranges and cannot always be calculated exactly in advance. For such cases, a safety factor of at least 2 is recommended when calculating (see calculation example).

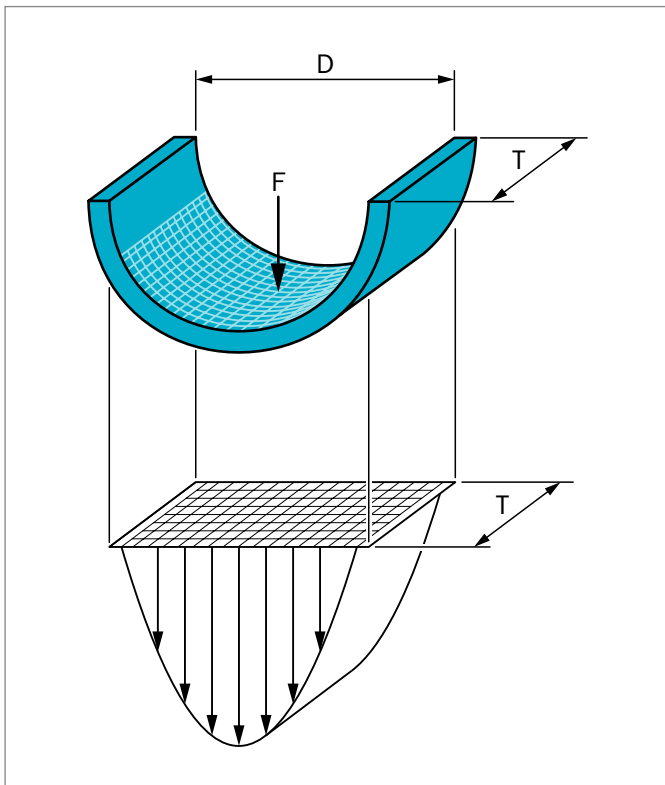


Figure 114: Load distribution

The large effective bearing area of non-metallic Slydring® gives low maximum contact pressure.

### DIMENSIONING OF SLYDRING®

The radial bearing pressure and the resulting elastic deflection are important parameters in the design of the Slydring®. The radial offset resulting from the dimensional tolerances, deflection and wear should always be less than the smallest gap to be sealed by the system. On request, we are willing to carry out dimensioning calculations for specific applications.

A rough estimate of the number and width of Slydring® required can be calculated using the following formula:

$$\text{Slydring® width } T_{\text{total}} = \frac{F \times f}{d_N \times Pr}$$

where:

- F = Maximum radial load [lbf]
- f = Safety factor
- $d_N$  = Rod diameter [inch]
- Pr = Radial Slydring® pressure [lbf/inch<sup>2</sup>]

Example:

- $d_N$  = 2.500 inch
- F = 9,000 lbf
- T = 105 °F
- f = 2

Slydring® material Orkot® C380

$$Pr_{\text{per.}} = 14,500 \text{ lbf/inch}^2$$

$$T_{\text{total}} = \frac{9,000 \times 2}{2.500 \times 14,500} = 0.497 \text{ inch}$$

From Table 109, a groove with a width of .510 inch is selected.

Selected:

Series GP2C with a Groove Width  $L_2$  = .510 inch

When calculating the width of Slydring® it is recommended to use a safety factor  $f=2$ .

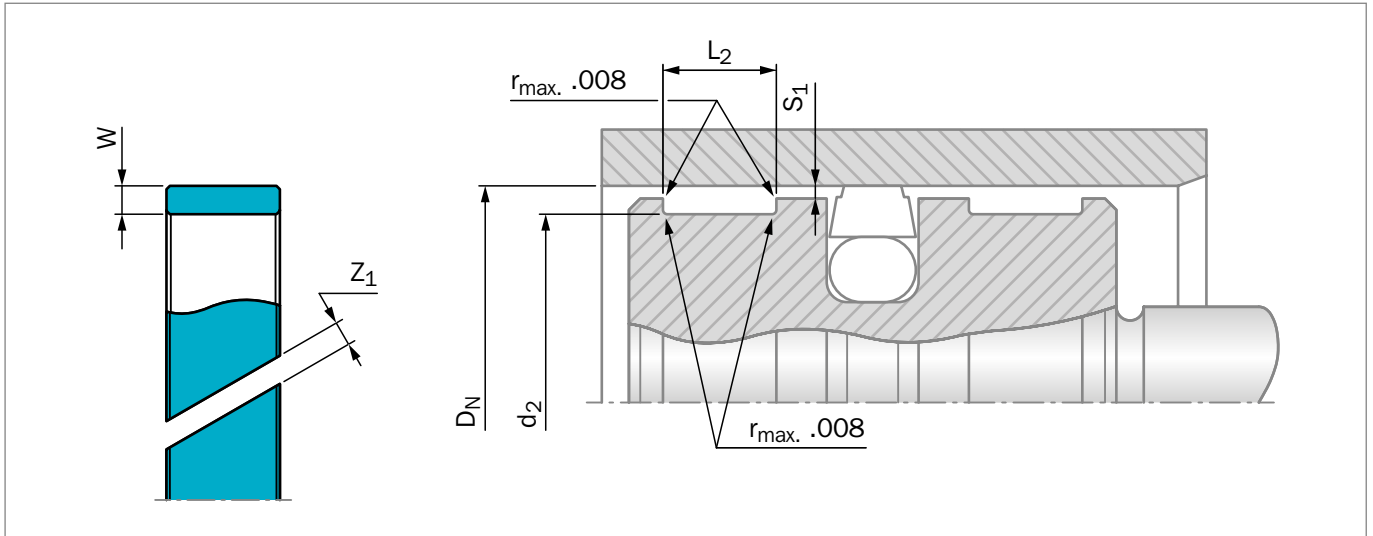


Figure 115: Piston guide

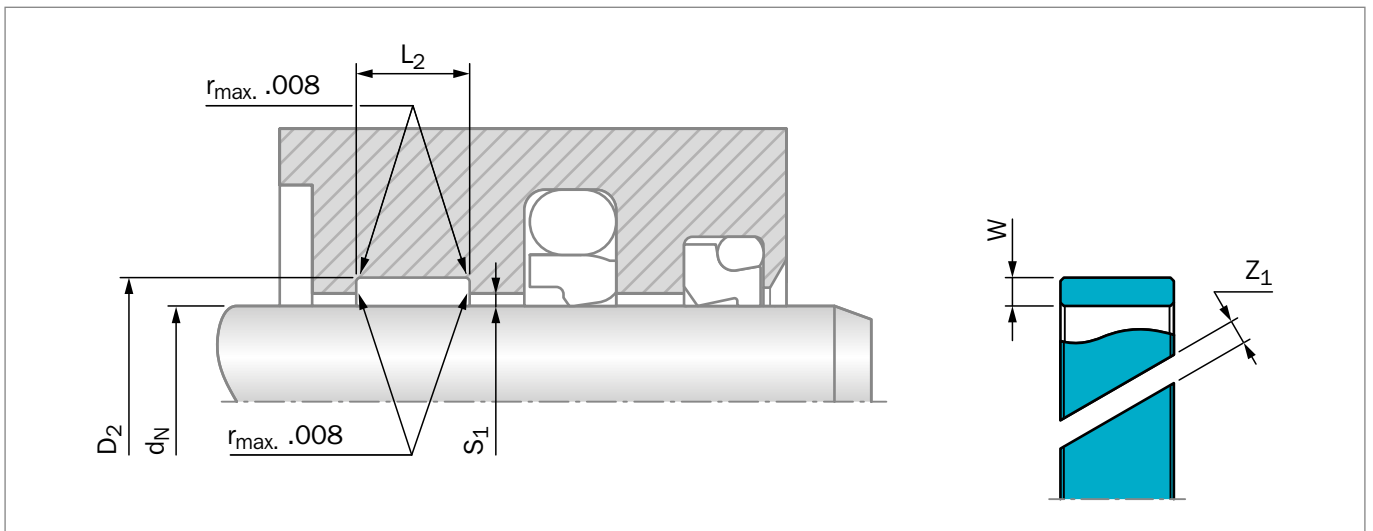


Figure 116: Rod guide

To improve the operational safety, particularly under high loads, the installation of a 3rd strip in material Turcite® M12 or T47 is recommended. It is installed on the oil side and serves, for example, as an internal scraper.

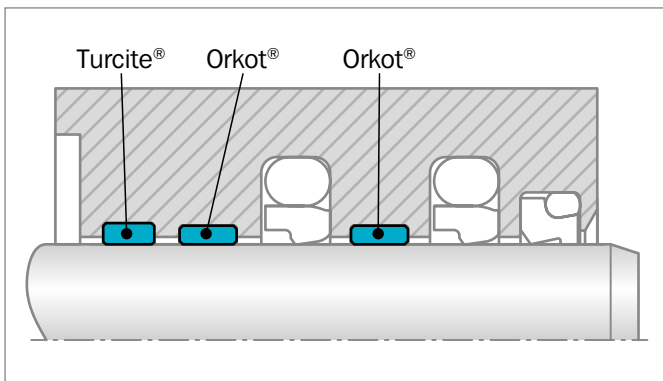


Figure 117: Rod guide for high loads



## ■ Turcite® Slydring® for Piston and Rod

### DESCRIPTION

Turcite® Slydring® is used as piston and rod guides due to their outstanding friction behaviour, stick-slip free running and good resistance to high temperatures and chemicals.

### DESIGN

Turcite® Slydring® is also available as cut-to-length strips or in bulk rolls. Please contact your local Customer Solution Center for more information.

### ADVANTAGES

- No stick-slip effect when starting for smooth operation even at very low speeds
- Minimum static and dynamic friction coefficient for low operating temperature and energy loss
- Suitable for non lubricating fluids depending on Turcite® material for optimum design flexibility
- High wear resistance ensures long service life
- Installation grooves according to ISO 10766
- Suitable for most hydraulic fluids in relation with the majority of modern hardware materials and surface finish depending on material selected
- Suitable for new environmentally safe hydraulic fluids
- The embedding of foreign particles is enhanced
- Good damping effect, absorbs vibrations

### TECHNICAL DATA

The Turcite® Slydring® with angle cut is recommended for reciprocating movements

<b>Velocity:</b>	Up to 10.8 ft/s
<b>Temperature:</b>	-71 °F to +302 °F
<b>Media:</b>	Mineral Oil based Hydraulic fluids, barely flammable hydraulic fluids, environmentally safe hydraulic fluids (biological degradable oils), water, air and others. Depending on the Turcite® material compatibility.
<b>Clearance:</b>	The maximum permissible radial clearance smax is depending on the actual sealing system.
<b>Radial Slydring® pressure Pr:</b>	Max. 2,175 psi at 77 °F Max. 1,740 psi at 176 °F Max. 1,160 psi at 248 °F

### MATERIALS

#### Standard Application:

- For hydraulic components with reciprocating movement in mineral oils or medium with good lubricating performance. Low friction, high resistance to wear, heat and chemicals:

Turcite® T47 (bronze filled)

Color: Turquoise

Material code: T47

#### Special Application:

- For lubricated and poor lubricated moving components: Water hydraulics and soft metal surfaces:

Turcite® T51 (carbon filled)

Color: Brown

Material code: T51

- For short stroke movements, non-lubricating fluids, water hydraulics, soft metal surfaces or pneumatic, applications requiring self-lubricating sealing materials:

Turcite® T59 (carbon fiber filled)

Color: Brown

Material code: T51

With the Turcite® materials it must be taken into account that the permissible surface pressure decreases with increasing temperatures. The load bearing ability for dynamic applications in practice is dependent primarily on the operating temperature.

This should therefore generally not exceed 302 °F (150 °C).

**Table 106: Installation in Closed Grooves  
Minimum Diameter for Turcite® Slydring®**

Axial Width	Ring Thickness	
	.063	.125
Minimum Ring Diameter		
.375	.875	1.000
.500	.875	1.000
.625	1.125	1.250
.750	1.125	1.500
1.000	1.500	1.500
1.250	1.620	2.000
1.500	2.000	2.000
1.750	2.000	2.500
2.000	2.000	2.500
2.500	2.000	2.750



## ■ Zurcon® Slydring® for Piston and Rod

### ZURCON® Z80

Z80 is a UHMW-PE (ultra high molecular weight polyethylene) material which meets the requirements in FDA 21 CFR 177:1520 and is therefore recommended for use in foodstuff applications. The material is also preferred for use in water hydraulics and pneumatics due to excellent friction and wear properties.

Color: White

Material code: Z80

### ADVANTAGES

- Good lubrication and wear performance
- Self-lubricating
- Low friction value
- No water absorption
- In compliance with FDA
- Excellent resistance to chemicals
- High wear resistance.

### TECHNICAL DATA

<b>Velocity, reciprocating:</b>	Max. 6.6 ft/s
<b>Temperature:</b>	-76 °F to +176 °F
<b>Radial Slydring® pressure Pr:</b>	Max. 3,625 psi at 77°F Max. 1,450 psi from 140 °F to 176 °F



## ■ HiMod® Slydring® for Piston and Rod

### DESCRIPTION

HiMod® Slydring® is in hydraulic cylinders as piston and rod guides for medium to high load applications.

HiMod® HM803:	A special glass fiber-reinforced heat-stabilized polyamid
HiMod® HM852:	A special glass fiber-reinforced heat-stabilized polyamid with PTFE
HiMod® HM861:	A special glass fiber-reinforced polyacetal

### DESIGN

HiMod® Slydring® are offered in two designs; a high precision HiMod® Slydring® HP and a value-focused HiMod® Slydring® HC.

#### HiMod® Slydring® HP

HiMod® Slydring® HP is a tight tolerance, machined product. The wall thickness tolerance is held to 0.002". The standard gap is offered as a scarf cut.

#### HiMod® Slydring® HC

HiMod® Slydring® HC is a cost effective net molded wear ring. The wall thickness is 0.120" to 0.125" and is offered with a straight cut gap. It is only available in HiMod HM803 material.

### MATERIALS

The HiMod® materials are special, modified thermoplastics known for their high stiffness and excellent friction and wear characteristics. Many different custom blended materials are available, but our standard grades are HiMod® HM803, HiMod® HM852, and HiMod® HM861.

### HIMOD® HM803

Proprietary heat-stabilized polyamid material with special glass fibers for improved bearing characteristics and proven performance

Color: Dark Gray  
Material code: HM803

### ADVANTAGES

- Excellent price/performance ratio
- High compressive strength even at high temperatures
- High wear resistance
- Easy installation on pistons and glands  
(Use .060 wall for bores under 1.50 inches)
- Low Friction

### TECHNICAL DATA

<b>Velocity, reciprocating:</b>	Max. 3.3 ft/s
<b>Temperature:</b>	-40° F to +275 °F
<b>Radial Slydring® pressure Pr:</b>	Max. 10,877 psi at 140 °F Max. 5,800 psi > 140 °F Water Absorption: <1%

**Table 107: Installation in Closed Grooves  
Minimum Diameter for HiMod® Slydring®**

Axial Width	Ring Thickness	
	.063	.125
	Minimum Ring Diameter	
.375	.875	1.000
.500	.875	1.000
.625	1.125	1.250
.750	1.125	1.500
1.000	1.500	1.500
1.250	1.620	2.000
1.500	2.369	2.000
1.750	2.870	2.500
2.000	2.875	2.500
2.500	N/A	2.750



## ■ HiMod® Slydring® for Piston and Rod

### HIMOD® HM852

Proprietary heat-stabilized polyamid material with special glass fibers plus PTFE lubricant for applications with marginal lubricity

Color: Dark Gray  
Material code: HM852

#### ADVANTAGES

- Excellent price/performance ratio
- High compressive strength even at high temperatures
- High wear resistance
- Easy installation on pistons and glands  
(Use .060 wall for bores under 1.50 inches)
- Lower friction
- For operation under poor lubrication.

#### TECHNICAL DATA

<b>Velocity, reciprocating:</b>	Max. 3.3 ft/s
<b>Temperature:</b>	-40° F to +275 °F
<b>Radial Slydring® pressure Pr:</b>	Max. 10,877 psi at 140 °F Max. 5,800 psi >140 °F

### HIMOD® HM861

HiMod® HM861 is a polyacetal (POM) based material with glass fibers.

Color: Dark Gray or Black  
Material code: HM861

#### ADVANTAGES

- Favorable price/performance ratio
- High compressive strength
- Easy installation on pistons and glands  
(gland bore <1.50 inches)
- High wear resistance
- Water absorption 0.2%
- High stiffness

#### TECHNICAL DATA

<b>Velocity, reciprocating:</b>	Max. 2.65 ft/s
<b>Temperature:</b>	-40 °F to +230 °F
<b>Radial Slydring® pressure Pr:</b>	Max. 5,800 psi at 77 °F Max. 3,625 psi > 140 °F





## ■ Orkot® Slydring® for Piston and Rod

### DESCRIPTION

Orkot® Slydring® of fabric-reinforced composite materials is used in hydraulic cylinders exposed to high loads that can occur, e.g. in mobile hydraulics and presses. The high compressive strength, good sliding behavior and the exceptional wear resistant properties ensure a long service life.

Slydring® of Orkot® fabric composite materials is produced as standard from tubular material. It is manufactured with an angle cut and already has the necessary gap  $Z_1$ .

For large diameters >12 inches rings can be cut from Orkot® C320, C380 strip material. This offers economical solutions for non-standard diameters or when quantities are limited.

### MATERIALS

#### Orkot® C320

Orkot® C320 is a fabric composite material made of a thermosetting polymer, reinforced by a fine plastic mesh and lubricant additives impregnated throughout the material. It has a very high resistance to wear, good dry-running properties and dampens vibrations.

Color: dark gray

Material code: C320

#### Orkot® C380

Orkot® C380 is the standard material, this turquoise colored composite is a further development of the proven C320. It is most versatile; it is suitable for all commonly used hydraulic fluids such as mineral or synthetic oils, as well as water based fluids. It is an excellent electrical insulator and features enhanced sliding properties in various media.

Color: Turquoise

Material code: C380

#### Orkot® C932

Orkot® C932 is a composite of phenolic resin impregnated into a fine cotton fabric. The material stiffness is higher than C380 / C320. The use in water-based fluids is not recommended.

Color: yellow-brown

Material code: C932

### INSTALLATION RECOMMENDATION

In order to protect the seal and guide system against ingress of foreign particles, we recommend the use of Turcite® Slydring® in combination with Orkot® Slydring®. The larger face area of these rings embeds the contaminant particles, when present in the system, and keeps them away from the actual guides and seals (Figure 118). Reducing the piston diameter at both ends allows the particles to become embedded on the face side.

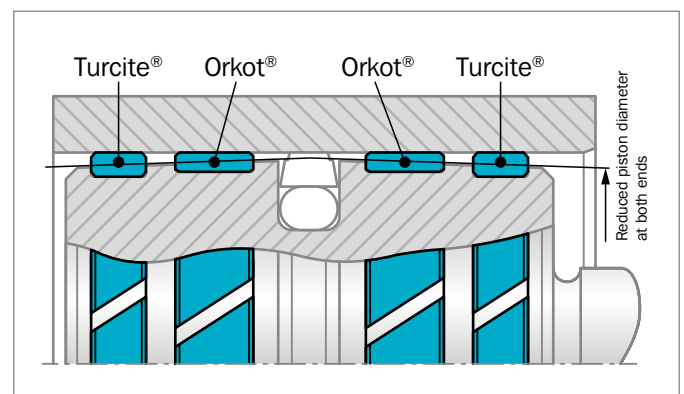


Figure 118: Arrangement of the Slydring® on the piston

### TECHNICAL DATA

**Velocity:** Up to 3.3 ft/s,  
with reciprocating movements

**Temperature:** -105 °F to +250 °F

**Pr under  
dynamic  
conditions**

**C380, C320:** max. 14,500 psi at 77 °F

**C932:** max. 7,250 psi >140 °F

**Ultimate  
compressive  
strength**

**C380, C320:** max. >43,500 psi

**C932:** max. 37,709 psi

### ADVANTAGES

- Dimensionally stable and vibration absorbing
- Even distribution of high radial forces
- Good sliding and dry running properties
- High wear resistance
- Good wiping effect
- Long service life.

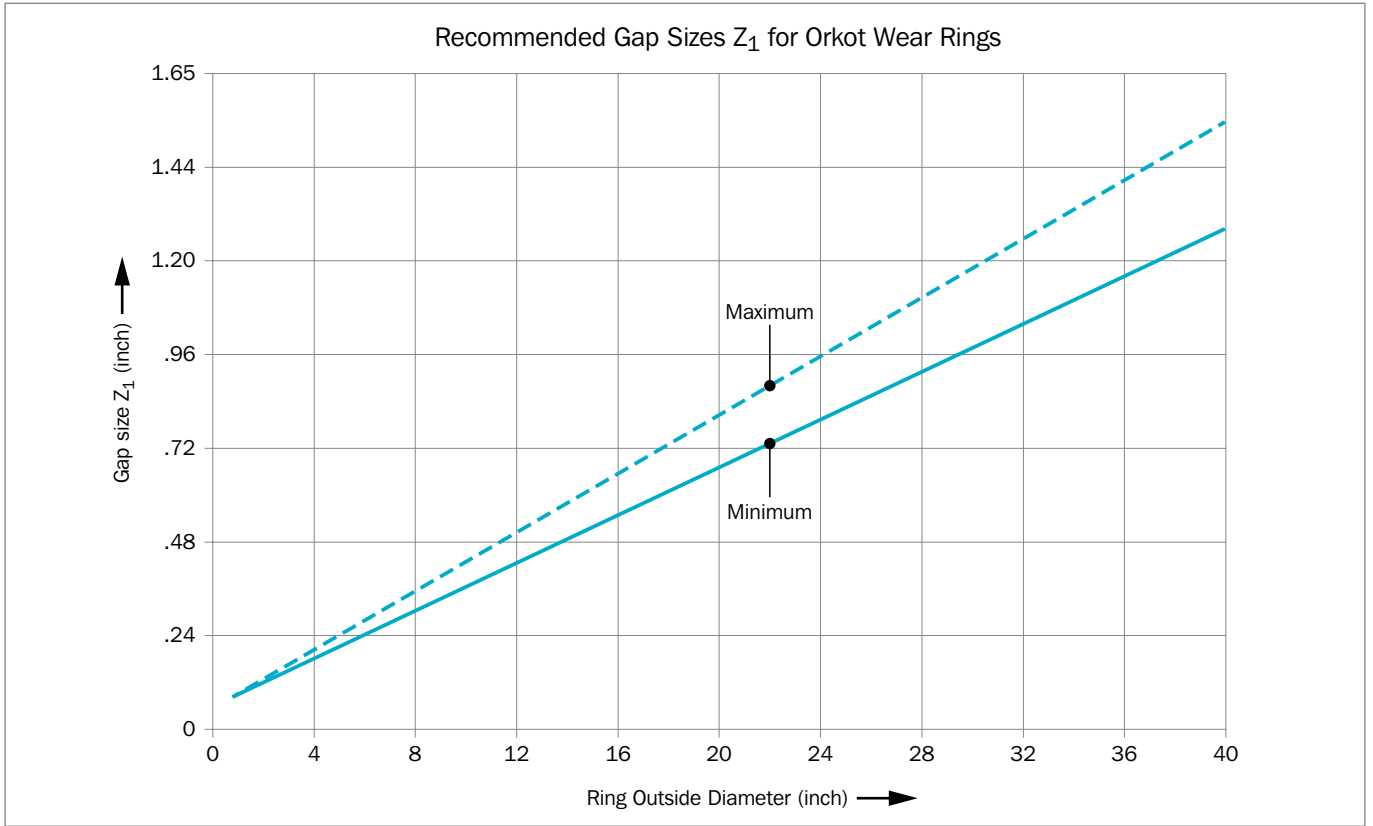


Figure 119: Recommended Gap Sizes  $Z_1$  for Orkot Wear Rings - Piston

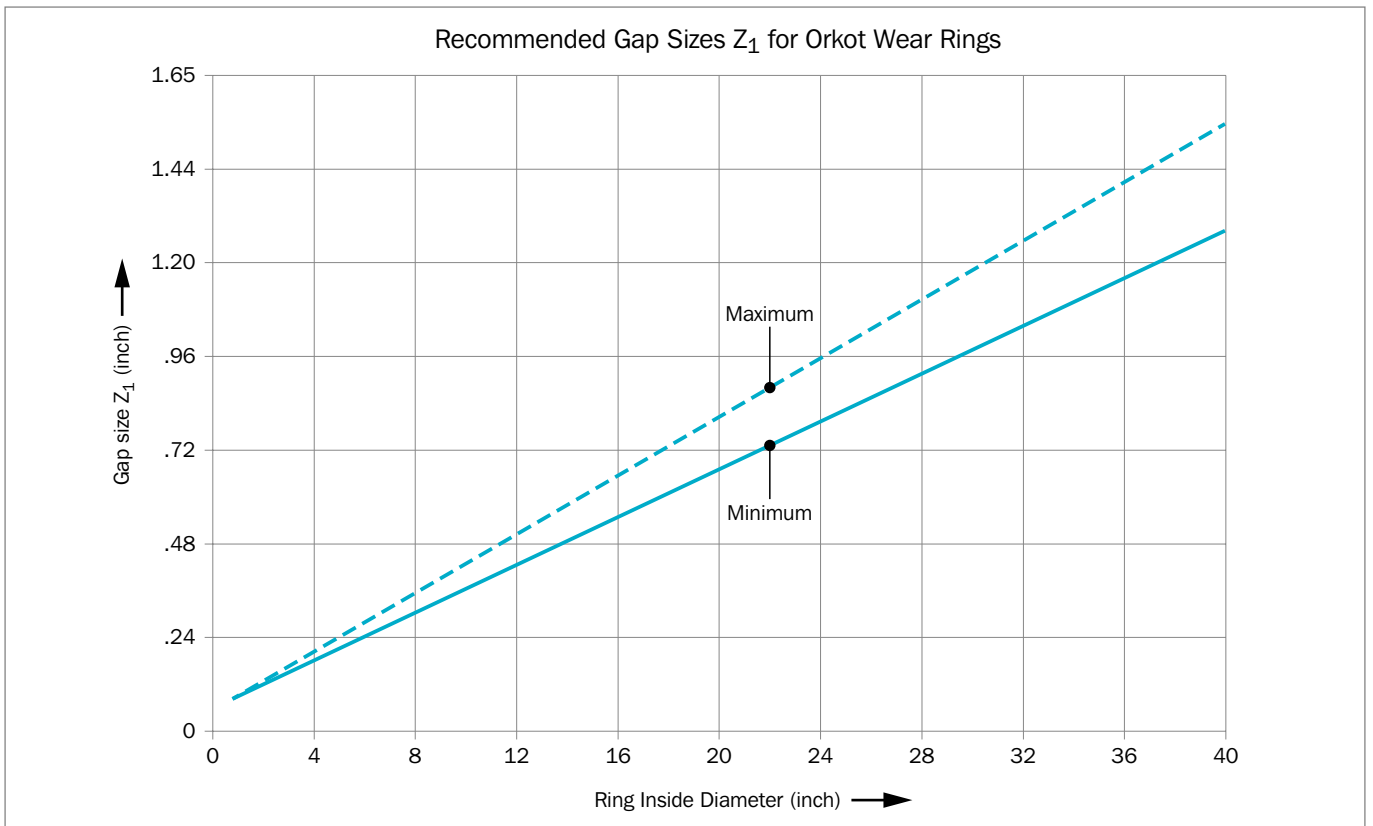


Figure 120: Recommended Gap Sizes  $Z_1$  for Orkot Wear Rings - Rod



**Table 108: Installation in Closed Grooves**  
**Minimum Diameter for Orkot® Slydring®**

Axial Width	Ring Thickness	
	.063	.125
	Minimum Ring Diameter	
.375	.500	.500
.500	.500	.500
.625	.750	.750
.750	1.000	1.000
1.000	1.000	1.000
1.250	1.750	1.750
1.500	1.750	1.750
1.750	2.000	2.000
2.000	2.000	2.000
2.500	3.000	3.000



## ■ Installation Recommendation and Part Numbers - Piston (Inch Series)

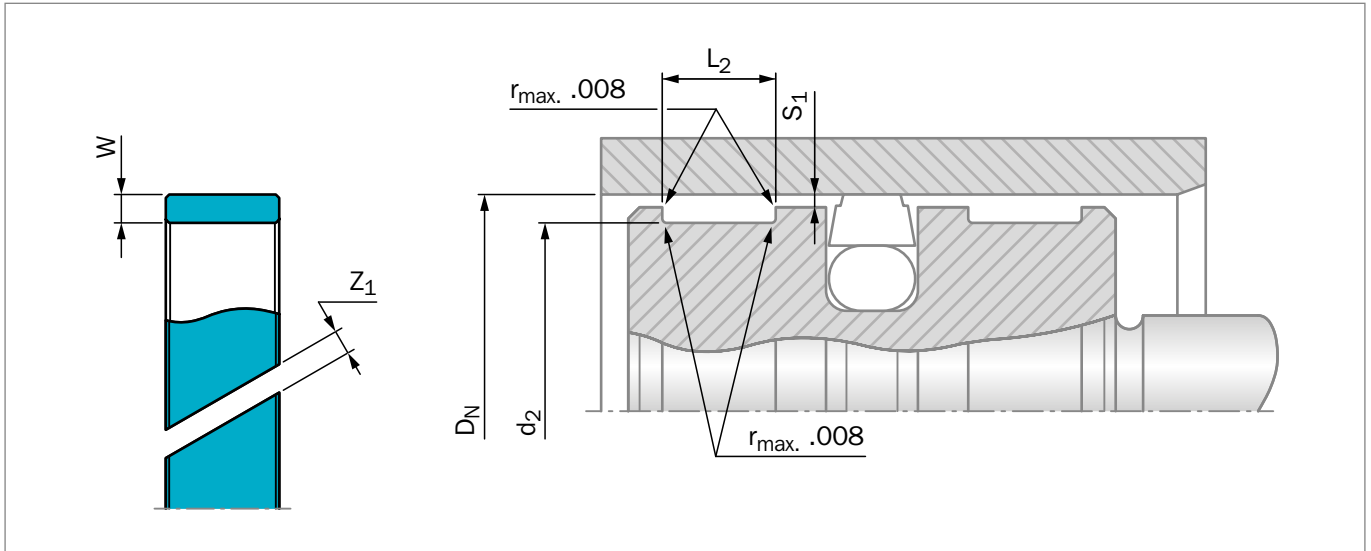


Figure 121: Installation drawing

**Table 109: Installation recommendation**

TSS Series No.	Bore Diameter	Groove Diameter	Groove Width	Thickness
	$D_N$ H9	$d_2$ h9	$L_2$ +.010	$W$ (max)
GPOB	1.000 - 4.000	$D_N$ -.126	.385	.063
GPOC	1.000 - 4.000	$D_N$ -.126	.510	.063
GP2B	1.000 - 4.000	$D_N$ -.250	.385	.125
<b>GP2C</b>	<b>1.250 - 10.000</b>	<b><math>D_N</math> -.250</b>	<b>.510</b>	<b>.125</b>
GP2D	1.500 - 10.000	$D_N$ -.250	.635	.125
<b>GP2E</b>	<b>2.000 - 12.000</b>	<b><math>D_N</math> -.250</b>	<b>.760</b>	<b>.125</b>
<b>GP2F</b>	<b>2.500 - 16.000</b>	<b><math>D_N</math> -.250</b>	<b>1.010</b>	<b>.125</b>
GB2G	3.000 - 20.000	$D_N$ -.250	1.260	.125
<b>GP2H</b>	<b>4.000 - 20.000</b>	<b><math>D_N</math> -.250</b>	<b>1.510</b>	<b>.125</b>
GP2J	6.000 - 20.000	$D_N$ -.250	1.760	.125
<b>GP2K</b>	<b>8.000 - 20.000</b>	<b><math>D_N</math> -.250</b>	<b>2.010</b>	<b>.125</b>
GP2L	10.000 - 20.000	$D_N$ -.250	2.510	.125

**Notes:**

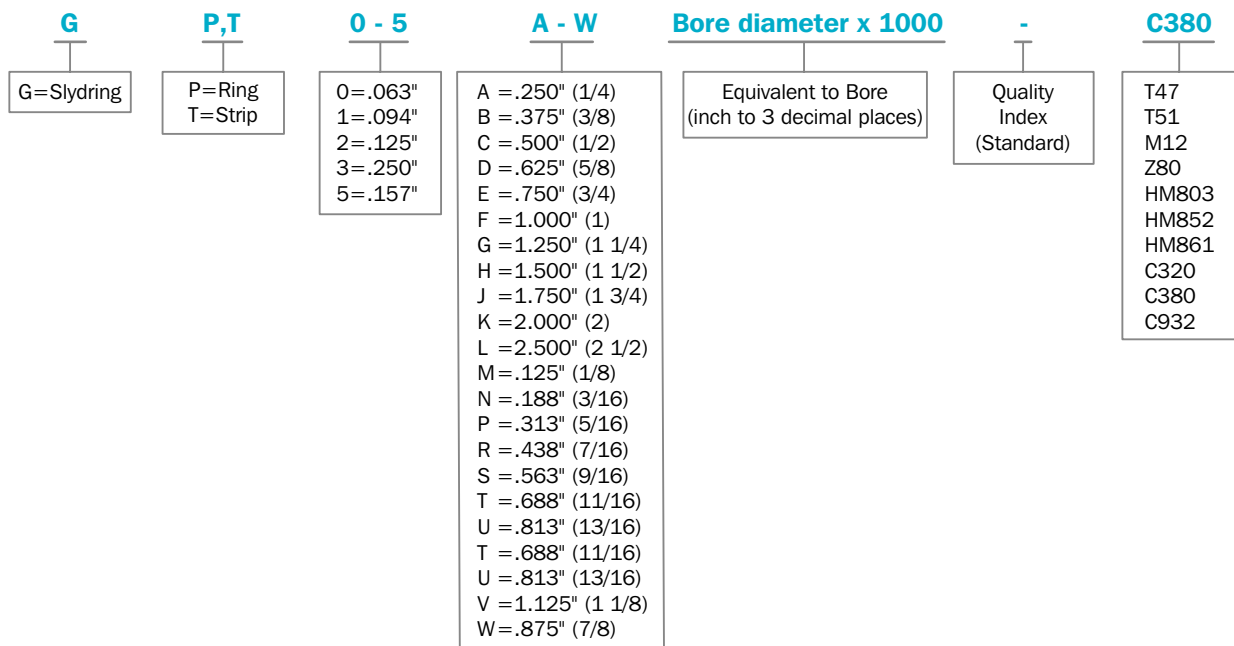
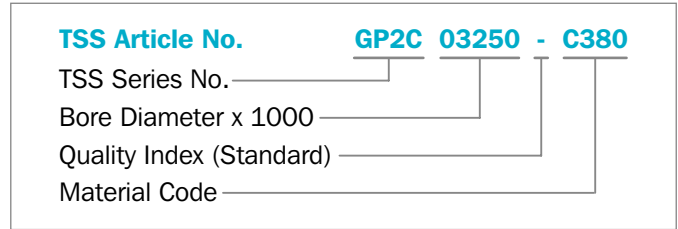
- (1) Tolerances used are per ISO-286 system of limits and fits.
- (2) **Bold Print** indicates preferred series



**ORDERING EXAMPLE**

Slydring® for Bore diameter  $D_N = 3.250$  inches Series GP2C from Table 109

<b>Groove width:</b>	.510 inches
<b>Ring thickness:</b>	.125 inches
<b>Material:</b>	Orkot® C380 Standard With angle cut
<b>TSS Part No.:</b>	GP2C03250 (from Table 110)



**Table 110: Slydring® for Pistons**

Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2$ +.010	<b>W</b>	
<b>1.000</b>	<b>.750</b>	<b>.510</b>	<b>.125</b>	<b>GP2C01000</b>
<b>1.250</b>	<b>1.000</b>	<b>.510</b>	<b>.125</b>	<b>GP2C01250</b>
1.313	1.063	.510	.125	GP2C01313
1.375	1.125	.510	.125	GP2C01375
1.438	1.188	.510	.125	GP2C01438
<b>1.500</b>	<b>1.250</b>	<b>.510</b>	<b>.125</b>	<b>GP2C01500</b>
1.563	1.313	.510	.125	GP2C01563
1.625	1.375	.510	.125	GP2C01625
1.688	1.438	.510	.125	GP2C01688
<b>1.750</b>	<b>1.500</b>	<b>.510</b>	<b>.125</b>	<b>GP2C01750</b>
1.813	1.563	.510	.125	GP2C01813
1.875	1.625	.510	.125	GP2C01875



Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
D <sub>N</sub> H9	d <sub>2</sub> h9	L <sub>2</sub> +.010	W	
1.938	1.688	.510	.125	GP2C01938
<b>2.000</b>	<b>1.750</b>	<b>.510</b>	<b>.125</b>	<b>GP2C02000</b>
2.125	1.875	.510	.125	GP2C02125
<b>2.250</b>	<b>2.000</b>	<b>.510</b>	<b>.125</b>	<b>GP2C02250</b>
2.375	2.125	.510	.125	GP2C02375
<b>2.500</b>	<b>2.250</b>	<b>.510</b>	<b>.125</b>	<b>GP2C02500</b>
2.625	2.375	.510	.125	GP2C02625
<b>2.750</b>	<b>2.500</b>	<b>.510</b>	<b>.125</b>	<b>GP2C02750</b>
2.875	2.625	.510	.125	GP2C02875
<b>3.000</b>	<b>2.750</b>	<b>.510</b>	<b>.125</b>	<b>GP2C03000</b>
3.125	2.875	.510	.125	GP2C03125
<b>3.250</b>	<b>3.000</b>	<b>.510</b>	<b>.125</b>	<b>GP2C03250</b>
3.375	3.125	.510	.125	GP2C03375
<b>3.500</b>	<b>3.250</b>	<b>.510</b>	<b>.125</b>	<b>GP2C03500</b>
3.625	3.375	.510	.125	GP2C03625
<b>3.750</b>	<b>3.500</b>	<b>.510</b>	<b>.125</b>	<b>GP2C03750</b>
3.875	3.625	.510	.125	GP2C03875
<b>4.000</b>	<b>3.750</b>	<b>.510</b>	<b>.125</b>	<b>GP2C04000</b>
4.125	3.875	.510	.125	GP2C04125
<b>4.250</b>	<b>4.000</b>	<b>.510</b>	<b>.125</b>	<b>GP2C04250</b>
4.375	4.125	.510	.125	GP2C04375
<b>4.500</b>	<b>4.250</b>	<b>.510</b>	<b>.125</b>	<b>GP2C04500</b>
4.625	4.375	.510	.125	GP2C04625
<b>4.750</b>	<b>4.500</b>	<b>.510</b>	<b>.125</b>	<b>GP2C04750</b>
4.875	4.625	.510	.125	GP2C04875
<b>5.000</b>	<b>4.750</b>	<b>.510</b>	<b>.125</b>	<b>GP2C05000</b>
5.125	4.875	.510	.125	GP2C05125
5.250	5.000	.510	.125	GP2C05250
5.375	5.125	.510	.125	GP2C05375
5.500	5.250	.510	.125	GP2C05500
5.625	5.375	.510	.125	GP2C05625
5.750	5.500	.510	.125	GP2C05750
5.875	5.625	.510	.125	GP2C05875
6.000	5.750	.510	.125	GP2C06000
6.250	6.000	.510	.125	GP2C06250
6.500	6.250	.510	.125	GP2C06500
6.750	6.500	.510	.125	GP2C06750
7.000	6.750	.510	.125	GP2C07000
7.250	7.000	.510	.125	GP2C07250
7.500	7.250	.510	.125	GP2C07500
7.750	7.500	.510	.125	GP2C07750



Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2$ +.010	W	
8.000	7.750	.510	.125	GP2C08000
8.250	8.000	.510	.125	GP2C08250
8.500	8.250	.510	.125	GP2C08500
8.750	8.500	.510	.125	GP2C08750
9.000	8.750	.510	.125	GP2C09000
9.250	9.000	.510	.125	GP2C09250
9.500	9.250	.510	.125	GP2C09500
9.750	9.500	.510	.125	GP2C09750
10.000	9.750	.510	.125	GP2C10000
10.500	10.250	.510	.125	GP2C10500
11.000	10.750	.510	.125	GP2C11000
11.500	11.250	.510	.125	GP2C11500
12.000	11.750	.510	.125	GP2C12000
<b>2.000</b>	<b>1.750</b>	<b>.760</b>	<b>.125</b>	<b>GP2E02000</b>
<b>2.250</b>	<b>2.000</b>	<b>.760</b>	<b>.125</b>	<b>GP2E02250</b>
<b>2.500</b>	<b>2.250</b>	<b>.760</b>	<b>.125</b>	<b>GP2E02500</b>
<b>2.750</b>	<b>2.500</b>	<b>.760</b>	<b>.125</b>	<b>GP2E02750</b>
<b>3.000</b>	<b>2.750</b>	<b>.760</b>	<b>.125</b>	<b>GP2E03000</b>
<b>3.250</b>	<b>3.000</b>	<b>.760</b>	<b>.125</b>	<b>GP2E03250</b>
<b>3.500</b>	<b>3.250</b>	<b>.760</b>	<b>.125</b>	<b>GP2E03500</b>
<b>3.750</b>	<b>3.500</b>	<b>.760</b>	<b>.125</b>	<b>GP2E03750</b>
<b>4.000</b>	<b>3.750</b>	<b>.760</b>	<b>.125</b>	<b>GP2E04000</b>
4.125	3.875	.760	.125	GP2E04125
<b>4.250</b>	<b>4.000</b>	<b>.760</b>	<b>.125</b>	<b>GP2E04250</b>
4.375	4.125	.760	.125	GP2E04375
<b>4.500</b>	<b>4.250</b>	<b>.760</b>	<b>.125</b>	<b>GP2E04500</b>
4.625	4.375	.760	.125	GP2E04625
<b>4.750</b>	<b>4.500</b>	<b>.760</b>	<b>.125</b>	<b>GP2E04750</b>
4.875	4.625	.760	.125	GP2E04875
<b>5.000</b>	<b>4.750</b>	<b>.760</b>	<b>.125</b>	<b>GP2E05000</b>
5.125	4.875	.760	.125	GP2E05125
5.250	5.000	.760	.125	GP2E05250
5.375	5.125	.760	.125	GP2E05375
5.500	5.250	.760	.125	GP2E05500
5.625	5.375	.760	.125	GP2E05625
5.750	5.500	.760	.125	GP2E05750
5.875	5.625	.760	.125	GP2E05875
6.000	5.750	.760	.125	GP2E06000
6.250	6.000	.760	.125	GP2E06250
6.500	6.250	.760	.125	GP2E06500



Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2$ +.010	W	
6.750	6.500	.760	.125	GP2E06750
7.000	6.750	.760	.125	GP2E07000
7.250	7.000	.760	.125	GP2E07250
7.500	7.250	.760	.125	GP2E07500
7.750	7.500	.760	.125	GP2E07750
8.000	7.750	.760	.125	GP2E08000
8.250	8.000	.760	.125	GP2E08250
8.500	8.250	.760	.125	GP2E08500
8.750	8.500	.760	.125	GP2E08750
9.000	8.750	.760	.125	GP2E09000
9.250	9.000	.760	.125	GP2E09250
9.500	9.250	.760	.125	GP2E09500
9.750	9.500	.760	.125	GP2E09750
10.000	9.750	.760	.125	GP2E10000
10.500	10.250	.760	.125	GP2E10500
11.000	10.750	.760	.125	GP2E11000
11.500	11.250	.760	.125	GP2E11500
12.000	11.750	.760	.125	GP2E12000
12.500	12.250	.760	.125	GP2E12500
13.000	12.750	.760	.125	GP2E13000
13.500	13.250	.760	.125	GP2E13500
14.000	13.750	.760	.125	GP2E14000
14.500	14.250	.760	.125	GP2E14500
15.000	14.750	.760	.125	GP2E15000
15.500	15.250	.760	.125	GP2E15500
16.000	15.750	.760	.125	GP2E16000
16.500	16.250	.760	.125	GP2E16500
17.000	16.750	.760	.125	GP2E17000
17.500	17.250	.760	.125	GP2E17500
18.000	17.750	.760	.125	GP2E18000
18.500	18.250	.760	.125	GP2E18500
19.000	18.750	.760	.125	GP2E19000
19.500	19.250	.760	.125	GP2E19500
20.000	19.750	.760	.125	GP2E20000
<b>2.500</b>	<b>2.250</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F02500</b>
<b>2.750</b>	<b>2.500</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F02750</b>
<b>3.000</b>	<b>2.750</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F03000</b>
<b>3.250</b>	<b>3.000</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F03250</b>
<b>3.500</b>	<b>3.250</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F03500</b>
<b>3.750</b>	<b>3.500</b>	<b>1.010</b>	<b>.125</b>	<b>GP2F03750</b>





Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2$ +.010	W	
4.000	3.750	1.010	.125	GP2F04000
4.250	4.000	1.010	.125	GP2F04250
4.500	4.250	1.010	.125	GP2F04500
4.750	4.500	1.010	.125	GP2F04750
5.000	4.750	1.010	.125	GP2F05000
5.250	5.000	1.010	.125	GP2F05250
5.500	5.250	1.010	.125	GP2F05500
5.750	5.500	1.010	.125	GP2F05750
6.000	5.750	1.010	.125	GP2F06000
6.250	6.000	1.010	.125	GP2F06250
6.500	6.250	1.010	.125	GP2F06500
6.750	6.500	1.010	.125	GP2F06750
7.000	6.750	1.010	.125	GP2F07000
7.250	7.000	1.010	.125	GP2F07250
7.500	7.250	1.010	.125	GP2F07500
7.750	7.500	1.010	.125	GP2F07750
8.000	7.750	1.010	.125	GP2F08000
8.250	8.000	1.010	.125	GP2F08250
8.500	8.250	1.010	.125	GP2F08500
8.750	8.500	1.010	.125	GP2F08750
9.000	8.750	1.010	.125	GP2F09000
9.250	9.000	1.010	.125	GP2F09250
9.500	9.250	1.010	.125	GP2F09500
9.750	9.500	1.010	.125	GP2F09750
10.000	9.750	1.010	.125	GP2F10000
10.500	10.250	1.010	.125	GP2F10500
11.000	10.750	1.010	.125	GP2F11000
11.500	11.250	1.010	.125	GP2F11500
12.000	11.750	1.010	.125	GP2F12000
12.500	12.250	1.010	.125	GP2F12500
13.000	12.750	1.010	.125	GP2F13000
13.500	13.250	1.010	.125	GP2F13500
14.000	13.750	1.010	.125	GP2F14000
14.500	14.250	1.010	.125	GP2F14500
15.000	14.750	1.010	.125	GP2F15000
15.500	15.250	1.010	.125	GP2F15500
16.000	15.750	1.010	.125	GP2F16000
16.500	16.250	1.010	.125	GP2F16500
17.000	16.750	1.010	.125	GP2F17000
17.500	17.250	1.010	.125	GP2F17500
18.000	17.750	1.010	.125	GP2F18000



Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
<b>D<sub>N</sub></b> H9	<b>d<sub>2</sub></b> h9	<b>L<sub>2</sub></b> +.010	<b>W</b>	
18.500	18.250	1.010	.125	GP2F18500
19.000	18.750	1.010	.125	GP2F19000
19.500	19.250	1.010	.125	GP2F19500
20.000	19.750	1.010	.125	GP2F20000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).



## ■ Installation Recommendation and Part Numbers HiMod® Slydring® HC - Piston (Inch Series)

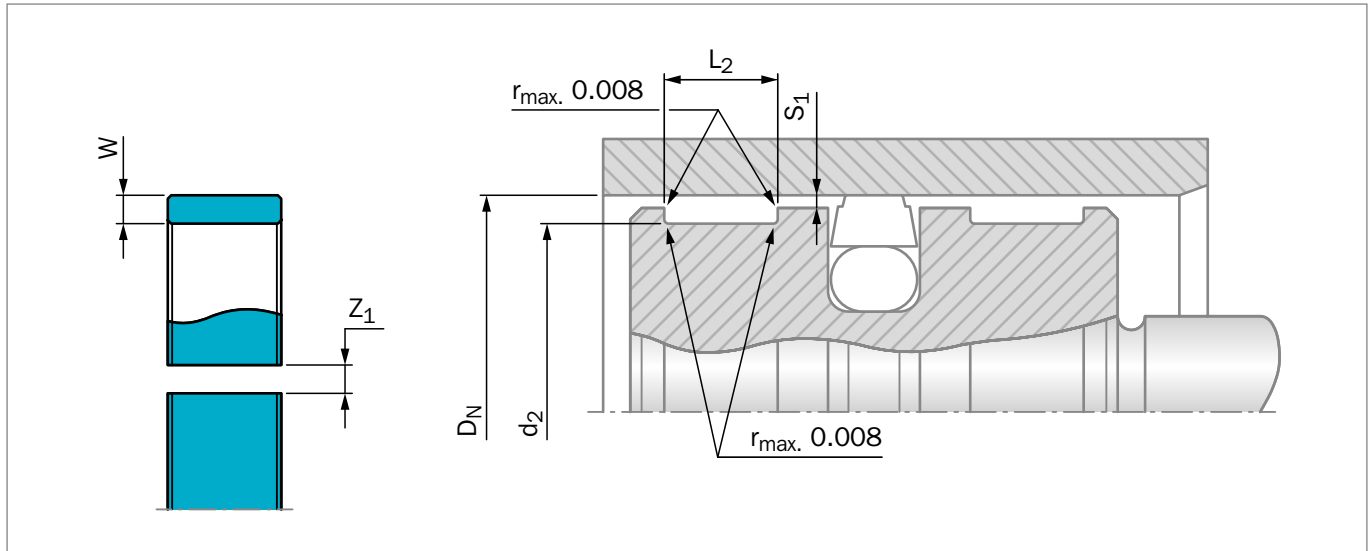


Figure 122: Installation drawing

**Table 111: Installation recommendation**

TSS Series No.	Bore Diameter	Groove Diameter	Groove Width	Thickness
	$D_n$ H9	$d_2$ h9	$L_2$ +.010	$W$ (max)
GPJA	1.000 - 4.000	$D_n$ -.250	0.260	0.125
GPJB	1.000 - 6.000	$D_n$ -.250	0.385	0.125
GPJC	1.000 - 12.000	$D_n$ -.250	0.510	0.125
GPJE	1.000 - 12.000	$D_n$ -.250	0.760	0.125
GPJF	1.000 - 12.000	$D_n$ -.250	1.010	0.125
GPJH	6.000 - 12.000	$D_n$ -.250	1.510	0.125
GPJK	6.000 - 12.000	$D_n$ -.250	2.010	0.125

**Notes:**

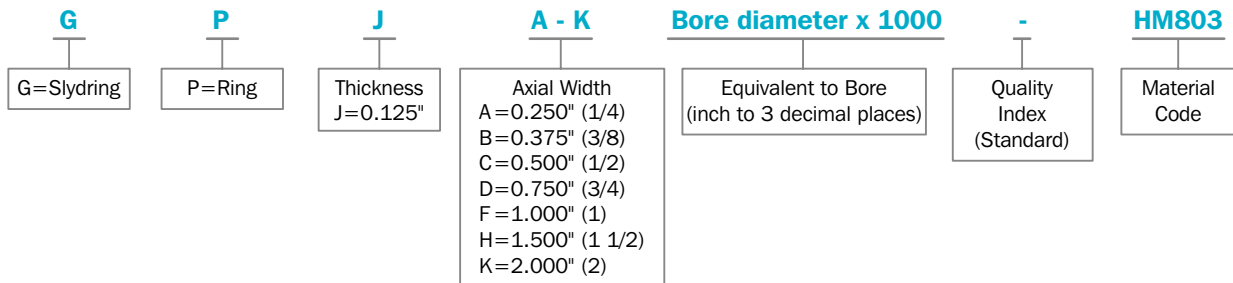
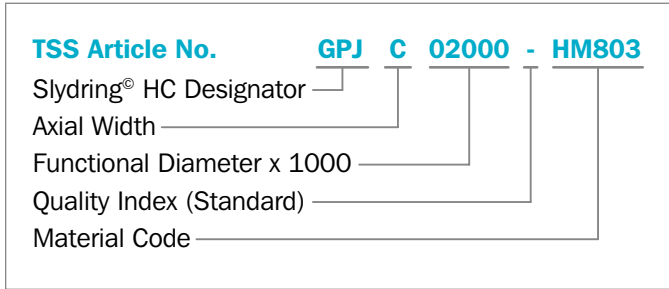
(1) Tolerances used are per ISO-286 system of limits and fits.



**ORDERING EXAMPLE**

Slydring® HC for Bore diameter  $D_N = 2.000$  inches Series GPJC from Table 111

<b>Groove width:</b>	.510 inches
<b>Ring thickness:</b>	.125 inches
<b>Material:</b>	HiMod® HM803 Standard with straight cut
<b>TSS Part No.:</b>	GPJC02000



**Table 112: HiMod® HC Wear Rings**

Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2 +0.010$	W	
1.500	1.250	.385	.125	GPJB01500
1.750	1.500	.385	.125	GPJB01750
2.000	1.750	.385	.125	GPJB02000
2.250	2.000	.385	.125	GPJB02250
2.500	2.250	.385	.125	GPJB02500
2.750	2.500	.385	.125	GPJB02750
3.000	2.750	.385	.125	GPJB03000
3.500	3.250	.385	.125	GPJB03500
4.000	3.750	.385	.125	GPJB04000
4.500	4.250	.385	.125	GPJB04500
1.000	.750	.510	.125	GPJC01000
1.500	1.250	.510	.125	GPJC01500
1.750	1.500	.510	.125	GPJC01750
2.000	1.750	.510	.125	GPJC02000
2.250	2.000	.510	.125	GPJC02250
2.500	2.250	.510	.125	GPJC02500
2.750	2.500	.510	.125	GPJC02750



Dimensions				TSS Part No.
Bore Diameter	Groove Diameter	Groove Width	Thickness	
$D_N$ H9	$d_2$ h9	$L_2$ +.010	W	
<b>3.000</b>	<b>2.750</b>	<b>.510</b>	<b>.125</b>	<b>GPJC03000</b>
<b>3.250</b>	<b>3.000</b>	<b>.510</b>	<b>.125</b>	<b>GPJC03250</b>
<b>3.500</b>	<b>3.250</b>	<b>.510</b>	<b>.125</b>	<b>GPJC03500</b>
<b>3.750</b>	<b>3.500</b>	<b>.510</b>	<b>.125</b>	<b>GPJC03750</b>
<b>4.000</b>	<b>3.750</b>	<b>.510</b>	<b>.125</b>	<b>GPJC04000</b>
<b>4.250</b>	<b>4.000</b>	<b>.510</b>	<b>.125</b>	<b>GPJC04250</b>
<b>4.500</b>	<b>4.250</b>	<b>.510</b>	<b>.125</b>	<b>GPJC04500</b>
<b>4.750</b>	<b>4.500</b>	<b>.510</b>	<b>.125</b>	<b>GPJC04750</b>
<b>5.000</b>	<b>4.750</b>	<b>.510</b>	<b>.125</b>	<b>GPJC05000</b>
<b>5.500</b>	<b>5.250</b>	<b>.510</b>	<b>.125</b>	<b>GPJC05500</b>
<b>6.000</b>	<b>5.750</b>	<b>.510</b>	<b>.125</b>	<b>GPJC06000</b>
<b>3.000</b>	<b>2.750</b>	<b>.760</b>	<b>.125</b>	<b>GPJE03000</b>
<b>3.250</b>	<b>3.000</b>	<b>.760</b>	<b>.125</b>	<b>GPJE03250</b>
<b>3.500</b>	<b>3.250</b>	<b>.760</b>	<b>.125</b>	<b>GPJE03500</b>
<b>3.750</b>	<b>3.500</b>	<b>.760</b>	<b>.125</b>	<b>GPJE03750</b>
<b>4.000</b>	<b>3.750</b>	<b>.760</b>	<b>.125</b>	<b>GPJE04000</b>
<b>4.500</b>	<b>4.250</b>	<b>.760</b>	<b>.125</b>	<b>GPJE04500</b>
<b>5.000</b>	<b>4.750</b>	<b>.760</b>	<b>.125</b>	<b>GPJE05000</b>
<b>6.000</b>	<b>5.750</b>	<b>.760</b>	<b>.125</b>	<b>GPJE06000</b>
<b>3.000</b>	<b>2.750</b>	<b>1.010</b>	<b>.125</b>	<b>GPJF03000</b>
<b>3.500</b>	<b>3.250</b>	<b>1.010</b>	<b>.125</b>	<b>GPJF03500</b>
<b>4.000</b>	<b>3.750</b>	<b>1.010</b>	<b>.125</b>	<b>GPJF04000</b>
<b>6.000</b>	<b>5.750</b>	<b>1.010</b>	<b>.125</b>	<b>GPJF06000</b>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).



## ■ Installation Recommendation and Part Numbers - Rod (Inch Series)

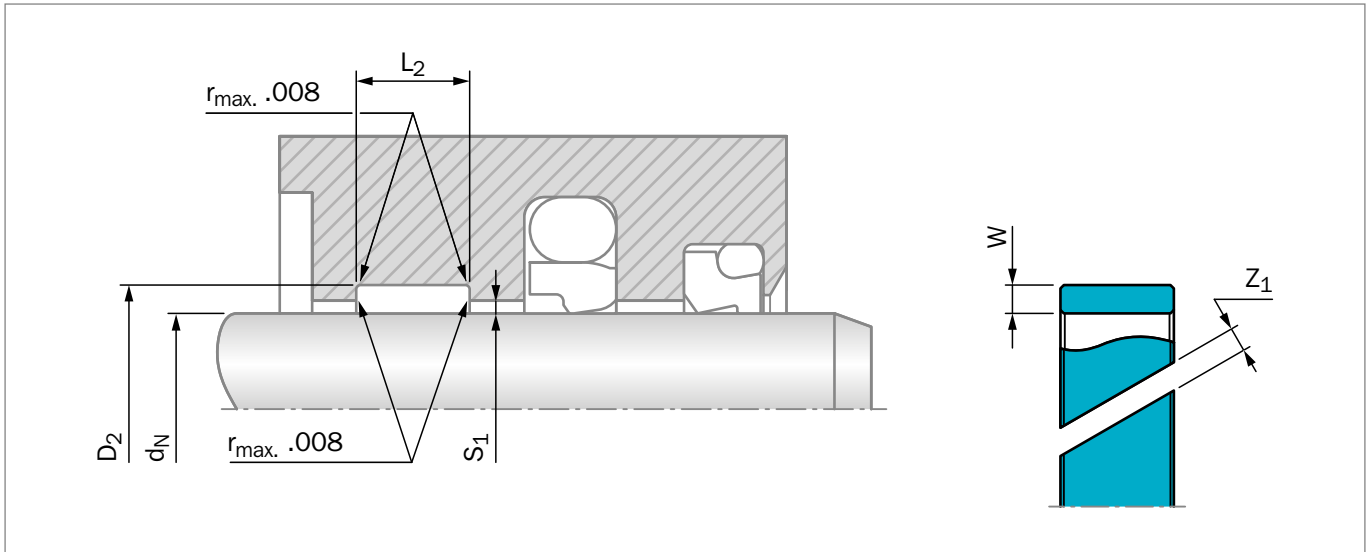


Figure 123: Installation drawing

**Table 113: Installation recommendation**

TSS Series No.	Rod Diameter	Groove Diameter	Groove Width	Thickness
	$d_N h9$	$D_2 H9$	$L_2 +.010$	$W (max)$
GR0B	.750 - 2.500	$D_N +.126$	.385	.063
GROC	1.250 - 4.000	$D_N +.126$	.510	.063
GR2B	1.250 - 4.000	$D_N +.250$	.385	.125
<b>GR2C</b>	<b>1.250 - 8.000</b>	<b><math>D_N +.250</math></b>	<b>.510</b>	<b>.125</b>
GR2D	1.500 - 10.000	$D_N +.250$	.635	.125
<b>GR2E</b>	<b>2.500 - 12.000</b>	<b><math>D_N +.250</math></b>	<b>.760</b>	<b>.125</b>
<b>GR2F</b>	<b>3.000 - 16.000</b>	<b><math>D_N +.250</math></b>	<b>1.010</b>	<b>.125</b>
GR2G	3.500 - 20.000	$D_N +.250$	1.260	.125
<b>GR2H</b>	<b>4.000 - 20.000</b>	<b><math>D_N +.250</math></b>	<b>1.510</b>	<b>.125</b>
GR2J	6.000 - 20.000	$D_N +.250$	1.760	.125
<b>GR2K</b>	<b>8.000 - 20.000</b>	<b><math>D_N +.250</math></b>	<b>2.010</b>	<b>.125</b>
GR2L	10.000 - 20.000	$D_N +.250$	2.510	.125

**Notes:**

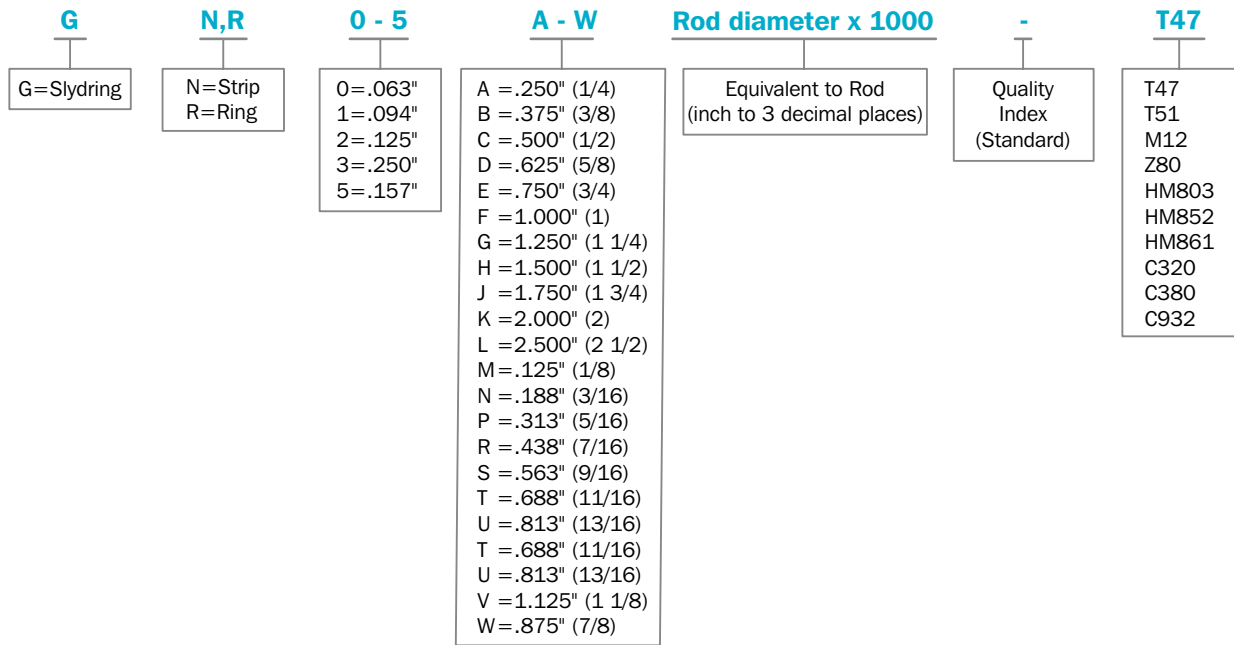
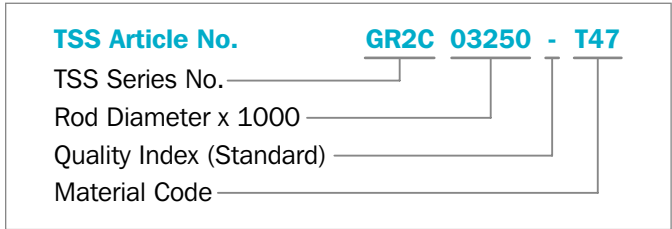
- (1) Tolerances used are per ISO-286 system of limits and fits.
- (2) **Bold** Print indicates preferred series



**ORDERING EXAMPLE**

Slydring® for Rod diameter  $d_N = 3.250$  inches Series GR2C from Table 113

<b>Groove width:</b>	.510 inches
<b>Ring thickness:</b>	.125 inches
<b>Material:</b>	Turcite® T47 Standard with angle cut
<b>TSS Part No.:</b>	GR2C03250 (from Table 114)



**Table 114: Slydring® for Rods**

Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
$d_N$ h9	$D_2$ H9	$L_2$ +.010	$W$ (Max)	
.750	.875	.510	.063	GROC00750
.875	1.000	.510	.063	GROC00875
1.000	1.125	.510	.063	GROC01000
1.125	1.250	.510	.063	GROC01125
1.250	1.375	.510	.063	GROC01250
1.375	1.500	.510	.063	GROC01375
1.500	1.625	.510	.063	GROC01500
1.625	1.750	.510	.063	GROC01625
1.750	1.875	.510	.063	GROC01750
1.875	2.000	.510	.063	GROC01875
2.000	2.125	.510	.063	GROC02000



Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
$d_N$ h9	$D_2$ H9	$L_2$ +.010	W (Max)	
<b>.750</b>	<b>1.000</b>	<b>.510</b>	<b>.125</b>	<b>GR2C00750</b>
<b>1.000</b>	<b>1.250</b>	<b>.510</b>	<b>.125</b>	<b>GR2C01000</b>
<b>1.250</b>	<b>1.500</b>	<b>.510</b>	<b>.125</b>	<b>GR2C01250</b>
1.313	1.563	.510	.125	GR2C01313
1.375	1.625	.510	.125	GR2C01375
1.438	1.688	.510	.125	GR2C01438
<b>1.500</b>	<b>1.750</b>	<b>.510</b>	<b>.125</b>	<b>GR2C01500</b>
1.563	1.813	.510	.125	GR2C01563
1.625	1.875	.510	.125	GR2C01625
1.688	1.938	.510	.125	GR2C01688
<b>1.750</b>	<b>2.000</b>	<b>.510</b>	<b>.125</b>	<b>GR2C01750</b>
1.813	2.063	.510	.125	GR2C01813
1.875	2.125	.510	.125	GR2C01875
1.938	2.188	.510	.125	GR2C01938
<b>2.000</b>	<b>2.250</b>	<b>.510</b>	<b>.125</b>	<b>GR2C02000</b>
2.125	2.375	.510	.125	GR2C02125
<b>2.250</b>	<b>2.500</b>	<b>.510</b>	<b>.125</b>	<b>GR2C02250</b>
2.375	2.625	.510	.125	GR2C02375
<b>2.500</b>	<b>2.750</b>	<b>.510</b>	<b>.125</b>	<b>GR2C02500</b>
2.626	2.876	.510	.125	GR2C02626
<b>2.750</b>	<b>3.000</b>	<b>.510</b>	<b>.125</b>	<b>GR2C02750</b>
2.875	3.125	.510	.125	GR2C02875
<b>3.000</b>	<b>3.250</b>	<b>.510</b>	<b>.125</b>	<b>GR2C03000</b>
3.125	3.375	.510	.125	GR2C03125
<b>3.250</b>	<b>3.500</b>	<b>.510</b>	<b>.125</b>	<b>GR2C03250</b>
3.375	3.625	.510	.125	GR2C03375
<b>3.500</b>	<b>3.750</b>	<b>.510</b>	<b>.125</b>	<b>GR2C03500</b>
3.625	3.875	.510	.125	GR2C03625
<b>3.750</b>	<b>4.000</b>	<b>.510</b>	<b>.125</b>	<b>GR2C03750</b>
3.875	4.125	.510	.125	GR2C03875
<b>4.000</b>	<b>4.250</b>	<b>.510</b>	<b>.125</b>	<b>GR2C04000</b>
4.125	4.375	.510	.125	GR2C04125
<b>4.250</b>	<b>4.500</b>	<b>.510</b>	<b>.125</b>	<b>GR2C04250</b>
4.375	4.625	.510	.125	GR2C04375
<b>4.500</b>	<b>4.750</b>	<b>.510</b>	<b>.125</b>	<b>GR2C04500</b>
4.625	4.875	.510	.125	GR2C04625
<b>4.750</b>	<b>5.000</b>	<b>.510</b>	<b>.125</b>	<b>GR2C04750</b>
4.875	5.125	.510	.125	GR2C04875
5.000	5.250	.510	.125	GR2C05000
5.125	5.375	.510	.125	GR2C05125
5.250	5.500	.510	.125	GR2C05250





Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
$d_N$ h9	$D_2$ H9	$L_2$ +.010	W (Max)	
5.375	5.625	.510	.125	GR2C05375
5.500	5.750	.510	.125	GR2C05500
5.625	5.875	.510	.125	GR2C05625
5.750	6.000	.510	.125	GR2C05750
5.875	6.125	.510	.125	GR2C05875
6.000	6.250	.510	.125	GR2C06000
6.250	6.500	.510	.125	GR2C06250
6.500	6.750	.510	.125	GR2C06500
6.750	7.000	.510	.125	GR2C06750
7.000	7.250	.510	.125	GR2C07000
7.250	7.500	.510	.125	GR2C07250
7.500	7.750	.510	.125	GR2C07500
7.750	8.000	.510	.125	GR2C07750
8.000	8.250	.510	.125	GR2C08000
8.250	8.500	.510	.125	GR2C08250
8.500	8.750	.510	.125	GR2C08500
8.750	9.000	.510	.125	GR2C08750
9.000	9.250	.510	.125	GR2C09000
9.250	9.500	.510	.125	GR2C09250
9.500	9.750	.510	.125	GR2C09500
9.750	10.000	.510	.125	GR2C09750
10.000	10.250	.510	.125	GR2C10000
10.500	10.750	.510	.125	GR2C10500
11.000	11.250	.510	.125	GR2C11000
11.500	11.750	.510	.125	GR2C11500
12.000	12.250	.510	.125	GR2C12000
<b>1.750</b>	<b>2.000</b>	<b>.760</b>	<b>.125</b>	<b>GR2E01750</b>
<b>2.000</b>	<b>2.250</b>	<b>.760</b>	<b>.125</b>	<b>GR2E02000</b>
<b>2.250</b>	<b>2.500</b>	<b>.760</b>	<b>.125</b>	<b>GR2E02250</b>
<b>2.500</b>	<b>2.750</b>	<b>.760</b>	<b>.125</b>	<b>GR2E02500</b>
<b>2.750</b>	<b>3.000</b>	<b>.760</b>	<b>.125</b>	<b>GR2E02750</b>
<b>3.000</b>	<b>3.250</b>	<b>.760</b>	<b>.125</b>	<b>GR2E03000</b>
<b>3.250</b>	<b>3.500</b>	<b>.760</b>	<b>.125</b>	<b>GR2E03250</b>
<b>3.500</b>	<b>3.750</b>	<b>.760</b>	<b>.125</b>	<b>GR2E03500</b>
<b>3.750</b>	<b>4.000</b>	<b>.760</b>	<b>.125</b>	<b>GR2E03750</b>
<b>4.000</b>	<b>4.250</b>	<b>.760</b>	<b>.125</b>	<b>GR2E04000</b>
4.125	4.375	.760	.125	GR2E04125
<b>4.250</b>	<b>4.500</b>	<b>.760</b>	<b>.125</b>	<b>GR2E04250</b>
4.375	4.625	.760	.125	GR2E04375
<b>4.500</b>	<b>4.750</b>	<b>.760</b>	<b>.125</b>	<b>GR2E04500</b>



Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
$d_N$ h9	$D_2$ H9	$L_2$ +.010	W (Max)	
4.625	4.875	.760	.125	GR2E04625
<b>4.750</b>	<b>5.000</b>	<b>.760</b>	<b>.125</b>	<b>GR2E04750</b>
4.875	5.125	.760	.125	GR2E04875
5.000	5.250	.760	.125	GR2E05000
5.125	5.375	.760	.125	GR2E05125
5.250	5.500	.760	.125	GR2E05250
5.375	5.625	.760	.125	GR2E05375
5.500	5.750	.760	.125	GR2E05500
5.625	5.875	.760	.125	GR2E05625
5.750	6.000	.760	.125	GR2E05750
5.875	6.125	.760	.125	GR2E05875
6.000	6.250	.760	.125	GR2E06000
6.250	6.500	.760	.125	GR2E06250
6.500	6.750	.760	.125	GR2E06500
6.750	7.000	.760	.125	GR2E06750
7.000	7.250	.760	.125	GR2E07000
7.250	7.500	.760	.125	GR2E07250
7.500	7.750	.760	.125	GR2E07500
7.750	8.000	.760	.125	GR2E07750
8.000	8.250	.760	.125	GR2E08000
8.250	8.500	.760	.125	GR2E08250
8.500	8.750	.760	.125	GR2E08500
8.750	9.000	.760	.125	GR2E08750
9.000	9.250	.760	.125	GR2E09000
9.250	9.500	.760	.125	GR2E09250
9.500	9.750	.760	.125	GR2E09500
9.750	10.000	.760	.125	GR2E09750
10.000	10.250	.760	.125	GR2E10000
10.500	10.750	.760	.125	GR2E10500
11.000	11.250	.760	.125	GR2E11000
11.500	11.750	.760	.125	GR2E11500
12.000	12.250	.760	.125	GR2E12000
12.500	12.750	.760	.125	GR2E12500
13.000	13.250	.760	.125	GR2E13000
13.500	13.750	.760	.125	GR2E13500
14.000	14.250	.760	.125	GR2E14000
14.500	14.750	.760	.125	GR2E14500
15.000	15.250	.760	.125	GR2E15000
15.500	15.750	.760	.125	GR2E15500
16.000	16.250	.760	.125	GR2E16000
16.500	16.750	.760	.125	GR2E16500



Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
$d_N$ h9	$D_2$ H9	$L_2$ +.010	W (Max)	
17.000	17.250	.760	.125	GR2E17000
17.500	17.750	.760	.125	GR2E17500
18.000	18.250	.760	.125	GR2E18000
18.500	18.750	.760	.125	GR2E18500
19.000	19.250	.760	.125	GR2E19000
19.500	19.750	.760	.125	GR2E19500
20.000	20.250	.760	.125	GR2E20000
<b>2.250</b>	<b>2.500</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F02250</b>
<b>2.500</b>	<b>2.750</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F02500</b>
<b>2.750</b>	<b>3.000</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F02750</b>
<b>3.000</b>	<b>3.250</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F03000</b>
<b>3.250</b>	<b>3.500</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F03250</b>
<b>3.500</b>	<b>3.750</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F03500</b>
<b>3.750</b>	<b>4.000</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F03750</b>
<b>4.000</b>	<b>4.250</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F04000</b>
<b>4.250</b>	<b>4.500</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F04250</b>
<b>4.500</b>	<b>4.750</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F04500</b>
<b>4.750</b>	<b>5.000</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F04750</b>
<b>5.000</b>	<b>5.250</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F05000</b>
<b>5.250</b>	<b>5.500</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F05250</b>
<b>5.500</b>	<b>5.750</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F05500</b>
<b>5.750</b>	<b>6.000</b>	<b>1.010</b>	<b>.125</b>	<b>GR2F05750</b>
6.000	6.250	1.010	.125	GR2F06000
6.250	6.500	1.010	.125	GR2F06250
6.500	6.750	1.010	.125	GR2F06500
6.750	7.000	1.010	.125	GR2F06750
7.000	7.250	1.010	.125	GR2F07000
7.250	7.500	1.010	.125	GR2F07250
7.500	7.750	1.010	.125	GR2F07500
7.750	8.000	1.010	.125	GR2F07750
8.000	8.250	1.010	.125	GR2F08000
8.250	8.500	1.010	.125	GR2F08250
8.500	8.750	1.010	.125	GR2F08500
8.750	9.000	1.010	.125	GR2F08750
9.000	9.250	1.010	.125	GR2F09000
9.250	9.500	1.010	.125	GR2F09250
9.500	9.750	1.010	.125	GR2F09500
9.750	10.000	1.010	.125	GR2F09750
10.000	10.250	1.010	.125	GR2F10000
10.500	10.750	1.010	.125	GR2F10500



Dimensions				TSS Part No.
Rod Diameter	Groove Diameter	Groove Width	Thickness	
<b>d<sub>N</sub></b> h9	<b>D<sub>2</sub></b> H9	<b>L<sub>2</sub></b> +.010	<b>W</b> (Max)	
11.000	11.250	1.010	.125	GR2F11000
11.500	11.750	1.010	.125	GR2F11500
12.000	12.250	1.010	.125	GR2F12000
12.500	12.750	1.010	.125	GR2F12500
13.000	13.250	1.010	.125	GR2F13000
13.500	13.750	1.010	.125	GR2F13500
14.000	14.250	1.010	.125	GR2F14000
14.500	14.750	1.010	.125	GR2F14500
15.000	15.250	1.010	.125	GR2F15000
15.500	15.750	1.010	.125	GR2F15500
16.000	16.250	1.010	.125	GR2F16000
16.500	16.750	1.010	.125	GR2F16500
17.000	17.250	1.010	.125	GR2F17000
17.500	17.750	1.010	.125	GR2F17500
18.000	18.250	1.010	.125	GR2F18000
18.500	18.750	1.010	.125	GR2F18500
19.000	19.250	1.010	.125	GR2F19000
19.500	19.750	1.010	.125	GR2F19500
20.000	20.250	1.010	.125	GR2F20000

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

In some cases the available part will be designated as a Piston part number, so please discuss with your TSS representative for further details.

# Dualseal



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Radial sealing

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For O-Ring grooves

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**Material:**  
Zurcon®

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## Dualseal

### Description

In current hydraulic cylinder design, O-Ring or O-Ring/Back-up Ring combinations are mainly used as static seals. However, this sealing solution hides the risk that during assembly the O-Ring may become twisted and that the position of the Back-up Ring is not optimal. This solution also exhibits weaknesses with regard to pressure pulsation and the ingress of dirt.

The Dualseal as a single component static hydraulic seal offers a good alternative in such cases.

**Table 115: Surface finish**

Type of load	Surface	Rt (µin)	Rz (µin)	Ra (µin)
Radial-static	Mating surface	≤394		≤63
	Groove surface (groove diameter, groove flanks)	≤630	≤248	≤126

### LEAD-IN CHAMFERS

Groove depth < .12 inches (3 mm) → .12 inches x 15° (3 mm x 15°)

Groove depth > .12 inches (3 mm) → .20 inches x 15° (5 mm x 15°)

### PREFERRED SEALING GAP

Bore H8

Gland g6

Due to the high extrusion resistance of the seal a radial sealing gap (S) of .008 inches (0.2 mm) can be realized.

In case of low temperature applications, deviations of the gland to the bore and rod should be avoided.

### TECHNICAL DATA

<b>Operating pressure:</b>	Max. 7,500 psi (Max. 50 MPa)
<b>Operating temperature:</b>	-31 °F to +230 °F (-35 °C to +110 °C)

### IMPORTANT NOTE

The application limits for pressure and temperature given in this catalogue 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.

### MATERIAL

Standard material: Zurcon® Z20 polyurethane 93 shore A, turquoise. Suitable for all HL and HLP hydraulic fluids.

### ADVANTAGES

Compared with the O-Ring / Back-up Ring combination, the Dualseal offers the following advantages:

- High resistance to twisting
- Easy assembly
- Long service life
- High extrusion resistance

### APPLICATIONS

The Dualseal allows general use in hydraulic cylinders:

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

Dualseal performs leak-free and is highly extrusion resistant under the following test conditions:

**Table 116: Test Conditions**

	High pressure test	Pressure pulsation test
Pressure P	6,000 / 7,800 psi (40 / 52 MPa)	4,500 psi (30 MPa)
Temperature T	212 °F / 176 °F (100 °C / 80 °C)	140 °F (60 °C (max. tank temperature))
Medium	Hydraulic oil HLP 46	Hydraulic oil HLP 46
Test duration	72 h	500,000 Pressure pulsations



## ■ Installation Recommendation (Inch Series)

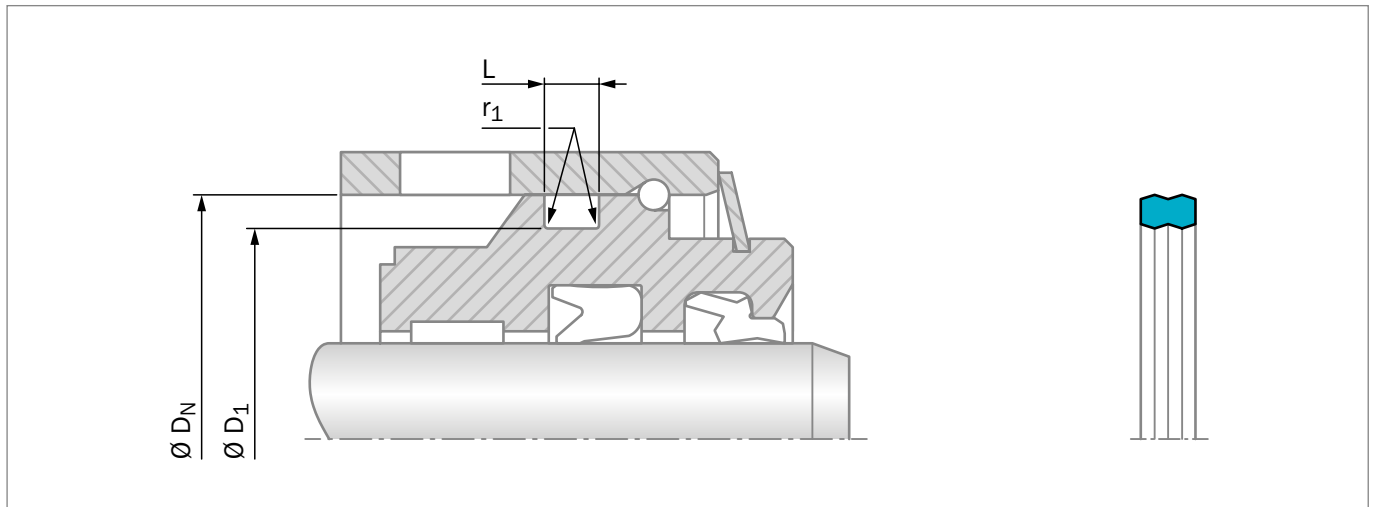


Figure 124: Installation drawing

**Table 117: Installation dimensions / TSS Article No.**

ASTM AS568	Bore Diameter	Groove Diameter	Groove Width	Radius	TSS Article No.
Size	$D_N$ H9	$D_1$ h9	$L + .008$	$r_1$ max.	
117	1.000	.838	.140	.020	DUB001000-Z20
121	1.250	1.088	.140	.020	DUB001250-Z20
125	1.500	1.338	.140	.020	DUB001500-Z20
129	1.750	1.588	.140	.020	DUB001750-Z20
133	2.000	1.838	.140	.020	DUB002000-Z20
137	2.250	2.088	.140	.020	DUB002250-Z20
141	2.500	2.338	.140	.002	DUB002500-Z20
232	3.000	2.778	.187	.020	DUC003000-Z20
234	3.250	3.028	.187	.020	DUC003250-Z20
236	3.500	3.278	.187	.020	DUC003500-Z20
238	3.750	3.528	.187	.020	DUC003750-Z20
240	4.000	3.778	.187	.020	DUC004000-Z20
242	4.250	4.028	.187	.020	DUC004250-Z20
244	4.500	4.278	.187	.020	DUC004500-Z20
246	4.750	4.528	.187	.020	DUC004750-Z20
248	5.000	4.778	.187	.020	DUC005000-Z20
250	5.250	5.028	.187	.020	DUC005250-Z20
354	5.500	5.160	.281	.020	DUD005500-Z20
358	6.000	5.660	.281	.020	DUD006000-Z20
<b>117</b>	<b>1.000</b>	<b>.838</b>	<b>.171</b>	<b>.020</b>	<b>DUB101000-Z20</b>
<b>121</b>	<b>1.250</b>	<b>1.088</b>	<b>.171</b>	<b>.020</b>	<b>DUB101250-Z20</b>
<b>125</b>	<b>1.500</b>	<b>1.338</b>	<b>.171</b>	<b>.020</b>	<b>DUB101500-Z20</b>
<b>129</b>	<b>1.750</b>	<b>1.588</b>	<b>.171</b>	<b>.020</b>	<b>DUB101750-Z20</b>
<b>133</b>	<b>2.000</b>	<b>1.838</b>	<b>.171</b>	<b>.020</b>	<b>DUB102000-Z20</b>





ASTM AS568	Bore Diameter	Groove Diameter	Groove Width	Radius	TSS Article No.
Size	D <sub>N</sub> H9	D <sub>1</sub> h9	L +.008	r <sub>1</sub> max.	
<b>137</b>	<b>2.250</b>	<b>2.088</b>	<b>.171</b>	<b>.020</b>	<a href="#">DUB102250-Z20</a>
<b>141</b>	<b>2.500</b>	<b>2.338</b>	<b>.171</b>	<b>.020</b>	<a href="#">DUB102500-Z20</a>
<b>232</b>	<b>3.000</b>	<b>2.778</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC103000-Z20</a>
<b>234</b>	<b>3.250</b>	<b>3.028</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC103250-Z20</a>
<b>236</b>	<b>3.500</b>	<b>3.278</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC103500-Z20</a>
<b>238</b>	<b>3.750</b>	<b>3.528</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC103750-Z20</a>
<b>240</b>	<b>4.000</b>	<b>3.778</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC104000-Z20</a>
<b>242</b>	<b>4.250</b>	<b>4.028</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC104250-Z20</a>
<b>244</b>	<b>4.500</b>	<b>4.278</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC104500-Z20</a>
<b>246</b>	<b>4.750</b>	<b>4.528</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC104750-Z20</a>
<b>248</b>	<b>5.000</b>	<b>4.778</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC105000-Z20</a>
<b>250</b>	<b>5.250</b>	<b>5.028</b>	<b>.208</b>	<b>.020</b>	<a href="#">DUC105250-Z20</a>
354	5.500	5.160	.311	.020	<a href="#">DUD105500-Z20</a>
358	6.000	5.660	.311	.020	<a href="#">DUD106000-Z20</a>

The sizes listed in **bold** font are preferred sizes (more likely to be available for immediate shipment).

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