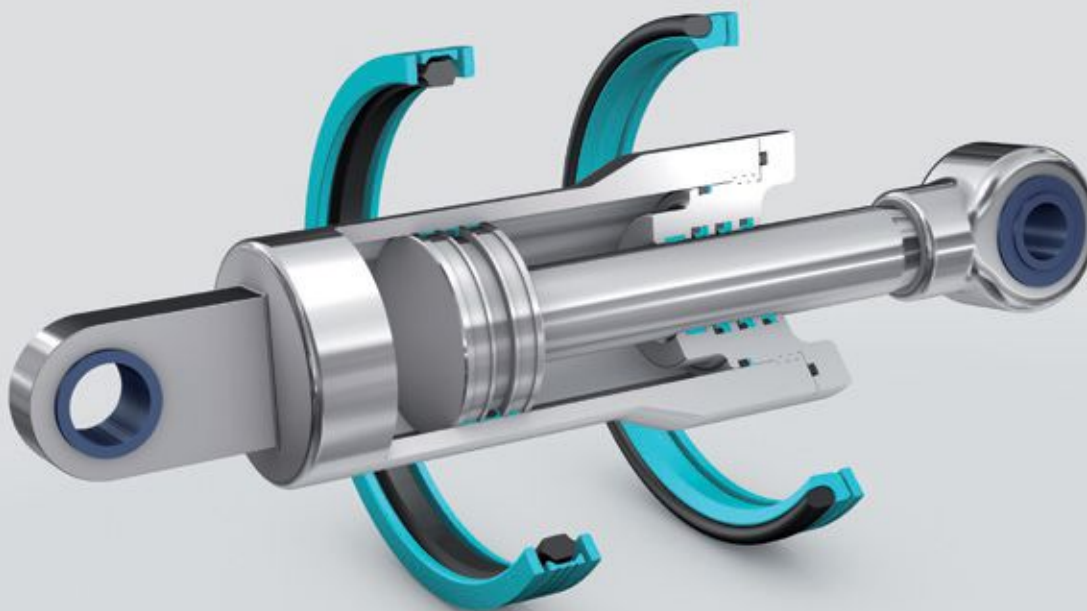




Aerospace Sealing Systems

PRODUCT CATALOG & ENGINEERING GUIDE





Your Partner for Sealing Technology

Trelleborg Sealing Solutions is a major international sealing force, 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, 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 70 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.

Facilities are certified to ISO 9001:2008 and ISO/TS 16949:2009. Trelleborg Sealing Solutions is backed by the experiences and resources of one of the world's foremost experts in polymer technology: the Trelleborg Group.

ISO 9001:2008

ISO/TS 16949:2009

The information in this brochure is intended to be for general reference purposes only and is not intended to be a specific recommendation for any individual application. The application limits for pressure, temperature, speed and media given are maximum values determined in laboratory conditions. In application, due to the interaction of operating parameters, maximum values may not be achieved. It is vital therefore, that customers satisfy themselves as to the suitability of product and material for each of 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 brochure. While every effort is made to ensure the accuracy of information contained herewith, Trelleborg Sealing Solutions cannot warrant the accuracy or completeness of information.

To obtain the best recommendation for a specific application, please contact your local Trelleborg Sealing Solutions marketing company.

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Aerospace Engineering Guide

■ Sealing Solutions for Demanding Aerospace Applications

As a global market leader in the supply of aerospace sealing solutions, with over 60 years of experience in the industry, Trelleborg Sealing Solutions can provide the optimum seal for the majority of applications. The materials and products included in this catalog can be fitted on anything from two-seater light aircraft to heavy-duty long-range commercial airliners, from

military planes to spacecraft and satellites, from ships to submarines and marine applications. Seals from Trelleborg Sealing Solutions provide proven performance in a wide variety of systems including flight controls, actuation, landing gear, wheels, brakes, fuel controls, engines and airframe.

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Aerospace Sealing Capabilities

■ Aerospace Sealing Capabilities

Seals from Trelleborg Sealing Solutions provide proven performance in a wide variety of systems including flight controls, actuation, landing gear, wheels, brakes, engines and airframe.

Actuation

High-integrity piston and gland seals are specified to meet the high usage, long-life demands of aircraft actuators. These can be engineered for a variety of configurations up to 8,000 psi/ 55 MPa. With our vast experience in this field, Trelleborg Sealing Solutions can also assist with actuator design by recommending component tolerances, surface finishes, coatings and seal groove geometries.

For rotary shaft seal applications, Trelleborg Sealing Solutions provides anything from conventional radial oil seals to high-performance Turcon® Varilip® PDR lip seals. Subassembly and installation support is also available.

Flight Controls

Flight controls, whether primary or secondary, are the most demanding of all the hydraulic actuation systems on an aircraft. Trelleborg Sealing Solutions has achieved a dominant role as a supplier of dynamic sealing systems for flight controls in both military and civil aircraft, on fixed and rotary wing airframes. Operating conditions and performance requirements have become more stringent when comparing traditional fly-by-wire systems, implemented in military aircraft during the 1980s, to the more complex electro hydraulic actuators used on the latest civil and military aircraft. We have evolved advanced sealing systems to match these.

Trelleborg Sealing Solutions has developed sealing systems that are able to cope with the high system pressure (5,000 psi) demands seen in today's aircraft. They can also handle an almost ten-fold increase in life expectancy as well as high frequency movements resulting from the transition from analog to digital signals to the controls. This has been made possible through extensive developments in seal profiles and materials along with research into the dynamic relationship between individual sealing system elements and performance life.

Landing Gear

As a major supplier of seals and bearings for both large and small landing gear, Trelleborg Sealing Solutions has, with a variety of proprietary seal types, pioneered the use of dual contact seals. These optimized seal

designs have contributed to extended operating and service life of landing gear on virtually all aircraft platforms. In addition, new seal designs that are able to work in ultra-high deflection environments on surfaces that are not coated with chrome, such as High-Velocity Oxygen Fuel (HVOF) applied tungsten carbide cobalt-based coatings, are now available.

To further increase service life, adding Orkot® bearings prevents scratches and for existing gear designs, significantly reduces bearing component weight. In addition, service life and seal performance can be improved with retrofit sealing systems in Turcon®, Turel® or Orkot®.

Wheel and Brake

Designed for superior performance in harsh environments, the Trelleborg Sealing Solutions portfolio provides a complete range of static and dynamic sealing systems including steel-reinforced bearing grease retainers, large O-Ring wheel hub seals and high-temperature brake seals. We have test capabilities specific to the rigors of braking applications.

Engine Systems*

A wide range of sealing systems for engine and engine management applications is available including fan blade annulus fillers, fan cowl and thrust reverser doors, heat exchangers, drive shafts, air intakes, fairings and coupling systems. Materials are selected for high-temperature performance including Isolast®, the advanced perfluoroelastomer specially developed by Trelleborg Sealing Solutions, which will operate at up to +608°F/ +320°C. Reinforced engine seals and ducts are available that can provide fire control at tested temperatures of +2,012°F/ +1,100°C.

Airframe*

With a focus on aerodynamic efficiency, Trelleborg Sealing Solutions offers a range of standard and customized designs, developed for reliability in service and efficiency in assembly and maintenance. The Trelleborg Sealing Solutions range includes seals for wing and moving surfaces such as complex aerodynamic shrouds for hydraulic jacks, extrusions and fabricated seals for doors and hatches, interior couplings, inflatable cockpit canopy seals and fabricated swing-wing fuselage fairings.

* For more information on our Engine and Airframe products see our separate brochure *Aero Engine and Airframe Sealing Solutions*.

Brands and Manufacturing Facilities

■ Brands and Manufacturing Facilities

Trelleborg Sealing Solutions is one of the largest seal producers in the world, with over 25 strategically located manufacturing facilities on four continents. Each site specializes in a single product group or type, whether it is seals in proprietary Turcon® PTFE based materials or Zurcon® polyurethane formulations, exclusive designs in unique elastomers including Turel® or Isolast®, bearings or airframe seals. Listed below are production sites that focus on supply to the aerospace market, many of which are responsible for world-renowned brands respected within the sector.

Trelleborg Sealing Solutions manufacturing sites:

Helsingør, Denmark **Formerly W.S. Shamban Europe A/S**



Founded in the 1960s as the European supplier of the Shamban range of products, this facility is a leading manufacturer of hydraulic, fuel systems and engine seals. It is the Trelleborg Sealing Solutions center for the development of the proprietary Turcon® PTFE based materials and Turcon® VL Seal®.

Condé, France **Formerly Impervia**

The facility has built its expertise over a 60-year history. It was the first manufacturer of elastomeric and plastic seals in France for the aerospace industry and is still the leading company in this sector within the country. It specializes in elastomer products, O-Rings, special moldings, bonded seals and machined seals.

Bridgwater, UK **Formerly Wills Polymers**



The main areas of expertise of this facility are Turcon® Variseal® and Turcon® Varilip® PDR. Wills Rings®, the original metal rings, were developed here in the 1930s.

Cadley Hill, UK **Formerly Woodville Polymers**



Experts in homogenous and fabric-reinforced silicone profiles used to seal airframe structures, access panels and engine systems.

Tewkesbury, UK **Formerly Dowty Seals**



With roots going back to the 1940s, this facility is the Trelleborg Sealing Solutions center of expertise for elastomer materials, high-performance O-Rings, gaskets and elastomer-based custom-designed sealing solutions.

Brands and Manufacturing Facilities

Broomfield, Colorado, USA Formerly American Variseal Corporation



The main areas of expertise of the facility are Turcon® Variseal® and Turcon® Varilip® PDR. It is also the design and manufacturing center for engineered bearing products made from high modulus materials.

São Paulo, Brazil

Manufacturer of elastomer seals to support the aerospace & defense industries in Brazil and Latin America.

Fort Wayne, Indiana, USA Formerly Busak+Shamban Seals Division

A leading manufacturer of hydraulic, fuel systems and engine seals, the company was established in the 1950s. The facility provides innovative and functional solutions for complex applications by utilizing the best of elastomer and thermoplastic materials technologies. Home of the slipper seal products originally developed by W.S. Shamban: Double Delta®, Footseal, HATSEAL®, Wedgpak® and Plus Seal®.

Northborough, Massachusetts, USA Formerly Chase-Walton Elastomers

Experts in homogenous and fabric-reinforced silicone profiles used to seal airframe structures, access panels and engine systems. Products manufactured at the facility include ducting for high-temperature applications, aerodynamic wing seals, nacelle seals, engine seals, fire seals and pylon seals.

For full details of our manufacturing facilities worldwide go to www.tss.trelleborg.com. All inquiries should be directed to your local Trelleborg Sealing Solutions marketing company.



Aerospace Service

■ Aerospace Service

Due to the increasingly stringent requirements of the aerospace market, Trelleborg Sealing Solutions places strong emphasis on its ability to globally service, support and supply its aerospace customers through our international network of manufacturing facilities and support teams.

Technical and Engineering Expertise

Trelleborg Sealing Solutions is uniquely placed to offer a dedicated seal design and development service to the aerospace market. As our seals are used in virtually every major commercial and military program, our engineering personnel are able to contribute their knowledge of this specialized technology directly to customers. Dedicated teams are appointed to manage the supply process that starts with the efficient handling of inquiries to complete project management of design, prototyping, production, testing and installation of sealing systems. To facilitate this we employ state-of-the-art design tools, fully customer-compatible CAD systems and leading-edge Finite Element Analysis (FEA).

Quality and Manufacturing Capability

Trelleborg Sealing Solutions manufacturing sites are strategically located to provide global coverage. They succeed in delivering cost-effective sealing solutions, while maintaining the highest standards of international airworthiness, quality control and conformance to the latest environmental legislation. The FAA, EASA and leading aerospace manufacturers are regular visitors to Trelleborg Sealing Solutions facilities worldwide, and Trelleborg Sealing Solutions continues to work with these groups to enhance their reputation for quality and to maintain their key position in the aerospace supply chain.

All Trelleborg Sealing Solutions manufacturing facilities are certified to ISO 9001:2008 and ISO/TS 16949:2009 and those involved in production of aerospace parts have AS/EN 9100 approval.

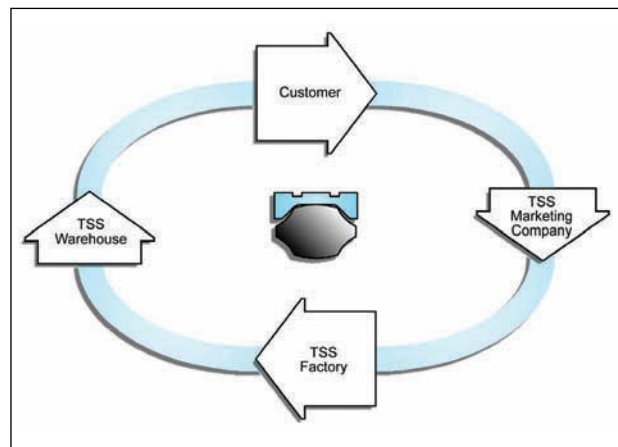
Logistics, Kitting, Direct Line Feed and Subassemblies

An extensive global distribution network, backed by logistic centers in Europe, Asia-Pacific and the Americas, ensures rapid delivery to our customers. Trelleborg Sealing Solutions has proven expertise in kitting to provide complete seal sets to customers presented in the way best suited to their needs. All the seals in the kits are backed up by full technical and quality support.

Trelleborg Sealing Solutions can also produce subassemblies on behalf of our customers. These make assembly at the next stage easier and can minimize installation-related seal failures. Subassemblies, kits or individual seals can be delivered direct to the customers' shop floors using reliable, low paperwork direct line feed (DLF) systems. These minimize customer procurement costs, stock and delivery error rates.

Aftermarket Support

Dedicated customer-focused teams ensure that aftermarket needs are met. Trelleborg Sealing Solutions engineers regularly visit the airframe manufacturers, airlines, Original Equipment Manufacturers (OEMs) and Maintenance Repair Overhaul (MRO) repair stations. Our engineers provide them with technical support and guidance so systems run at peak performance. Our knowledge of seal and bearing system performance in operating conditions has enabled many customers to upgrade to more reliable systems and increase performance, without additional hardware or tooling costs.



Aerospace Standards

■ Aerospace Standards

There are a large number of standards that apply to the aerospace industry. Listed in this section are the key ones.

Standard authorities

All standards prefixed with either AS (Aerospace Standard) or ARP (Aerospace Recommended Practice) are issued by SAE International (Society of Automotive Engineers) in the US. Trelleborg Sealing Solutions is an active contributor to the SAE work. Copies of SAE standards may be obtained from the Society of Automotive Engineers. Go to their website at www.sae.org.

This is a standards development organization for the engineering of powered vehicles of all kinds including aerospace. In addition, MIL standards cover military aircraft and are issued by the US Department of Defense.

ARP1234, Revision B Gland Design, Elastomeric O-Ring Seals, Static Axial, Without Back-up Rings

Provides standardized dimensional criteria for static axial elastomeric O-Ring seal glands, without Back-up Rings. This standard supplements ARP 1231, "Gland Design, Elastomeric O-Ring Seals, General Considerations." The criteria are similar, but not identical, to those in MIL-G-5514.

ARP5316 Storage of Elastomer Seals and Seal Assemblies Which Include an Elastomer Element Prior to Hardware Assembly

Addresses the general requirements for data recording procedures, packaging and storing of elastomeric seals and seal assemblies which include an elastomeric element prior to the seal being assembled into hardware components.

The requirement for packaging is an integral part of the controlled storage procedure and provides a means of positive product identity from the time of manufacturing to the time of assembly into a component.

AS4088 Aerospace Rod Scraper Gland Design Standard

Defines gland dimensions for rod scrapers. Gives specifications for rod diameters from ¼ to 15 ½ inches/ six to 394 mm, inclusive corresponding to AS568 O-Ring Dash No. sizes -108/-111, -206/-222, -325/-349

and -425/-460. The gland details provide more space than MS33765 and are sufficient to fit more efficient and reliable exclusion devices.

AS4052 Gland Design: Scraper, Landing Gear, Installation

Covers an alternate gland design for the installation of scraper/ wiper rings in the lower end of landing gear shock struts for the purpose of contaminant exclusion.

Piston rod diameters, gland internal diameters, groove sidewall angles and the surface finish are all defined by AS4716, but the gland outer retaining wall diameter is changed. The gland has a reduced atmospheric gland lip and profiled lead in geometry to allow for a PTFE jacket metal spring-energized scraper to be installed.

AS4716 Gland Design, O-Ring and Other Elastomeric Seals

Provides standardized gland design criteria and dimensions for elastomeric seal glands for static and dynamic applications.

The glands have been specifically designed for applications using SAE AS568 size O-Rings, with related class 2 tolerances, at pressures exceeding 1,500psi/ 10.3 MPa utilizing one or two anti-extrusion Back-up Rings and applications at pressures under 1,500psi/ 10.3 MPa without Back-up Rings. While this specification covers the basic design criteria and recommendations for use with standard size O-Rings, these glands are also for use with other elastomeric and PTFE based seals and packings.

AS4832 Gland Design: Nominal 3/8 Inch Cross Section for Custom Compression Type Seals

Offers gland details for a nominal 3/8 inch/ 0.364 mm cross section gland with proposed gland lengths for compression-type seals with two Back-up Rings over a range of eight to 20 inches/ 203 to 508 mm in diameter.

A dash number system is proposed similar to AS568A. Seal configurations and design are not a part of this document. This gland is for use with custom compression-type seals including, but not limited to O-Rings, T-Rings, D-Rings, etc.

AS5857

Gland Design, O-Ring and Other Elastomeric Seals, Static Applications

Provides standardized gland design criteria and dimensions for seal glands for static applications.

The glands have been specifically designed for applications using SAE AS568 size O-Rings, with related class 2 tolerances, at pressures exceeding 1,500psi/ 10.3 MPa utilizing one or two anti-extrusion Back-up Rings and applications at pressures under 1,500psi / 10.3 MPa without Back-up Rings. The glands have been sized to provide increased squeeze as compared to AS4716 for more effective sealing at low temperatures and low seal swell conditions. Primary usage is for static external sealing.

ASME B46.1

Surface Texture (Surface Roughness, Waviness and Lay)

This standard is concerned with the geometric irregularities of surfaces. It defines surface texture and its constituents: roughness, waviness and lay along with parameters for specifying surface texture.

The terms and ratings in this standard relate to surfaces produced by such means as abrading, casting, coating, cutting, etching, plastic deformation, sintering, wear, erosion, etc.

ISO 4287

Geometrical Product Specifications (GPS) -- Surface Texture: Profile Method -- Terms, Definitions and Surface Texture Parameters

This international standard specifies terms, definitions and parameters for the determination of surface texture (roughness, waviness and primary profile) by profiling methods.

MIL-G-5514

Military Specification- General Requirements for Gland Design; Packings, Hydraulic Equipment

Approved for use by all Departments and Agencies of the Department of Defense.

This specification covers basic design criteria recommendations for use and application in packings, gaskets, packing and gasket glands and related features for use in hydraulic equipment utilized in systems designed in accordance with MIL-H-5440.

■ Material technology



As specialists in polymer technology, Trelleborg Sealing Solutions has for decades been a world-leader in the development of new polymeric compounds for use in aerospace applications. Not only does Trelleborg Sealing Solutions develop and formulate its aerospace materials in-house, it has also acquired significant skills in the field of applied materials technology enabling us to recommend coatings and surface finishes. Seals can be individually hand-fabricated, automatically molded, fabric-reinforced or bonded to metallic components.

A full range of aerospace grade Turel® elastomers is available, specifically engineered to withstand the extremes of temperature and aggressive chemicals encountered in today's aircraft. To complement these materials, many proprietary blends of premium-grade Turcon® PTFE based materials along with high-modulus Zurcon® thermoplastics are available to provide a one-stop-shop of engineered solutions for aerospace sealing challenges. In addition for bearings there is Orkot®, a unique thermoplastic composite material.

■ Turel® and Isolast®

The Turel® range of elastomers is specifically engineered to meet the challenging requirements of the aerospace industry. It includes Nitrile (NBR), Fluorocarbon (FKM), Ethylene Propylene Diene Monomer (EPDM), Hydrogenated Nitrile Butadiene Rubber (HNBR), Fluorosilicone (FVMQ) and Silicone Rubber (Q). In addition, for high-temperature applications, an Isolast® perfluoroelastomer (FFKM) is recommended. These materials are extremely flexible in their use and are suitable for a large number of applications.

The various elastomers can be characterized as follows:

NBR (Nitrile Butadiene Rubber)

Turel® Standard Grades: NE, NG, NB, NZ

NBR is primarily used with mineral-based oils and greases. The properties of NBR depend mainly on their acrylonitrile (ACN) content, which ranges between 18 and 50 percent. In general the materials have good mechanical properties with operating temperatures ranging between -22°F/-30°C and +212°F/+100°C. For short periods of time NBRs can withstand up to +248°F/+120°C and specially formulated NBR can be used down to -76°F/-60°C.

FKM (Fluorocarbon Rubber)

Turel® Standard Grades: FK, FT, FG, FL

FKM is primarily used with mineral-based oils and greases at high temperatures. Depending on structure and fluorine content, FKM materials can differ with regards to their chemical resistance and cold-flexibility. FKM is particularly known for its non-flammability, low gas permeability, and excellent resistance to ozone, weathering, and aging. The operating temperatures of FKM materials range between -4°F/-20°C and +392°F/+200°C. For short periods of time FKM materials can withstand up to +446°F/+230°C and specially formulated FKM can be used down to -60°F/-51°C.

EPDM (Ethylene Propylene Diene Monomer)

Turel® Standard Grades: EP, EH

EPDM is often used in applications with brake fluids, based on glycol, and hot water. EPDM materials give good heat, ozone, and aging resistance. In addition they also exhibit high levels of elasticity, good low temperature behavior as well as good insulating properties.

The operating temperatures of EPDM materials range between -49°F/-45°C and +302°F/+150°C. For short periods of time they can withstand up to +347°F/+175°C. Operating temperatures of sulfur cured types are reduced to between -49°F/-45°C and +248°F/+120°C, for short periods of time EPDMs can withstand up to +302°F/+150°C.

HNBR (Hydrogenated Nitrile Butadiene Rubber)

HNBR is often used in high-temperature applications due to excellent abrasion resistance. HNBR materials are produced by selective hydrogenation of the NBR groups. Like these, the properties of the HNBR rubber depend on their acrylonitrile (ACN) content which ranges between 18 and 50 percent as well as on the degree of its saturation. HNBR has good mechanical properties.

The operating temperatures of HNBR materials range between -22°F/-30°C and +284°F/+140°C. For short periods of time HNBRs can withstand up to +320°F/+160°C in contact with mineral oils and greases. Special formulations can be used down to -40°F/-40°C.

FVMQ (Fluorosilicone Rubber)

Turel® Standard Grades: LA, LB, LD, LF

FVMQ is often used in the military applications and fuel systems. FVMQ materials give excellent heat resistance, cold flexibility, dielectric properties and especially good resistance to oxygen and ozone.

Depending on the material, operating temperatures range between -76°F/-60°C and +392°F/+200°C. For short periods of time FVMQs can withstand up to +446°F/+230°C. Special formulations can be used down to -130°F/-90°C.

Q (Silicone Rubber)

Turel® Standard Grades: SL

Silicone rubber is often used in gaskets, molded seals, airframe, aerodynamic and engine seals. The material gives excellent heat resistance, cold flexibility, dielectric properties and especially good resistance to oxygen and ozone.

Depending on the material, operating temperatures range between -76°F/-60°C and +392°F/+200°C. For short periods of time Silicone Rubbers can withstand up to +446°F/+230°C. Special types can be used down to -130°F/-90°C.

FFKM (Perfluoroelastomer)

Isolast® Standard Grades: J8325

Applications for FFKM can be mostly found in aircraft engines and in all applications with either aggressive environments or high temperatures.

Perfluoroelastomers are resistant to virtually all media at elevated temperatures and demonstrate low swelling.

Material Technology

Depending on the material, operating temperatures range between -13°F/-25°C and +464°F/+240°C. Special types can be used up to +617°F/+325°C.

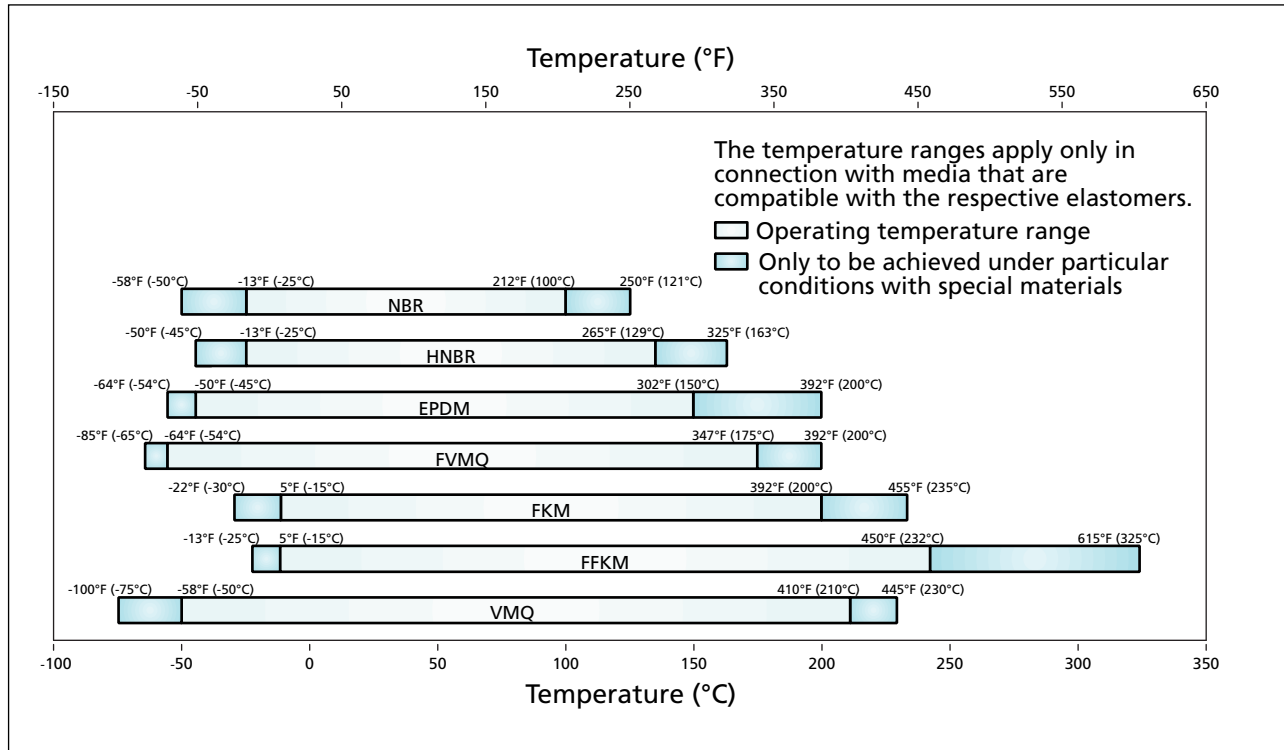


Figure 1 General temperature range of various elastomer types

Material Technology

Meeting Specifications and Approvals

For aerospace applications many designs are composite seals, with an elastomer element as an integral part of the seal. It is therefore important that parameters such as elastomer swell, shrinkage during molding, compression set, media compatibility and tolerances are carefully controlled.

Through stable processes and 100 percent batch testing in our laboratories, we make sure that materials are manufactured to Trelleborg Sealing Solutions specifications. A number of materials have also been approved for a Qualified Products List (QPL) as part of US Government and Aerospace Industry support programs.

Chemical Compatibility

Elastomer materials are more sensitive to fluids than other sealing compounds. Chemical reaction can cause damage to the seal, affecting physical properties. Specifically in hydraulic applications, selection of the optimum elastomer material for a given hydraulic fluid is critical. Not only must the oil used be taken into account but also the additives, as these can cause adverse behavior. It may be necessary to conduct a soak test at elevated temperature in order to verify the performance in application. An online chemical compatibility guide can be accessed at www.tss.trelleborg.com.

Temperature Range

Turel[®] compounds are available to operate in temperatures from -100°F to +500°F / -73°C to +260°C . Most will therefore meet the temperature requirements of AS4716 type II systems, specified as -65°F to +275°F / -54°C to +135°C. The use of spring-energized Variseal[®] can expand the temperature range even further. In addition, for high-temperature applications, Isolast[®] J8325 has an operating temperature up to +617°F / +325°C.

Temperature Cycling

The effect of temperature cycling on elastomer seals can result in compression set. This means that the elastomer material loses its elasticity over time. For Turel[®] materials, this effect is kept to an acceptable minimum if they are specified for applications with operating temperatures within the indicated parameters. The low-temperature dynamic cycling limits vary according to elastomer type.

Cold Temperatures

Elastomer materials from Trelleborg Sealing Solutions are specially engineered to give maximum performance in cold conditions.

Elastomer materials contract approximately ten times more than steel in cold environments. The material becomes stiffer and loses its flexibility at cold temperatures. When passing the lower limit it reaches the glass transition stage, when it becomes extremely brittle. Physical properties will recover when temperatures elevate again. Increased squeeze can improve performance at low temperatures.

Hot Temperatures

Elastomer materials soften and lose their physical properties if the upper temperature limit is exceeded. Physical properties will not recover and the seal will take on a permanent compression set. The compression set also varies with the type of media to which the elastomer is exposed. Continuous exposure to temperatures higher than those recommended can permanently damage the seal.

Surface Speed

In general, the speed of the dynamic surface in contact with an elastomer seal should be kept below 9.8 ft/s / three m/s to avoid damage to the elastomer. Elastomers can be used at speeds greater than listed here. Please contact your local Trelleborg Sealing Solutions marketing company for more information.

Aging

The maximum recommended storage time and shelf-life is shown in Table I, per SAE ARP 5316. This is only valid if the elastomer is stored under controlled conditions in light-proof and airtight packaging, as specified in above standard.

Total Materials Capability

In this section we have given details of those elastomer materials that are recommended and commonly used in aerospace applications. Other materials are available. For further details on these either contact your local marketing company or go to www.tss.trelleborg.com.

Material Technology

Table I Turel® and Isolast® Materials

TSS Material Code	Base Polymer	Temperature Range °F (°C)	Hardness (Shore A)	Material commonly used in listed fluids	Reference Specification	Recommended ²⁾ Shelf Life
Turel®						
NE	Nitrile (NBR)	-65°F to +275°F (-54°C to +135°C)	75	MIL-PRF-83282 MIL-PRF-87257	AMS-P-83461 (on QPL)	15 Years
NG	Nitrile (NBR)	-65°F to +275°F (-54°C to +135°C)	75	MIL-PRF-5606 MIL-PRF-83282	MIL-P-25732	15 Years
EH	Ethylene Propylene (EP)	-65°F to +300°F (-54°C to +149°C)	80	AS1241 Phosphate Ester	NAS 1613 Rev. 2 Equivalent	Unlimited
EP	Ethylene Propylene (EP)	-65°F to +300°F (-54°C to +149°C)	80	AS1241 Phosphate Ester	NAS 1613 Rev. 5 Equivalent	Unlimited
FT	Fluorocarbon (FKM)	-30°F to +500°F (-34°C to +260°C)	75	Jet Fuel	MIL-R-83485 ¹⁾	Unlimited
FG	Fluorocarbon (FKM)	-40°F to +400°F (-40°C to +204°C)	75	Jet Fuel	AMS 7379	Unlimited
LF	Fluorosilicone (FVMQ)	-100°F to +350°F (-73°C to +177°C)	70	MIL-PRF-7808 MIL-PRF-23699 MIL-PRF-5606 MIL-PRF-83282 MIL-PRF-87257	MIL-R-25988 ¹⁾	Unlimited
LA	Fluorosilicone (FVMQ)	-70°F to +350°F (-57°C to +177°C)	80	MIL-PRF-7808 MIL-PRF-23699 MIL-PRF-5606 MIL-PRF-83282 MIL-PRF-87257	MIL-R-25988 ¹⁾	Unlimited
Isolast®						
J8325	Perfluoroelastomer (FFKM)	+5°F to +617°F (-15°C to + 325°C)	75	MIL-PRF-7808 MIL-PRF-23699	AMS 7257C	Unlimited

¹⁾ Meets physical property requirements of applicable specification

²⁾ Shelf life guidelines per SAE Aerospace Recommended Practice ARP 5316 and ISO DIS 27996:2009 (published 2009-02-03)

³⁾ This table represents common TSS Turel & Isolast elastomer material grades, this table is not comprehensive, for additional materials and for any material questions please contact you local TSS Sales Engineer.

Testing to reference specification on a lot-by-lot basis is available on request.

Material Technology

Material recommendations for sealing in Aerospace Hydraulic Fluids

Hydraulic fluid is integral to all hydraulic systems. When specifying seals for these systems it is important to understand the interaction between the polymers the seals are made of and the operating fluid. The elastomer must be compatible with the fluid to ensure long-term performance and durability. It must also be capable of withstanding the operating environment. Listed below are fluids commonly used in today's Aerospace applications along with the most suitable Trelleborg Sealing Solutions elastomer.

A fluid viscosity versus temperature graph is included for referencing the performance characteristics of typical aerospace fluids and lubricants with which Turel® and Isolast® materials are compatible.

Table II Typical Aerospace Hydraulic Fluids with recommended Turel® Material

Specification	Oil Type (base)	Temperature Range	General Information	Most Suitable Turel® Elastomers
MIL-PRF-5606 (NATO code H-515)	Petroleum	-65°F to +275°F (-54°C to +135°C)	Fluid used mostly for landing gear shock strut applications	Turel® NG (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
MIL-PRF-83282 (NATO code H-537)	Synthetic hydrocarbon	-40°F to +401°F (-40°C to +205°C)	Gives improved fire resistance and shear stability. Reduced low temperature capability compared to MIL-PRF-5606 and MIL-PRF-87257.	Turel® NG (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
MIL-PRF-87257 (NATO code H-538)	Synthetic hydrocarbon	-65°F to +350°F (-54°C to +177°C)	Similar to MIL-PRF-83282 with improved low temperature capability	Turel® NE (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
AS1241 Class 1 AS1241 Class 2	Phosphate ester	-65°F to +275°F (-54°C to +135°C)	Primarily used on commercial aircrafts. No fire propagation. Class 1 is low-density and Class 2 is high-density.	Turel® EH (EPR) Turel® EP (EPR)
MIL-PRF-7808	Synthetic oil-ester	-65°F to +300°F (-54°C to +149°C)	Engine lubrication oil	Turel® FT (FKM) Turel® FG (FKM) Turel® FL (FKM) Isolast® J8325 (FFKM)
MIL-PRF-23699	Synthetic lubricant oil	-40°F to +400°F (-40°C to +204°C)	Engine lubrication oil. High Thermal Stability (HTS) versions available for longer operating duration applications. Operating temperatures up to + 450°F/ + 232°C.	Turel® FT (FKM) Turel® FG (FKM) Turel® FL (FKM) Isolast® J8325 (FFKM)
Jet Fuel; JP-4, JP-5 and JP-8, Jet-A and Jet A-1	Wide-cut (gas and kerosene)	-52°F to +100°F (-47°C to +38°C)	Commercial aviation fuel grades. Freezing temperature of Jet A is -40°F/ 40°C and Jet A-1 is -52°F/ -47°C.	Turel® FT (FKM) Turel® FG (FKM) Turel® FL (FKM)

Material Technology

Table III Typical Aerospace Greases with recommended Turel® material

Specifications	Temperature Range	Type	Most Suitable Turel® Elastomers
MIL-G-21164D	-73°C to +121° C (-100° F to +250° F)	Multi-purpose grease; micro gel-thickened synthetic diester oil base with molybdenum disulfide	1)
MIL-PRF-23827C	-73°C to +121° C (-100° F to +250° F)	Synthetic aviation grease; lithium complex-thickened synthetic base oil	1)
MIL-PRF-81322F	-54°C to +125° C (-65° F to +250° F)	Multi-purpose grease; micro gel-thickened synthetic hydrocarbon oil base	Turel® NE (NBR) Turel® NG (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
MIL-G-24139A	-73°C to +121° C (-100° F to +250° F)	General purpose airframe grease; Composition: Micro Gel-thickened mineral oil base (Boeing BMS3-33)	Turel® NE (NBR) Turel® NG (NBR)
MIL-G-25537C	-54°C to +93° C (-65° F to +200° F)	Multi-purpose helicopter grease; calcium soap thickened mineral oil base	Turel® NE (NBR) Turel® NG (NBR)
MIL-G-81322E, Grade A	-54°C to +125° C (-65° F to +250° F)	Synthesized hydrocarbon fluid & a non-soap thickener	Turel® NE (NBR) Turel® NG (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
MIL-L-46000	-54°C to +127° C (-65° F to +260° F)	Lithium stearate, thickened, synthetic grease for lubricating small gearboxes, automatic weapons, etc.	Turel® NE (NBR) Turel® NG (NBR) Turel® FT (FKM) Turel® FK (FKM) Turel® FG (FKM)
MIL-G-4343C	-65°C to +120° C (-85° F to +250° F)	Lithium soap thickened synthetic oil based grease compounded with additives to enhance oxidation resistance, rust and corrosion protection, and lubricity at extreme low temperatures	Turel® NE (NBR) Peroxide Cured)
MIL-G-81827A	-55°C to +232° C (-67° F to +450° F)	Synthetic grease with a synthetic hydrocarbon PolyAlphaOlefin- (P.A.O) type base, containing molybdenum disulfide additives thickened by an inorganic gel	Turel® NE (NBR) Turel® NG (NBR)
MIL-PRF-32014	-40°C to +175° C (-40° F to +350° F)	A lithium soap thickened, medium viscosity synthetic hydrocarbon grease designed for high speed and temperature applications	Turel® NG (NBR, Sulfur-Cured)

1) These greases have different base stocks that can meet specification requirements. Due to this, elastomer compatibility needs to be confirmed based on the base stock and manufacturer of the grease. For more information on compatibility with these greases please contact your local Trelleborg Sealing Solutions Marketing Company.

Material Technology

Viscosities of Typical Fluids vs. Temperature

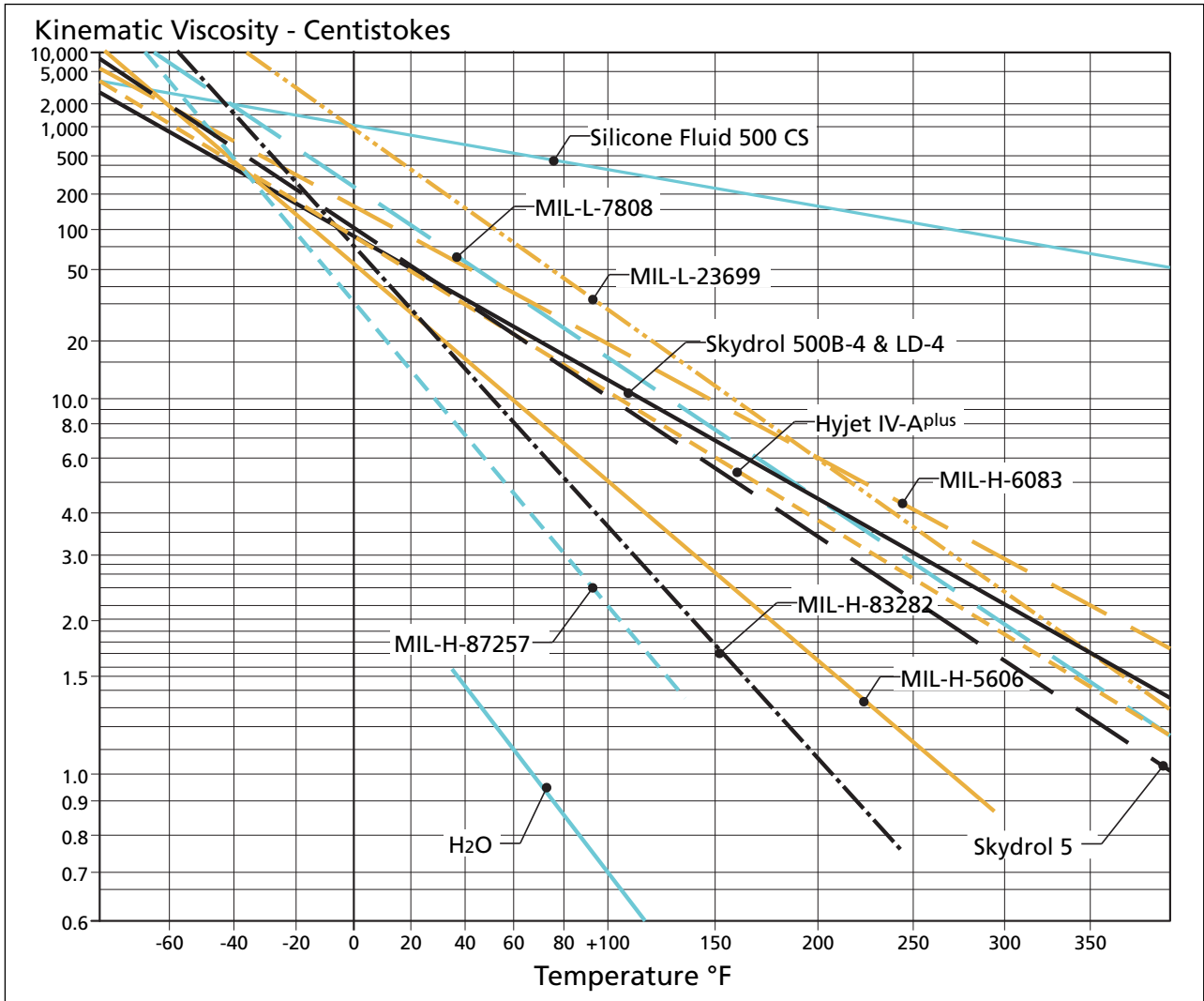


Figure 2 Fluid Viscosity – For reference only. For further information, please contact your fluid supplier.

■ Turcon®

The Turcon® range consists of proprietary materials based on premium-grade Polytetrafluoroethylene (PTFE) fluoropolymer resins. Fillers are added to enhance material properties.

Low Friction

Turcon® materials exhibit the lowest coefficient of friction of any known solid and have a uniquely low static coefficient of friction. This results in an extremely low breakout friction, and as the materials do not adhere to their mating surfaces, stick-slip in dynamic applications is eliminated.

Chemical Compatibility

Turcon® materials are chemically inert in virtually all media, even at elevated temperatures and pressures. They are therefore compatible with an extremely wide range of solvents, acids and other aggressive media.

Temperature Range

Turcon® compounds are available to operate in temperatures from -320°F to +500°F/ -196°C to +260°C and will endure temperature spikes of up to +680°F/ +360°C. Approaching these limits, it is necessary to limit other working conditions.

Temperature Cycling

Turcon® materials are not altered or adversely affected by cycling temperatures.

Degradation

Turcon® does not contain plasticizers or any other ingredients which could degrade at temperatures below +572°F/ +300°C.

Surface Speed

Turcon® materials generate far less heat than other materials. This means that the speed of the dynamic surface in contact with the seal can go up to 49.2 ft/s / 15 m/s, depending on seal design and working conditions. Speeds exceeding 65.6 ft/s / 20 m/s have been achieved under certain conditions.

Aging

The properties of Turcon® materials do not significantly change over time. They will not become brittle or degrade when exposed to severe-weathering conditions such as heat, light, water or salt spray. This is a benefit when seals are left idle for long periods of time, even years, and still need to perform with complete reliability.

Resilience

As they do not have the resilience of elastomers, Turcon® materials may experience cold-flow or creep under continued thermal or mechanical stress. To counter this, Turcon® seals require an elastomer element or spring to provide a radial force. This compensates for seal wear, cold-flow and the normal variations in gland dimensions due to the range of tolerances or eccentricity.

Wear Resistance

The wear resistance of Turcon® materials exceeds the demands of even the most challenging sealing environments. This extends seal life at high speeds, pressures and temperatures.

Radiation

When exposed to radiation, the molecular-chain structure of PTFE can be damaged, lowering tensile strength and potentially leading to seal disintegration. Turcon® is therefore not recommended for an accumulated radiation dose above 7×10^4 rad/ 7×10^2 Gy. In high-radiation service other fluoropolymers are recommended.

Electrical Properties

Turcon® has excellent electric properties such as a low dielectric constant and a very high dielectric strength, even at elevated temperatures.

Carbon and Graphite filled Turcon® compounds are electrically conductive. Examples are:

Turcon® Material	Filler(s)	Surface Resistivity (Ω)	Volume Resistivity ($\Omega \times \text{cm}$)
Turcon® T11	Carbon Graphite	2×10^5	2×10^4
Turcon® T29	Carbon Fiber	6×10^4	1×10^4
Turcon® T40	Carbon Fiber	5×10^{12}	2×10^{13}

Fibers making contact throughout the structure help electrical conductivity through the material.

Material Technology

Turcon® materials that do not have fillers, or are low-filled with particles that do not contact have low conductivity. Examples are:

Turcon® Material	Filler(s)	Surface Resistivity (Ω)	Volume Resistivity (Ω x cm)
Turcon® T01	Virgin	5 X 10 ¹⁷	2 X 10 ¹⁷
Turcon® T05	Turcon® (Pigment)	7 X 10 ¹⁷	1 X 10 ¹⁷
Turcon® T99	Turcon® Lubricant	1 X 10 ¹⁷	3 X 10 ¹⁷

Absorption of fluids

The water absorption of PTFE is 0.01 percent and it does not absorb any other fluids to a significant level. One exception is fluorinated-cooling media, for example Freon. These can cause a reversible weight increase of approximately five percent accompanied by dimensional increases of approximately one percent.

Vacuum

PTFE has an extremely low vapor pressure of <10⁻⁵ mbar at +248°F/ +120°C and can be used safely in vacuum.

Other Characteristics










PTFE will not sustain fire in pure oxygen. Virgin PTFE is physiologically inert. All Trelleborg Sealing Solutions materials are lead and mercury-free.

Total Materials Capability

In this section we have given details of those Turcon® materials that are recommended and commonly used in aerospace applications. Other materials are available. For further details on these either contact your local marketing company or go to www.tss.trelleborg.com.

Material Technology

Table IV Turcon® Material Physical Properties

TSS Material Code	Description and Recommended Usage	Color	Tensile Strength		Elongation at Break	Specific Gravity	Hardness
			ASTM D 4894 (psi)	ASTM D 4894 (Mpa)	ASTM D 4894 (%)	ASTM D 792 (g/cm ³)	ASTM D 2240 (Shore D)
T01	Virgin PTFE, exceeding AMS-R-8791 Profile: Clean system, low-friction and pressure Surface: Steel and chrome		6130	42.3	378	2.16	58
T05	Turcon® Profile: All systems, low friction, medium lifetime and pressure Surface: Steel and chrome		5682	39.2	392	2.17	57
T08	Additive: Bronze (high-filled) Profile: Strong extrusion resistance Surface: Steel and chrome		2450	17.0	175	3.88	60
T19	Additive: Mineral fibers and molybdenum disulfide (MoS ₂) Profile: High-pressure and long wear life Surface: Steel, chrome and HVOF*		3506	24.2	226	2.30	63
T25	Additive: Glass fibers and Molybdenum disulfide (MoS ₂) Profile: Rotary applications Surface: Hardened steel, chrome and HVOF*		4562	31.5	286	2.23	59
T29	Additive: Carbon fiber (high-filled) Profile: Long wear life and large extrusion gap Surface: Steel, chrome and HVOF*		3208	22.1	217	2.01	61
T46	Additive: Bronze (medium-filled) Profile: Extrusion-resistant Surface: Hardened steel and chrome		4000	27.6	250	3.10	63
T99	Additive: Molybdenum disulfide (MoS ₂) Profile: Low-friction, medium pressure, long seal life Surface: Steel, chrome anodized aluminum and HVOF*		5385	37.2	347	2.22	58
M30	Additive: Thermoplastic and lubrication package Profile: Long wear life, high-frequency Surface: Steel, chrome and HVOF*		3000	21.0	250	1.92	55



























Data sheets available upon request.

* HVOF = High Velocity Oxygen Fuel thermal spray coating process

This table represents common Trelleborg Sealing Solutions Turcon® PTFE material grades. This table is not comprehensive; for additional Turcon® PTFE materials and for any Turcon® PTFE material questions please contact your local Trelleborg Sealing Solutions marketing company.

Material Technology

Table V Recommended Turcon® Materials For Seal Designs

Turcon® TSS Material Code	Profile	 T01	 T05	 T08	 T19	 T25	 T29	 T46 (T49)	 T78	 T99	 M30
Turcon® Excluder® DC			•		•					•	
Turcon® SLYDRING® II				•	•			•			
Turcon® Back-up Ring				•			•				
Turcon® AQ-Seal® 5					•					•	
Turcon® Varilip® PDR						•			•		
Turcon® Roto Glyd Ring®					•	•	•				
Turcon® Roto Variseal®					•	•	•				
Turcon® Dual Piston Ring					•		•			•	•
Turcon® Variseal®			•		•		•		•	•	•
Turcon® Stepseal® 2K					•		•	•			•
Turcon® Glyd Ring®					•		•	•			•
Turcon® T-Seal					•		•				•
Turcon® Wedgpak® II					•		•			•	•
Turcon® Double Delta® II					•		•				•
Turcon® Plus Seal® II					•		•			•	•
Turcon® VL Seal®					•						•

The table of general materials and seal recommendations are based on sealing surfaces with hardness of 44 Rockwell C and above that have the recommended Trelleborg Sealing Solutions surface finish. This table is presented as a general guideline for material consideration.

Material Technology

■ Zurcon® Materials

The Zurcon® range of materials is made up of high modulus compounds. They are recommended to support and protect sealing elements from conditions such as high-pressure, large clearance gaps and

hardware deflections. These materials have high creep resistance and excellent shear properties giving superior protection from extrusion in Back-up Ring configurations.

Table VI Zurcon® Z60 Physical Properties




TSS Material Code	Description	Color	Tensile Strength		Elongation at Break	Specific Gravity	Hardness
			ASTM D 638 (psi)	ASTM D 638 (MPa)	ASTM D 638 (%)	ASTM D 792 (g/cm ³)	ASTM D 785 (Shore R)
Zurcon®							
Z60	Composition: Polyamide and Molybdenum Disulfide (MoS ₂) Profile: T-Seal and corner reinforcement Surfaces: Steel and chrome Formerly HiMod® 60		12,000	82.7	50	1.16	120

Table VII Zurcon® Z43 and Z40 Physical Properties

Material Code	Description	Color	Tensile Strength		Elongation at Break	Specific Gravity	Hardness
			ASTM D 1457 (psi)	ASTM D 1457 (MPa)	ASTM D 1457 (%)	ASTM D 621 (Deformation @ 2,000 psi 73°F/ 23°C for 24 hrs)	ASTM D 785 (M Scale)
Zurcon®							
Z43	Composition: High modulus thermoplastics, PTFE and carbon Profile: Bearing, Stakbak® and corner reinforcement Surfaces: Steel, chrome and ceramic Formerly HiMod® 552		11,750	81	25	1.4	95
Z40	Composition: Virgin PEEK™ to Mil-R-46183, Poly-Ether-Ether-Ketone thermoplastic Formerly HiMod® 550		13,000	90	10-25	1.3	99

Note:

The testing of tensile properties is based on the micro-tensile specimen per ASTM D 1457/D 4894, pulled at 2 inches/ 50 mm per minute with an initial jaw separation at 0.875 ± .005 inches/ 0.127 mm. Tensile properties are determined in accordance with the procedures described in ASTM D 638.

The values in the tables above are nominal, intended for engineering reference only. These values are not to be used as a specification requirement. Specified values can only be obtained from each batch.

Material Technology

Table VIII Zurcon® Design Data

Material	Technical Data		Application
	Temperature °F/ °C	Velocity	
Zurcon® Z60	-65 to +250°F -54 to +121°C	16 ft/s 4.9 m/s	Good extrusion and wear resistance, primarily used for piston rings and Wear Rings
Zurcon® Z43	-76 to +500°F -60 to +260°C	16 ft/s 4.9 m/s	Excellent extrusion and wear resistance, high temperature and load capabilities
Zurcon® Z40	-76 to +500°F -60 to +260°C	16 ft/s 4.9 m/s	Excellent extrusion and wear resistance

Total materials capability

In this section we have given details of those Zurcon® materials that are recommended and commonly used in aerospace applications. Other materials are

available. For further details on these either contact your local marketing company or go to www.tss.trelleborg.com.

Material Technology

■ Orkot®

Orkot® materials are made of special thermoplastic resin impregnated with a fabric composite of fine weave fibers.

Slydring® Bearings

Where heavy-duty bearing systems are required, Slydring® bearings made from Orkot® material are an established solution worldwide. They offer excellent service life, high compressive strength, heat

and chemical resistance along with very low friction characteristics. For rod and piston applications in dynamic hydraulic systems where high side loads are present, Orkot® Slydring® bearings can act as guide rings to maintain correct positioning and concentricity of reciprocating and rotating components. Use of Orkot® Slydring® prevents metal-to-metal hardware contact between moving parts and eliminates scoring and fretting of hardware, resulting in improved system life and reliability.

Table IX Orkot® Physical Properties



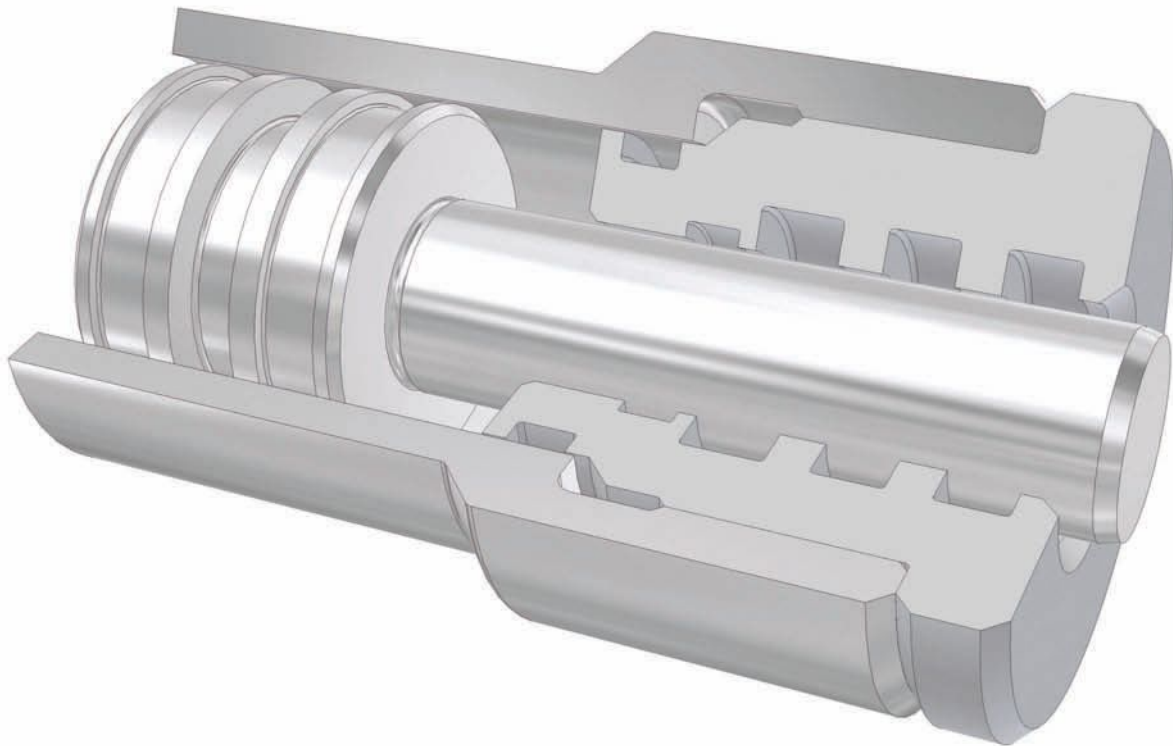
Material Code	Description	Color	Tensile Strength		Elongation at Break	Specific Gravity	Hardness
			ASTM D 638 (psi)	ASTM D 638 (MPa)	ASTM D 638 (%)	ASTM D 792 (g/cm ³)	Rockwell M
C324	Vinylester resin and meta aramid fine mesh		8,700	60.0	N/A	1.3	105
C380	Polyester resin, polyester fine mesh and PTFE		8,000	55.2	N/A	1.3	100

Table X Orkot® Design Data

Material	Technical Data		Application
	Temperature	Velocity	
Orkot® C324	-328 to +482°F -200 to +250°C	3.280 ft/s 1 m/s	High temperatures. For use in Phosphate Ester or high-temperature applications. Test Report R1081 available upon request.
Orkot® C380	-328 to +266°F -200 to +130°C	3.280 ft/s 1 m/s	High wear resistance with good sliding properties. For use in mineral, synthetic hydrocarbon-based oils and grease only.

Material Technology

■ Hardware Expertise



The functioning of seals not only depends on the seal itself and its operating conditions, but also on other factors. Over the years Trelleborg Sealing Solutions has developed an in-depth knowledge of applied materials technology. To maximize system performance, we can advise on relevant issues related to the hardware into which seals are fitted and significant properties of mating surfaces.

In this section we give detailed recommendations on surface finishes, outlining shaft materials typically used in contact with polymer seals and the properties of mating part surface coatings and platings. We also provide some basic hardware information.

To find out more contact your local Trelleborg Sealing Solutions marketing company. It is best to involve them at concept stage. This allows them to advise on the design of the component or housing to ensure that it will function as effectively as possible and give maximum seal life and performance.



■ Surface Finishes

Surface finish quality relates directly to dynamic seal performance. Properly defining, measuring and controlling surface finish quality is critical to the functional reliability and service life of a seal.

Developments in surface finish measurement equipment and capabilities, along with finishing methods, have resulted in functional seal testing being performed to determine and verify surface finish recommendations for improved seal performance.

Standard Recommendations

Given below are two sets of standard recommendations that apply to linear hydraulic external seals (rod), dynamic sealing surfaces. The first is for HVOF (High Velocity Oxygen Fuel) applied coatings like Tungsten Carbide Cobalt-Chrome ($W_c-C_o-C_r$). The second is for bare steel, aluminum or chrome plating. Within the product sections you will find further product specific surface finish recommendations.

Table I Surface Finish Recommendations for HVOF Applied Surfaces

Measurement	Standard Recommendation
R_a	$< 5 \mu\text{in} / 0.12 \mu\text{m}$
R_p	$\leq 8 \mu\text{in max.} / 0.2 \mu\text{m maximum}$
$R_z (R_{tm})$	$40 \mu\text{in} / 1.0 \mu\text{m maximum}$
$T_p (M_r)$	$70 - 90\% \text{ @ depth of p}$ $= 0.25 R_z (R_{tm}) \text{ relative to a ref. line}$ $c = 5\% \text{ tp}$
R_{sk}	$-0.1 \text{ to } -3$

Table II Surface Finish Recommendations, Chrome Plating, Anodized Surfaces, Bare Metals (Hardened) and Others (Non-HVOF)

Measurement	Standard Recommendation
R_a	$< 8 \mu\text{in} / 0.2 \mu\text{m}$
R_p	$\leq 24 \mu\text{in} / 0.6 \mu\text{m maximum}$
R_z	$40 \mu\text{in} / 1.0 \mu\text{m maximum}$
T_p	$50 - 75\% \text{ @ depth of p}$ $= 0.25 R_z (R_{tm}) \text{ relative to a ref. line}$ $c = 5\% \text{ tp}$
R_{sk}	$-0.5 \text{ to } -1.5$

For internal seals (piston) the surface finish should be less than $8 \mu\text{in} / 0.2 \mu\text{m}$.

For surface finish recommendations on the seal groove sidewalls and groove bottoms as well as static seal interfaces, please follow recommendations in SAE AS4716 and AS5857 seal gland standards. If you have any questions related to surface finish and methods please contact your local Trelleborg Sealing Solutions marketing company.

Pockets and Valleys

Values are given for the high end of the bearing ratio. The seal surface should not be completely closed or void of adequate pockets and valleys. These are needed for seal lubrication retention and build-up of operating fluid film. A bearing ratio of 100 percent is not desirable, but it can be quite high for HVOF-coated surfaces. The values of Valley Roughness (R_v) need to be evaluated during the set-up of the production process.

Optimum Profile

The optimum surface profile for seal counterparts is shown in figure 1. A high concentration and magnitude of peaks on a surface can cause excessive seal wear, promoting unwanted leakage and egression. Surfaces relatively void of peaks but including valleys for lubrication retention are more suitable for sealing applications.

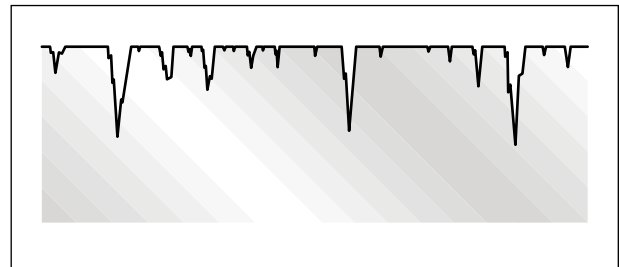


Figure 1 Optimum surface profile for seal counterparts

Direction of Lay

Each method used to obtain a specific surface finish, such as turning, grinding, honing, ball peening, polishing or superfinishing, produces a characteristic direction or lay to the surface. This can have an effect on sealing performance and wear patterns in certain applications.

To obtain the best seal performance, avoid finishing methods which promote the formation of leak paths in your application. For example, avoid a strong axial lay in a reciprocating rod seal application or a definite spiral pattern on the shaft in a rotary application.

Hardware Expertise

Mating Surface Hardness

The hardness of the surface that mates with the seal affects the seal's performance in several ways.

If mating materials are too soft, the seal will burnish or damage the surface. A harder material improves wear life, resisting damage by the seal. Hard surfaces also have a tendency to lower the running friction of a seal.

A seal will polish its mating surface, especially if it is a softer metal. For example, a reciprocating rod made of stainless steel with a hardness of 28 to 30 Rockwell C and a finish of 25 $\mu\text{in}/0.635\ \mu\text{m}\ R_a$ will generally be polished by the seal to a finish of 12 $\mu\text{in}/0.305\ \mu\text{m}\ R_a$ or better, over a short period of time. Seal friction and wear will then decrease accordingly. Materials that are harder than 44 Rockwell C do not polish as easily.

Longer-lasting tougher Turcon[®] seal materials such as thermoplastic-filled Turcon[®] M30 and Carbon fiber-filled T29 should only be specified against harder mating surfaces.

When an application requires the longest possible wear life under moderate to severe conditions, the seal material should be one of the harder, highly-filled Turcon[®] blends.

Running In

In standard hydraulic systems, the seals and mating surfaces have an initial period of high wear. This phase, known as the run-in, ends once the peaks on the mating surface are broken off and the surface and seal reach an equilibrium state. Provided the seals are sufficiently lubricated, the wear rate drops significantly once the equilibrium state is reached.

By defining the surface finish using multiple surface finish parameters, the overall surface profile can be controlled more precisely. This reduces the sealing system run-in period, and once equilibrium between the seal and sealing surface is reached, gives a more optimal surface finish for leakage control, wear resistance and service life.

The abrasive nature of a rough finish can cause excessive seal wear during the early run-in period. Therefore, the harder the mating surface, the more important it is to start with the correct surface finish.

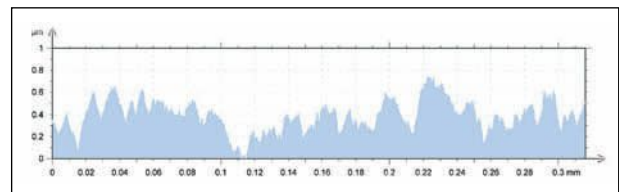
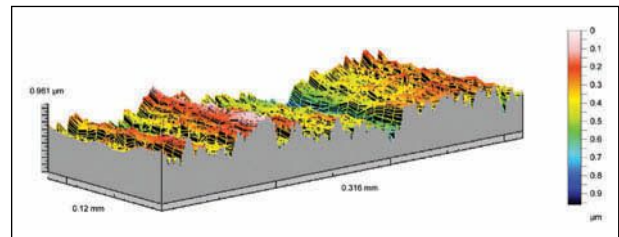
Substrates

Seals run well against unplated surfaces at moderate speeds and pressures. In high-speed rotary or high-pressure reciprocating applications, harder surfaces are preferable.

Typical mating surface materials are listed below. These materials can also act as substrates for plating or coating to achieve higher hardness values.

Platings and Coatings

It is important to consider the ability of the substrate to support the plating. For example, when a high-pressure load is exerted on a seal running against hard-chrome plating supported by a soft substrate, such as 300 series Stainless Steel, the plating may peel or crack and then abrade the seal. A better substrate would be Stainless Steel Type 440C (hardened to 44 Rockwell C) or an alloy steel such as 4340 in the fully-hardened condition.



The surface finish measurement illustrations above clearly show the difference between three-dimensional (3D) and two-dimensional (2D) surface finish topography. The correct surface finish profile is critical to proper seal performance.

■ Surface Finish Measurement Methods

R_a – Arithmetic Average Roughness

Roughness averages provide a simple value for accept/reject decisions for surface finishes. Arithmetic average roughness, or R_a, is the arithmetic average height of roughness-component irregularities (peak heights and valleys) from the mean line, measured within the sampling length, L. See Figure 2.

The measurements are taken by the fine point of the stylus on a profilometer, which traverses the sampling length on the surface being measured.

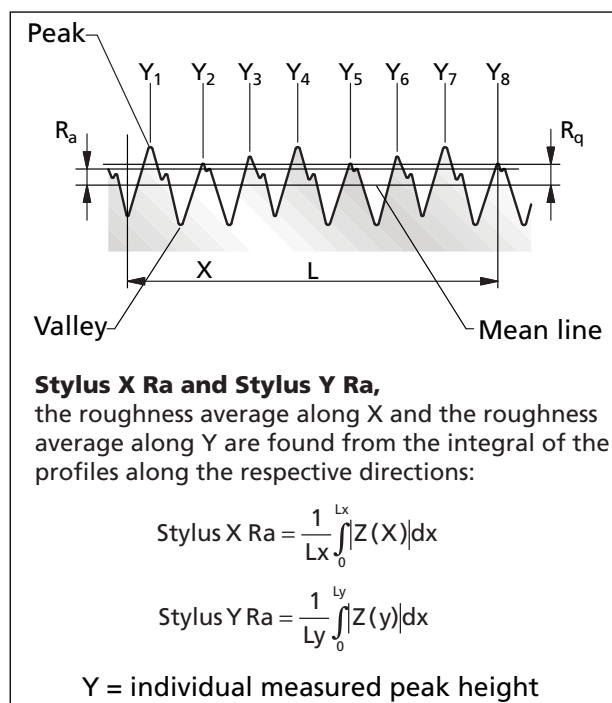


Figure 2 Surface Finish – R_a versus R_q

R_q – Geometric Average Roughness

R_q is the current term for what was formerly called root-mean-square or RMS. R_q is more sensitive to occasional highs and lows, making it a valuable complement to R_a. R_q is the geometric average height of roughness-component irregularities from the mean line measured within the sampling length, L. Compare to R_a in Table III.

The main difference in the two scales is that R_q amplifies occasional high or low readings, while R_a simply averages them. For a given surface, therefore, the R_q value will be higher than the R_a value by approximately 11 percent. A surface finish that measures 2 μin/ 0.051 μm R_q is equivalent to approximately 18 μin/ 0.457 μm R_a.

Table III Surface finish conversion table

R _a , AA, CLA		R _q or RMS		German-Swiss Norm ¹⁾
Inch (μin)	Metric (μm)	Inch (μin)	Metric (μm)	
0.9	0.023	1.0	0.025	N1
1.0	0.025	1.1	0.028	
1.8	0.046	2.0	0.051	N2
2.0	0.051	2.2	0.056	
3.6	0.091	4.0	0.102	N3
4.0	0.102	4.4	0.112	
5.4	0.137	6.0	0.152	N4
7.2	0.183	8.0	0.203	
8.0	0.203	8.9	0.226	N5
10.8	0.274	12.0	0.305	
14.4	0.366	16.0	0.406	N6
16.0	0.406	17.8	0.452	
28.8	0.732	32.0	0.813	N7
32.0	0.813	35.5	0.902	
56.8	1.443	63.0	1.600	
63.0	1.600	69.9	1.775	

R_a : Arithmetic average roughness

AA : Arithmetic Average

CLA : Center Line Average

R_q : Geometric average roughness

RMS : Root-mean-square

1) The German-Swiss Norm is a series of roughness-grade numbers used to avoid confusion with numerical values of other types.

Improved Measurement Methods

The R_a measurement does not give a true picture of the real surface profile which is also affected by the finish. An open profile or peak structure can seriously affect seal performance as its jagged structure can cut and nick the seal surface. On the other hand, the closed profile form or valley structure, gives improved seal performance. This is because the valleys retain fluid and lubricate the running seal surface. Please see Table IV.

Table IV R_a Comparison

Surface Profile	R _a
	7.8 μin /0.2 μm
	7.8 μin /0.2 μm

Even with identical R_a values, the resulting seal performance will be very different.

Hardware Expertise

An improved surface measurement method is described in ISO 13565-1/-2/-3, including the peak, valley and material ratios as described below:

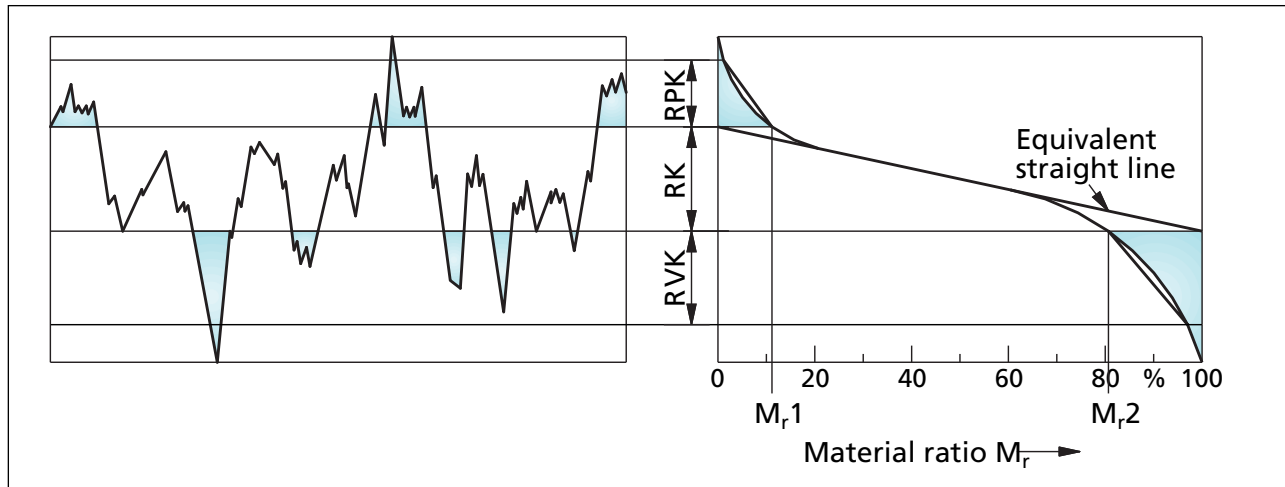


Figure 3 Abbot Curve

R_k Core roughness

The depth of the roughness core profile

M_r Material ratio

M_{r1} in percent

The material portion M_{r1} is determined by the intersecting line that separates the protruding peaks from the roughness core profile.

M_{r2} in percent

The material portion M_{r2} is determined by the intersecting line that separates the valleys from the roughness core profile.

R_{pk} Reduced peak height

The average height of the protruding peaks above the roughness core profile

R_{vk} Reduced valley depth

The average depth of the profile valleys projecting through the roughness core profile

The harder the material the more important it is to reduce the peak height R_{pk} . If the mating surface is ceramic, the R_{pk} value must be down to $2 \mu\text{in}/0.051 \mu\text{m}$ otherwise the hard peaks will cut into the seal surface.

Other surface parameters are skewness and kurtosis, which give a more detailed picture of the surface.

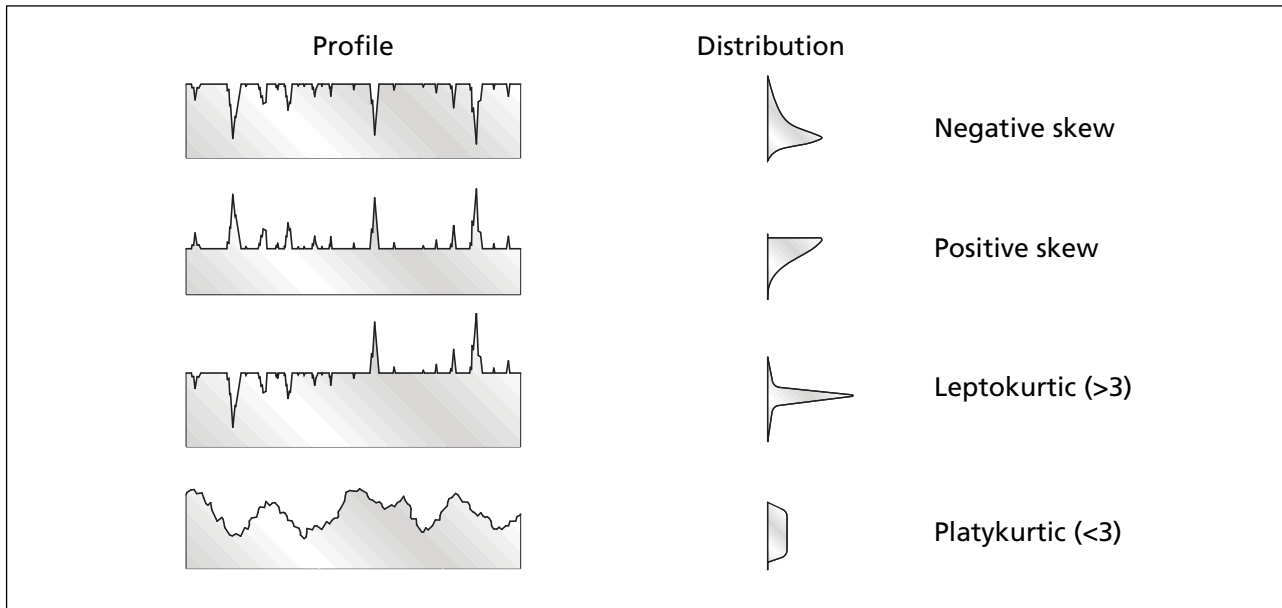


Figure 4 Surface Measurement Visualized

The optimum view of the surface structure is a 3-dimensional computerized picture showing not only peak, core and valley but also direction of ridges and channels in the surface structure. Such pictures can be very valuable in evaluating seal performance. This method of measurement will expose widely varying surface profiles depending on base materials, platings or coatings and the process used to produce the surface.

Hardware Expertise

Table V Properties of Surface Structure

Parameter	Unworn $\mu\text{in} / \mu\text{m}$	Worn $\mu\text{in} / \mu\text{m}$
S_a	4.331 0.11	8.268 0.21
S_{pk}	3.543 0.09	4.331 0.11
S_k	9.843 0.25	14.567 0.37
S_{vk}	15.748 0.40	38.583 0.98

S denotes 3-dimensional surface texture characteristics. R denotes 2-dimensional surface texture characteristics. E.g. S_a is the 3-D equivalent to R_a .

To obtain measurements as shown in table V, a sophisticated filter technique and software program is required that can convert the mathematical rounding. This technique is not readily available in industry, but is available at some universities and technical institutes.

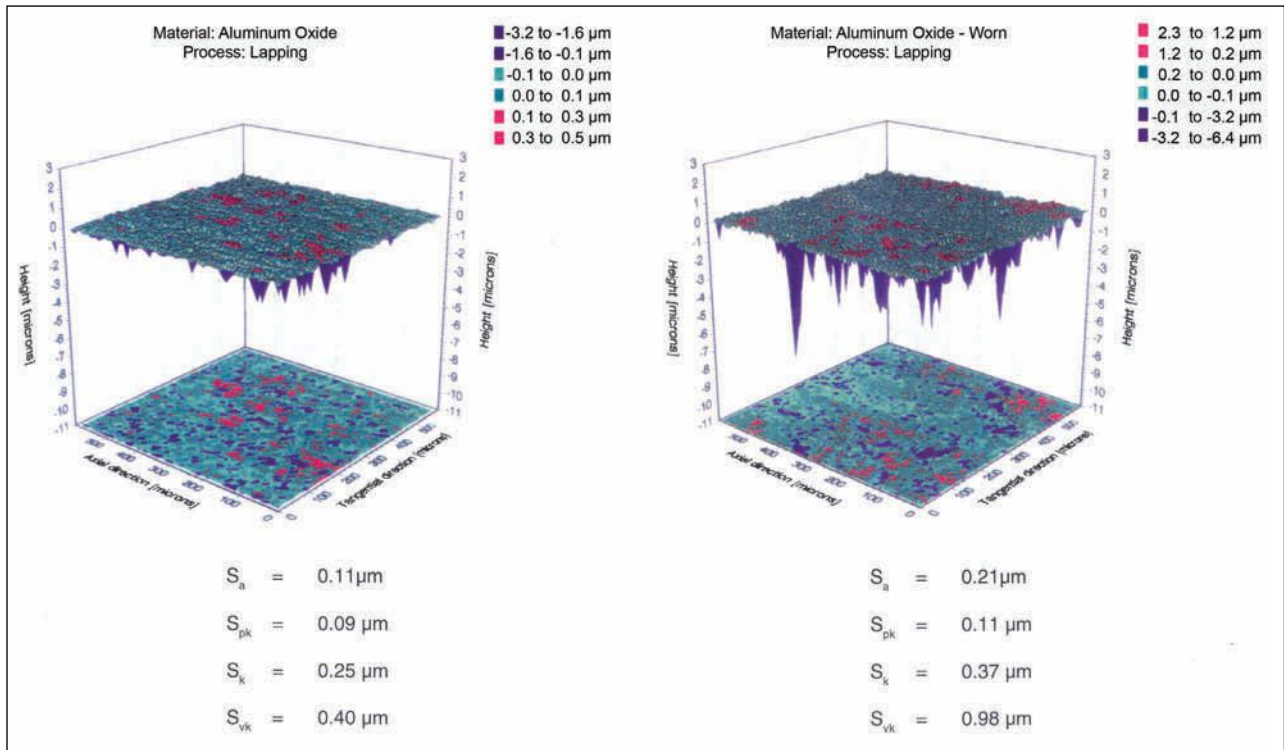


Figure 5 Surface Structure

Hardware Expertise

■ Shaft Materials

Table VI Typical shaft materials used in contact with polymer seals

Material		Typical Hardness, RC		Applications
		Annealed	Hardened	
Stainless Steel	15-5 PH	35	46	General purpose providing high strength, good corrosion resistance and mechanical properties with moderate hardness. Good for moderate wear applications
	17-4 PH	35	44	General-purpose with moderate corrosion resistance. Material can be hardened for moderate-wear applications.
	Type 303	-	20 ¹⁾	Free-machining and very soft with moderate corrosion resistance. For low speeds and pressures
	Type 304	-	28 ¹⁾	Soft material with moderate corrosion resistance. For use at low speeds and pressures
	Type 316	-	28 ¹⁾	Soft material with excellent corrosion resistance. For use at low speeds and pressure.
	Type 440C	22	44	Heat-treated material is the hardest of all Stainless Steels but has lower corrosion resistance than 300 series Stainless Steel. For higher speeds and pressures
Carbon Steel	SAE 1045	19	58	Good mechanical properties with higher strength than other low-carbon steels. Use in non-corrosive media only.
Alloy Steel	4140	13	50	General-purpose applications in non-corrosive media. For moderate speeds and pressures
	4340	13	50	General service with better mechanical properties than Alloy 4140
Tool Steel	D-2	-	62	High hardness and wear-resistance but limited corrosion resistance. For high speeds at moderate pressures.
Other Metals	Hard-anodized aluminium 6061-T6	-	70+	Hard-anodized aluminium makes an excellent low-friction bore surface for reciprocating piston-seal applications. Not recommended for rotary services.
	Bronze	40 Rockwell B	85 Rockwell B	For light-duty service in slow speeds with low pressures and where friction and corrosion are not concerns
	Mild Steel	150 Brinell	-	Light-duty service in non-corrosive media only
	Titanium	36 Rockwell C		Hard material with high corrosion resistance. Good for high-pressure and speed
Non-Metallic	Ceramic	70		For high wear resistance at high pressures or high speeds and for low friction against Turcon [®] seals
	Sapphire	9 Mohs ²⁾ Scale		Very hard, chemically-inert material with ability to obtain flame-polished finishes less than 1 µin/ 0.025 µm R _a

The information supplied above is intended only as a guide. We strongly recommend that you test the selected material in the application before production use.

¹⁾ Series 300 Stainless Steel cannot be hardened by heat treatment. Values shown are for 30 percent cold-worked material.

Hardware Expertise

■ Plating and Coating

Table VII Properties of typical types of plating and coatings used in contact with polymer seals

Coating or plating type		Military specification	Hardness Rockwell C	Suggested thickness	Corrosion resistance	Abrasiveness to seal	Comments
Chrome plating	Hard chrome	QQC 320B Class 2E	65	0.0008/0.0050 in 0.020/0.127 mm	Fair to Good	High	Wear-resistant for light-duty. Not recommended for fast-rotary or corrosive applications.
	Thin dense chrome	AMS 2438	70	0.0002/0.0006 in 0.005/0.015 mm	Excellent	Low	Higher wear resistance and lower friction than conventional chrome in light to moderate speeds.
Electroless nickel plating	Nickel as deposited	MIL-C-26074B	48-52	0.0010 in minimum 0.0254 mm minimum	Excellent	Low	Excellent for corrosive applications in light to moderate speeds and pressures.
	Nickel fully hardened	MIL-C-26074B	58-70	0.0010 in minimum 0.0254 mm minimum	Good	High	Harder but more abrasive than as-deposited nickel. Not recommended for high-speed rotary applications.
Plasma spray coating	Chromium oxide	See note 2.	71	0.0050/0.0300 in 0.127/0.762 mm	Excellent	Low	Recommended when wear life is the primary concern. Not recommended for high-shock loads.
	Aluminium oxide	MIL-P-83348 ²⁾ AMS 2448	60-69	0.0050/0.0300 in 0.127/0.762 mm	Excellent	Low	Lower-cost, less wear-resistant but greater ductility than chromium-oxide coatings.
HVOF ¹⁾	Tungsten Carbide	MIL-P-83348 ²⁾ AMS 2448	67-74	0.0050/0.0300 in 0.127/0.762 mm	Excellent	Low	High wear-resistance, with higher bonding strength. For high-speed and pressure combinations.

Hardware Expertise

Anodizing	Hard anodized aluminium	MIL-A-8625C Type III	Over 70	0.0005/0.0045 in 0.013/0.114 mm	Excellent	Low	Excellent bore material in piston-seal applications as a low-friction mating surface.
Thermal spray	Triballoy 400 & 800	N/A	55	0.001/0.02 in 0.025/0.508 mm	Excellent	High	Hard to get better than a 14 Ra so not recommended for most dynamic seal applications.
Nitriding	Titanium nitride (TiN)	N/A	Up to 70	0.000039 / 0.000197 in 0.001/0.005mm	Excellent	High	Wear resistant, low friction and resists corrosion. Thickness of coating can be an issue related to useful wear-life.

The information supplied above is intended only as a guide. Testing of the selected material in actual service conditions is recommended to determine the suitability of a plating or coating for a specific application.

- 1) HVOF = High Velocity Oxygen Fuel. This coating system uses high-pressure, high-temperature, high-velocity spray guns to improve coating density, hardness and bond strength.
- 2) The military specification is noted for reference only. Plasma spray and HVOF coatings are typically produced using industry standards developed by certain companies whose standards normally meet or exceed the military specifications.

Hardware Expertise

Dash No	Bore Sizes per AS4716													
	Inch					mm								
	ϕA Bore Diameter	ϕF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			ϕA Bore Diameter	ϕF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
104	+0.001 -0.000	+0.000 -0.001	0.004					+0.025 -0.000	+0.000 -0.025	0.10				
105	0.297	0.128						7.54	3.25					
106	0.329	0.158						8.36	4.01					
107	0.360	0.187						9.14	4.75					
108	0.391	0.215						9.93	5.46					
109	0.422	0.246						10.72	6.25					
109	0.485	0.308	12.32	7.82										
110	+0.002 -0.000	+0.000 -0.002	0.005					+0.05 -0.00	+0.00 -0.05	0.13				
111	0.550	0.379						13.97	9.63					
112	0.613	0.441						15.57	11.20					
113	0.675	0.502						17.15	12.75					
114	0.738	0.565						18.75	14.35					
114	0.800	0.627						20.32	15.93					
115	0.863	0.689						21.92	17.50					
116	0.925	0.751						23.50	19.08					
117	0.991	0.817						25.17	20.75					
118	1.053	0.879						26.75	22.33					
119	1.116	0.942						28.35	23.93					
120	1.178	1.003						29.92	25.48					
121	1.241	1.066						31.52	27.08					
122	1.303	1.128						33.10	28.65					
123	1.366	1.191	34.70	30.25										
124	1.428	1.253	36.27	31.83										
125	1.491	1.316	37.87	33.43										
126	1.553	1.378	39.45	35.00										
127	1.616	1.441	41.05	36.60										
128	1.678	1.503	42.62	38.18										
129	1.741	1.566	44.22	39.78										
130	1.805	1.631	0.006	0.015 0.005	0.141	0.183	0.245	45.85	41.43	0.15	0.38 0.13	3.58	4.65	6.22
131	1.867	1.693						47.42	43.00					
132	1.930	1.756						49.02	44.60					
133	1.992	1.818						50.60	46.18					
134	2.055	1.881						52.20	47.78					
135	2.118	1.944						53.80	49.38					
136	2.180	2.006						55.37	50.95					
137	2.243	2.069						56.97	52.55					
138	2.305	2.131						58.55	54.13					
139	2.368	2.194						60.15	55.73					
140	2.430	2.256	61.72	57.30										
141	2.493	2.319	63.32	58.90										
142	2.555	2.381	64.90	60.48										
143	2.618	2.444	66.50	62.08										
144	2.680	2.506	68.07	63.65										
145	2.743	2.569	0.007					69.67	65.25	0.18				
146	2.805	2.631						71.25	66.83					
147	2.868	2.694						72.85	68.43					
148	2.930	2.756						74.42	70.00					
149	2.993	2.819						76.02	71.60					

Recommended for static applications only.

Metric Sizes

Hardware Expertise

Hardware Expertise

Dash No	Bore Sizes per AS4716													
	Inch						mm							
	øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
	+0.002 -0.000	+0.000 -0.002						+0.05 -0.00	+0.00 -0.05					
210	0.991	0.750	0.005					25.17	19.05	0.13				
211	1.053	0.812						26.75	20.63					
212	1.116	0.874						28.35	22.20					
213	1.178	0.936						29.92	23.77					
214	1.241	0.999						31.52	25.38					
215	1.303	1.061						33.10	26.95					
216	1.366	1.124	34.70	28.55										
217	1.428	1.186	36.27	30.12										
218	1.491	1.249	37.87	31.73										
219	1.553	1.311	39.45	33.30										
220	1.616	1.374	41.05	34.90										
221	1.678	1.436	42.62	36.47										
222	1.741	1.499	44.22	38.08										
223	1.867	1.625	0.006					47.42	41.28	0.15				
224	1.992	1.750						50.60	44.45					
225	2.118	1.876						53.80	47.65					
226	2.243	2.001						56.97	50.83					
227	2.368	2.126						60.15	54.00					
228	2.493	2.251						63.32	57.18					
229	2.618	2.376	66.50	60.35										
230	2.743	2.501	0.007	0.025 0.010	0.188	0.235	0.304	69.67	63.53	0.18	0.64 0.25	4.78	5.97	7.72
231	2.868	2.626						72.85	66.70					
232	2.993	2.751						76.02	69.88					
233	3.118	2.876						79.20	73.05					
234	3.243	3.001						82.37	76.23					
235	3.368	3.126						85.55	79.40					
236	3.493	3.251	88.72	82.58										
237	3.618	3.376	91.90	85.75										
238	3.743	3.501	95.07	88.93										
239	3.868	3.626	98.25	92.10										
240	3.993	3.751	0.008					101.42	95.28	0.20				
241	4.118	3.876						104.60	98.45					
242	4.243	4.001						107.77	101.63					
243	4.368	4.126						110.95	104.80					
244	4.493	4.251						114.12	107.98					
245	4.618	4.376						117.30	111.15					
246	4.743	4.501	120.47	114.33										
247	4.868	4.626	123.65	117.50										
325	1.867	1.495	0.006					47.42	37.97	0.15				
326	1.992	1.620						50.60	41.15					
327	2.118	1.746						53.80	44.35					
328	2.243	1.871						56.97	47.52					
329	2.368	1.996						60.15	50.70					
330	2.493	2.121						63.32	53.87					
331	2.618	2.246	66.50	57.05										
332	2.743	2.371	69.67	60.22										
333	2.868	2.496	72.85	63.40										
334	2.993	2.621	76.02	66.57										
335	3.118	2.746	0.007	0.035 0.020	0.281	0.334	0.424	79.20	69.75	0.18	0.89 0.51	7.14	8.48	10.77
336	3.243	2.871						82.37	72.92					
337	3.368	2.996						85.55	76.10					
338	3.493	3.121						88.72	79.27					
339	3.618	3.246						91.90	82.45					

Recommended for static applications only.

Metric Sizes

Hardware Expertise

Dash No	Bore Sizes per AS4716															
	Inch					mm										
	øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00				
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂			
340	+0.002 -0.000	+0.000 -0.002	0.007	0.035 0.020	0.281	0.334	0.424	+0.05 -0.00	+0.00 -0.05	0.18	0.89 0.51	7.14	8.48	10.77		
341	3.743	3.371						95.07	85.62							
342	3.868	3.496						98.25	88.80							
343	3.993	3.621						101.42	91.97							
344	4.118	3.746						104.60	95.15							
345	4.243	3.871						107.77	98.32							
346	4.368	3.996					110.95	101.50								
347	4.493	4.121	0.008					114.12	104.67	0.20						
348	4.618	4.246						117.30	107.85							
349	4.743	4.371						120.47	111.02							
	4.868	4.496						123.65	114.20							
425	+0.003 -0.000	+0.000 -0.003	0.009	0.035 0.020	0.375	0.475	0.579	+0.08 -0.00	+0.00 -0.08	0.23	0.89 0.51	9.53	12.07	14.71		
426	4.974	4.497						126.34	114.22							
427	5.099	4.622						129.51	117.40							
428	5.224	4.747						132.69	120.57							
429	5.349	4.872						135.86	123.75							
430	5.474	4.997						139.04	126.92							
431	5.599	5.122						142.21	130.10							
432	5.724	5.247						145.39	133.27							
433	5.849	5.372						148.56	136.45							
434	5.974	5.497						151.74	139.62							
435	6.099	5.622	154.91	142.80												
436	6.224	5.747	158.09	145.97												
437	6.349	5.872	161.26	149.15												
438	6.474	5.997	164.44	152.32												
439	6.624	6.247	170.79	158.67												
440	6.724	6.497	177.14	165.02												
441	7.224	6.747	183.49	171.37												
442	7.474	6.997	189.84	177.72												
443	7.724	7.247	196.19	184.07												
444	7.974	7.497	202.54	190.42												
445	8.224	7.747	208.89	196.77												
446	8.474	7.997	215.24	203.12												
447	8.974	8.497	227.94	215.82												
448	+0.004 -0.000	+0.000 -0.003	0.010					+0.10 -0.00	+0.00 -0.08	0.25						
449	9.474	8.997					240.64	228.52								
450	9.974	9.497					253.34	241.22								
451	10.474	9.997					266.04	253.92								
452	10.974	10.497					278.74	266.62								
453	11.474	10.997					291.44	279.32								
454	11.974	11.497	0.011						0.28							
455	12.474	11.997													304.14	292.02
456	12.974	12.497													316.84	304.72
457	13.474	12.997													329.54	317.42
458	13.974	13.497													342.24	330.12
459	14.474	13.997													354.94	342.82
460	14.974	14.497	367.64	355.52												
	15.474	14.997	380.34	368.22												
	15.974	15.497	393.04	380.92												
			405.74	393.62												

Recommended for static applications only.

Metric Sizes

The above dimensions are for reference only.

600 Series (3/8") cross section AS4832 recommended for diameters above -442.

Dash numbers are size codes.

Hardware Expertise

Hardware Expertise

Hardware Dimensions per AS4716 ROD

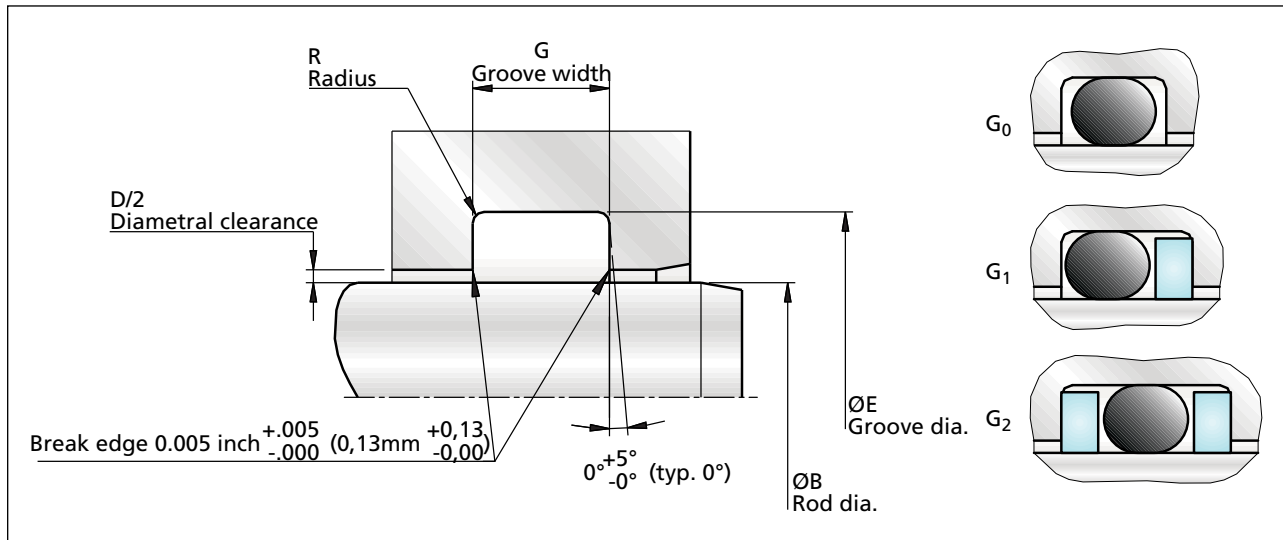


Figure 7 Installation Drawing for ROD

Table IX Groove Dimensions, ROD per AS4716

Dash No	Rod Sizes per AS4716													
	Inch						mm							
	ØB Rod Diameter	ØE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			ØB Rod Diameter	ØE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂	
004	+0.000 -0.001	+0.001 -0.000	0.004	0.015	0.098	0.154	0.210	+0.000 -0.025	+0.025 -0.000	0.10	0.38	2.49	3.91	5.33
005	0.076	0.190						1.93	4.83					
006	0.108	0.217						2.74	5.51					
007	0.123	0.232						3.12	5.89					
007	0.154	0.264						3.91	6.71					
008	0.185	0.294	0.004	0.015	0.094	0.150	0.207	4.70	7.47	0.10	0.38	2.39	3.81	5.26
009	0.217	0.327						5.51	8.31					
010	0.248	0.359						6.30	9.12					
011	0.310	0.421						7.87	10.69					
012	0.373	0.484						9.47	12.29					
013	+0.000 -0.002	+0.002 -0.000	0.005	0.005	0.099	0.160	0.217	+0.00 -0.05	+0.05 -0.00	0.13	0.13	2.51	4.06	5.51
014	0.435	0.545						11.05	13.84					
015	0.498	0.608						12.65	15.44					
016	0.560	0.670						14.22	17.02					
017	0.623	0.733						15.82	18.62					
017	0.685	0.795	17.40	20.19										
018	0.748	0.858	0.005	0.005	0.099	0.160	0.217	19.00	21.79	0.13	0.13	2.51	4.06	5.51
019	0.810	0.920						20.57	23.37					
020	0.873	0.983						22.17	24.97					
021	0.935	1.045						23.75	26.54					
022	0.998	1.108						25.35	28.14					
023	1.060	1.170						26.92	29.72					
024	1.123	1.233						28.52	31.32					
025	1.185	1.295						30.10	32.89					
026	1.248	1.358						31.70	34.49					
027	1.310	1.420						33.27	36.07					
028	1.373	1.483	34.87	37.67										

Recommended for static applications only.

Metric Sizes

Hardware Expertise

Dash No	Rod Sizes per AS4716													
	Inch						mm							
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
104	+0.000 -0.001	+0.001 -0.000	0.004					+0.000 -0.025	+0.025 -0.000	0.10				
105	0.123	0.295						3.12	7.49					
106	0.154	0.327						3.91	8.31					
107	0.185	0.359						4.70	9.12					
108	0.217	0.392						5.51	9.96					
109	0.248	0.423						6.30	10.74					
110	+0.000 -0.002	+0.002 -0.000	0.005				+0.00 -0.05	+0.05 0.00	0.13					
111	0.373	0.546					9.47	13.87						
112	0.435	0.609					11.05	15.47						
113	0.498	0.672					12.65	17.07						
114	0.560	0.734					14.22	18.64						
115	0.623	0.797					15.82	20.24						
116	0.685	0.859					17.40	21.82						
117	0.748	0.923					19.00	23.44						
118	0.810	0.985					20.57	25.02						
119	0.873	1.048					22.17	26.62						
120	0.935	1.110	23.75	28.19										
121	0.998	1.173	25.35	29.79										
122	1.060	1.235	26.92	31.37										
123	1.123	1.298	28.52	32.97										
124	1.185	1.360	30.10	34.54										
125	1.248	1.423	31.70	36.14										
126	1.310	1.485	33.27	37.72										
127	1.373	1.548	34.87	39.32										
127	1.435	1.610	0.006	0.015 0.005	0.141	0.183	0.245	36.45	40.89	0.15	0.38 0.13	3.58	4.65	6.22
128	1.498	1.673						38.05	42.49					
129	1.560	1.735						39.62	44.07					
130	1.623	1.798	0.007				41.22	45.67	0.18					
131	1.685	1.860					42.80	47.24						
132	1.748	1.923					44.40	48.84						
133	1.810	1.984					45.97	50.39						
134	1.873	2.047					47.57	51.99						
135	1.936	2.110					49.17	53.59						
136	1.998	2.172					50.75	55.17						
137	2.061	2.235					52.35	56.77						
138	2.123	2.297					53.92	58.34						
139	2.186	2.360					55.52	59.94						
140	2.248	2.422	57.10	61.52										
141	2.311	2.485	58.70	63.12										
142	2.373	2.547	60.27	64.69										
143	2.436	2.610	61.87	66.29										
144	2.498	2.672	63.45	67.87										
145	2.561	2.735	65.05	69.47										
146	2.623	2.797	66.62	71.04										
147	2.686	2.860	68.22	72.64										
148	2.748	2.922	69.80	74.22										
149	2.811	2.985	71.40	75.82										

Recommended for static applications only.

Metric Sizes

Hardware Expertise

Hardware Expertise

Dash No	Rod Sizes per AS4716													
	Inch						mm							
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
	+0.000 -0.002	+0.002 -0.000						+0.00 -0.05	+0.05 -0.00					
210	0.748	0.989	0.005					19.00	25.12	0.13				
211	0.810	1.051												
212	0.873	1.115												
213	0.935	1.177												
214	0.998	1.240												
215	1.060	1.302												
216	1.123	1.365												
217	1.185	1.427												
218	1.248	1.490												
219	1.310	1.552												
220	1.373	1.615												
221	1.435	1.677												
222	1.498	1.740												
223	1.623	1.865												
224	1.748	1.990												
225	1.873	2.115	0.006					41.22	47.37	0.15				
226	1.998	2.240												
227	2.123	2.365												
228	2.248	2.490												
229	2.373	2.615												
230	2.498	2.740												
231	2.623	2.865												
232	2.748	2.990												
233	2.873	3.115												
234	2.997	3.239												
235	3.122	3.364	0.007	0.025 0.010	0.188	0.235	0.304	79.30	85.45	0.18	0.64 0.25	4.78	5.97	7.72
236	3.247	3.489												
237	3.372	3.614												
238	3.497	3.739												
239	3.622	3.864												
240	3.747	3.989												
241	3.872	4.114												
242	3.997	4.239												
243	4.122	4.364												
244	4.247	4.489												
245	4.372	4.614	0.008					111.05	117.20	0.20				
246	4.497	4.739												
247	4.622	4.864												
325	1.498	1.870	0.006					38.05	47.50	0.15				
326	1.623	1.995												
327	1.748	2.120												
328	1.873	2.245	0.007	0.035 0.020	0.281	0.334	0.424	47.57	57.02	0.18	0.89 0.51	7.14	8.48	10.77
329	1.998	2.370												
330	2.123	2.495												
331	2.248	2.620												
332	2.373	2.745												
333	2.498	2.870												
334	2.623	2.995												
335	2.748	3.120												
336	2.873	3.245												
337	2.997	3.369												

Recommended for static applications only.

Metric Sizes

Hardware Expertise

Dash No	Rod Sizes per AS4716													
	Inch						mm							
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂	
338	+0.000 -0.002	+0.002 -0.000	0.007	0.035 0.020	0.281	0.334	0.424	+0.00 -0.05	+0.05 -0.00	0.18	0.89 0.51	7.14	8.48	10.77
339	3.122	3.494						79.30	88.75					
340	3.247	3.619						82.47	91.92					
341	3.372	3.744						85.65	95.10					
342	3.497	3.869						88.82	98.27					
343	3.622	3.994						92.00	101.45					
344	3.747	4.119						95.17	104.62					
345	3.872	4.244						98.35	107.80					
346	3.997	4.369						101.52	110.97					
347	4.122	4.494						104.70	114.15					
348	4.247	4.619	107.87	117.32										
349	4.372	4.744	111.05	120.50										
	4.497	4.869	114.22	123.67										
425	+0.000 -0.003	+0.003 -0.000	0.009					+0.000 -0.076	+0.076 -0.000	0.23				
426	4.497	4.974						114.22	126.34					
427	4.622	5.099						117.40	129.51					
428	4.747	5.224						120.57	132.69					
429	4.872	5.349						123.75	135.86					
430	4.997	5.474						126.92	139.04					
431	5.122	5.599						130.10	142.21					
432	5.247	5.724						133.27	145.39					
433	5.372	5.849						136.45	148.56					
434	5.497	5.974						139.62	151.74					
435	5.622	6.099	142.80	154.91										
436	5.747	6.224	145.97	158.09										
437	5.872	6.349	149.15	161.26										
438	5.997	6.474	152.32	164.44										
439	6.247	6.724	158.67	170.79										
440	6.497	6.974	165.02	177.14										
441	6.747	7.224	171.37	183.49										
442	6.997	7.474	177.72	189.84										
443	7.247	7.724	184.07	196.19										
444	7.497	7.974	190.42	202.54										
445	7.747	8.224	196.77	208.89										
446	7.997	8.474	203.12	215.24										
447	8.247	8.724	209.47	221.59										
448	8.497	8.974	215.82	227.94										
449	+0.000 -0.003	+0.004 -0.000	0.010					+0.000 -0.076	+0.102 -0.000	0.25				
450	8.997	9.474						228.52	240.64					
451	9.497	9.974						241.22	253.34					
452	9.997	10.474						253.92	266.04					
453	10.497	10.974						266.62	278.74					
454	10.997	11.474						279.32	291.44					
455	11.497	11.974						292.02	304.14					
456	11.997	12.474						304.72	316.84					
457	12.497	12.974						317.42	329.54					
458	12.997	13.474						330.12	342.24					
459	13.497	13.974	342.82	354.94										
460	13.997	14.474	355.52	367.64										
	14.497	14.974	368.22	380.34										
	14.997	15.474	380.92	393.04										
	15.497	15.974	393.62	405.74										

Recommended for static applications only.

Metric Sizes

The above dimensions are for reference only.

600 Series (3/8") cross section AS4832 recommended for diameters above -442.

Dash Numbers are size codes.

Hardware Expertise

Hardware Expertise

Hardware Dimensions per AS5857 BORE

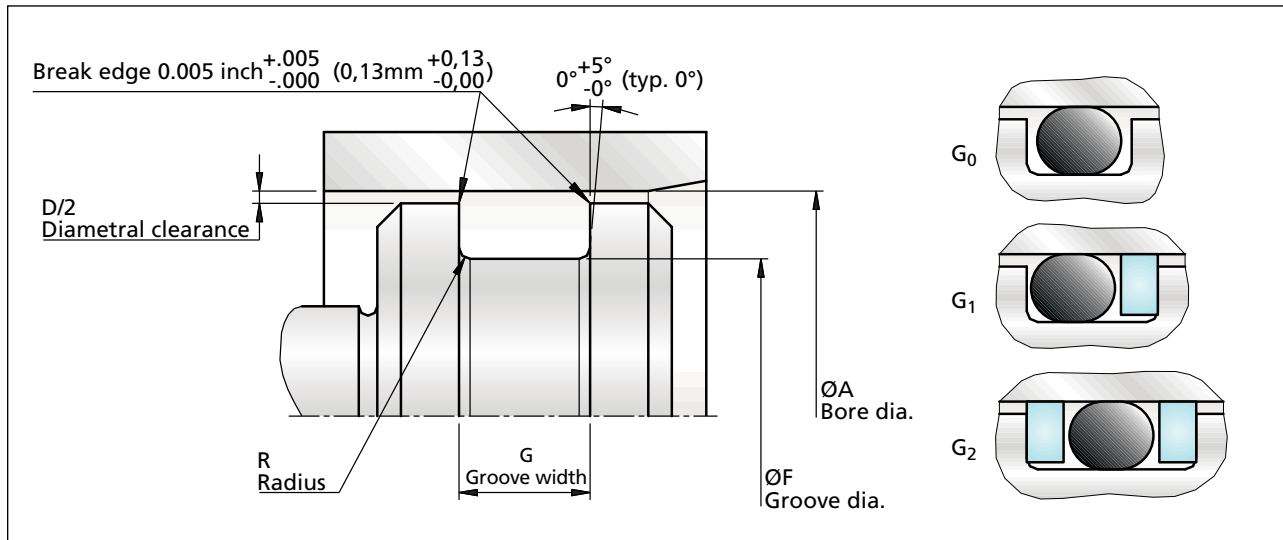


Figure 8 Installation Drawing for BORE

Table X Groove Dimensions, BORE per AS5857

Dash No	Bore Sizes per AS5857													
	Inch					mm								
	ØA Bore Diameter	ØF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			ØA Bore Diameter	ØF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂	
	+0.001 -0.000	+0.000 -0.001			+0.005 -0.000	+0.010 -0.000	+0.010 -0.000	+0.025 -0.000	+0.000 -0.025			+0.13 -0.00	+0.25 -0.00	+0.25 -0.00
001	0.086	0.035	0.004	0.015 0.005	0.090	-	-	2.18	0.89	0.10	0.38 0.13	2.29	-	-
002	0.118	0.048			0.095	-	-	3.00	1.22			2.41	-	-
003	0.151	0.063			0.105	-	-	3.84	1.60			2.67	-	-
004	0.185	0.078	0.004		0.115 0.120	0.174 0.184	0.230 0.240	4.70	1.98	0.10		2.92 3.05	4.42	5.84
005	0.217	0.110						5.51	2.79				4.42	5.84
006	0.230	0.123						5.84	3.12				4.42	5.84
007	0.261	0.154						6.63	3.91				4.42	6.09
008	0.293	0.186						7.44	4.72					
009	0.326	0.219						8.28	5.56					
010	0.357	0.250						9.07	6.35					
011	0.420	0.313	10.67	7.95										
012	0.485	0.378	12.32	9.60										
	+0.002 -0.000	+0.000 -0.002					+0.05 -0.00	+0.00 -0.05						
013	0.550	0.443	0.005	0.015 0.005	0.105	0.164 0.174	0.220 0.230	13.97	11.25	0.13	0.38 0.13	2.67 2.79	4.17 4.42	5.59 5.84
014	0.613	0.506						15.57	12.85					
015	0.675	0.568						17.15	14.43					
016	0.738	0.631						18.75	16.03					
017	0.800	0.693						20.32	17.60					
018	0.863	0.756						21.92	19.20					
019	0.925	0.818						23.50	20.78					
020	0.991	0.884	25.17	22.45										
021	1.053	0.946	26.75	24.03										
022	1.116	1.009	28.35	25.63										
023	1.178	1.071	29.92	27.20										
024	1.241	1.134	31.52	28.80										
025	1.303	1.196	33.10	30.38										
026	1.366	1.259	34.70	31.98										
027	1.428	1.321	36.27	33.55										
028	1.491	1.384	37.87	35.15										

Hardware Expertise

Dash No	Bore Sizes per AS5857													
	Inch					mm								
	ϕA Bore Diameter	ϕF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			ϕA Bore Diameter	ϕF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
104	+0.001 -0.000	+0.000 -0.001	0.004		0.150	0.210	0.275	+0.025 -0.000	+0.000 -0.025	0.10		3.81	5.33	6.99
105	0.286	0.121						7.26	3.07					
106	0.317	0.152						8.05	3.86					
107	0.349	0.184						8.86	4.67					
108	0.382	0.217						9.70	5.51					
109	0.414	0.249						10.52	6.32					
110	0.477	0.312	12.12	7.92										
111	+0.002 -0.000	+0.000 -0.002	0.005	0.015 0.005				+0.05 -0.00	+0.00 -0.05	0.13				
112	0.541	0.377						13.74	9.58					
113	0.604	0.440						15.34	11.18					
114	0.668	0.504						16.97	12.80					
115	0.734	0.570						18.64	14.48					
116	0.800	0.636						20.32	16.15					
117	0.863	0.699						21.92	17.75					
118	0.925	0.761						23.50	19.33					
119	0.991	0.827						25.17	21.01					
120	1.053	0.889						26.75	22.58					
121	1.116	0.952						28.35	24.18					
122	1.178	1.014						29.92	25.76					
123	1.241	1.077						31.52	27.36					
124	1.303	1.139						33.10	28.93					
125	1.366	1.202	34.70	30.53										
126	1.428	1.264	36.27	32.11										
127	1.491	1.327	37.87	33.71										
128	1.553	1.389	39.45	35.28										
129	1.616	1.452	41.05	36.88										
130	1.678	1.514	42.62	38.46										
131	1.741	1.577	44.22	40.06										
132	1.805	1.641	0.006		0.140	0.200	0.265	45.85	41.68	0.15		3.56	5.08	6.73
133	1.867	1.703						47.42	43.26					
134	1.930	1.766						49.02	44.86					
135	1.992	1.828						50.60	46.43					
136	2.055	1.891						52.20	48.03					
137	2.118	1.954						53.80	49.63					
138	2.180	2.016						55.37	51.21					
139	2.243	2.079						56.97	52.81					
140	2.305	2.141						58.55	54.38					
141	2.368	2.204						60.15	55.98					
142	2.430	2.266	61.72	57.56										
143	2.493	2.329	63.32	59.16										
144	2.555	2.391	64.90	60.73										
145	2.618	2.454	66.50	62.33										
146	2.680	2.516	68.07	63.91										
147	2.743	2.579	0.007					69.67	65.51	0.18				
148	2.805	2.641						71.25	67.08					
149	2.868	2.704						72.85	68.68					
	2.930	2.766						74.42	70.26					
	2.993	2.829						76.02	71.86					

Metric Sizes

Hardware Expertise

Hardware Expertise

Dash No	Bore Sizes per AS5857																							
	Inch							mm																
	øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00												
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂											
210	+0.002 -0.000	+0.000 -0.002	0.006	0.025 0.010	0.185	0.250	0.320	+0.05 -0.00	+0.00 -0.05	0.15	0.64 0.25	4.70	6.35	8.13										
211	0.991	0.767						25.17	19.48															
212	1.053	0.829						26.75	21.06															
213	1.116	0.892						28.35	22.66															
214	1.178	0.954						29.92	24.23															
215	1.241	1.017						31.52	25.83															
216	1.303	1.079	0.006	0.025 0.010	0.185	0.250	0.320	33.10	27.41	0.15	0.64 0.25	4.70	6.35	8.13										
217	1.366	1.142						34.70	29.01															
218	1.428	1.204						36.27	30.58															
219	1.491	1.267						37.87	32.18															
220	1.553	1.329						39.45	33.76															
221	1.616	1.392						41.05	35.36															
222	1.678	1.454						42.62	36.93															
223	1.741	1.517						44.22	38.53															
224	1.867	1.643						0.006	0.025 0.010						0.185	0.250	0.320	47.42	41.73	0.15	0.64 0.25	4.70	6.35	8.13
225	1.992	1.768																50.60	44.91					
226	2.118	1.894																53.80	48.11					
227	2.243	2.019	56.97	51.28																				
228	2.368	2.144	60.15	54.46																				
229	2.493	2.269	0.007	0.025 0.010	0.185	0.250	0.320	63.32	57.63	0.18	0.89 0.51	6.86	9.14	11.56										
230	2.618	2.394						66.50	60.81															
231	2.743	2.519						69.67	63.98															
232	2.868	2.644						72.85	67.16															
233	2.993	2.769						76.02	70.33															
234	3.118	2.894						79.20	73.51															
235	3.243	3.019	82.37	76.68																				
236	3.368	3.144	0.008	0.025 0.010	0.185	0.250	0.320	85.55	79.86	0.20	0.89 0.51	6.86	9.14	11.56										
237	3.493	3.269						88.72	83.03															
238	3.618	3.394						91.90	86.21															
239	3.743	3.519						95.07	89.38															
240	3.868	3.644						98.25	92.56															
241	3.993	3.769						101.42	95.73															
242	4.118	3.894						104.60	98.91															
243	4.243	4.019						107.77	102.08															
244	4.368	4.144						110.95	105.26															
245	4.493	4.269						114.12	108.43															
246	4.618	4.394	0.006	0.025 0.010	0.185	0.250	0.320	117.30	111.61	0.15	0.89 0.51	6.86	9.14	11.56										
247	4.743	4.519						120.47	114.78															
248	4.868	4.644						123.65	117.96															
325	1.867	1.523						0.006	0.025 0.010						0.185	0.250	0.320	47.42	38.68	0.15	0.89 0.51	6.86	9.14	11.56
326	1.992	1.648																50.60	41.86					
327	2.118	1.774	53.80	45.06																				
328	2.243	1.899	56.97	48.23																				
329	2.368	2.024	60.15	51.41																				
330	2.493	2.149	0.007	0.035 0.020	0.270	0.360	0.455	63.32	54.58	0.18	0.89 0.51	6.86	9.14	11.56										
331	2.618	2.274						66.50	57.76															
332	2.743	2.399						69.67	60.93															
333	2.868	2.524						72.85	64.11															
334	2.993	2.649						76.02	67.28															
335	3.118	2.774						79.20	70.46															
336	3.243	2.899						82.37	73.63															
337	3.368	3.024						85.55	76.81															
338	3.493	3.149						88.72	79.98															
339	3.618	3.274						91.90	83.16															

Metric Sizes

Hardware Expertise

Dash No	Bore Sizes per AS5857													
	Inch					mm								
	øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øA Bore Diameter	øF Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂	
340	+0.002 -0.000	+0.000 -0.002	0.007	0.035 0.020	0.270	0.360	0.455	+0.05 -0.00	+0.00 -0.05	0.18	0.89 0.51	6.86	9.14	11.56
341	3.743	3.399						95.07	86.33					
342	3.868	3.524						98.25	89.51					
343	3.993	3.649						101.42	92.68					
344	4.118	3.774						104.60	95.86					
345	4.243	3.899						107.77	99.03					
346	4.368	4.024					110.95	102.21						
347	4.493	4.149	0.008					114.12	105.38	0.20				
348	4.618	4.274						117.30	108.56					
349	4.743	4.399						120.47	111.73					
	4.868	4.524						123.65	114.91					
425	+0.003 -0.000	+0.000 -0.003	0.009					+0.076 -0.000	+0.000 -0.076	0.23				
426	4.974	4.519						126.34	114.78					
427	5.099	4.644						129.51	117.96					
428	5.224	4.769						132.69	121.13					
429	5.349	4.894						135.86	124.31					
430	5.474	5.019						139.04	127.48					
431	5.599	5.144						142.21	130.66					
432	5.724	5.269						145.39	133.83					
433	5.849	5.394						148.56	137.01					
434	5.974	5.519						151.74	140.18					
435	6.099	5.644	154.91	143.36										
436	6.224	5.769	158.09	146.53										
437	6.349	5.894	161.26	149.71										
438	6.474	6.019	164.44	152.88										
439	6.624	6.269	170.79	159.23										
440	6.724	6.519	177.14	165.58										
441	7.224	6.769	0.035 0.020	0.345	0.475	0.610	183.49	171.93	0.25					
442	7.474	7.019					189.84	178.28						
443	7.724	7.269					196.19	184.63						
444	7.974	7.519					196.19	184.63						
445	8.224	7.769					202.54	190.98						
446	8.474	8.019					208.89	197.33						
447	8.974	8.519	215.24	203.68										
448	+0.004 -0.000	+0.000 -0.003	0.010					+0.100 -0.000	+0.000 -0.076	0.28				
449	9.474	9.020						227.94	216.38					
450	9.974	9.520						240.64	229.11					
451	10.474	10.020						253.34	241.81					
452	10.974	10.520						266.04	254.51					
453	11.474	11.020						278.74	267.21					
454	11.974	11.520						291.44	279.91					
455	12.474	12.020						304.14	292.61					
456	12.974	12.520						316.84	305.31					
457	13.474	13.020						329.54	318.01					
458	13.974	13.520	342.24	330.71										
459	14.474	14.020	354.94	343.41										
460	14.974	14.520	367.64	356.11										
	15.474	15.020	380.34	368.81										
	15.974	15.520	393.04	381.51										
			405.74	394.21										

Metric Sizes

The above dimensions are for reference only.

600 Series (3/8") cross section AS4832 recommended for diameters above -442.

Dash numbers are size codes

Hardware Expertise

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Hardware Dimensions per AS5857 ROD

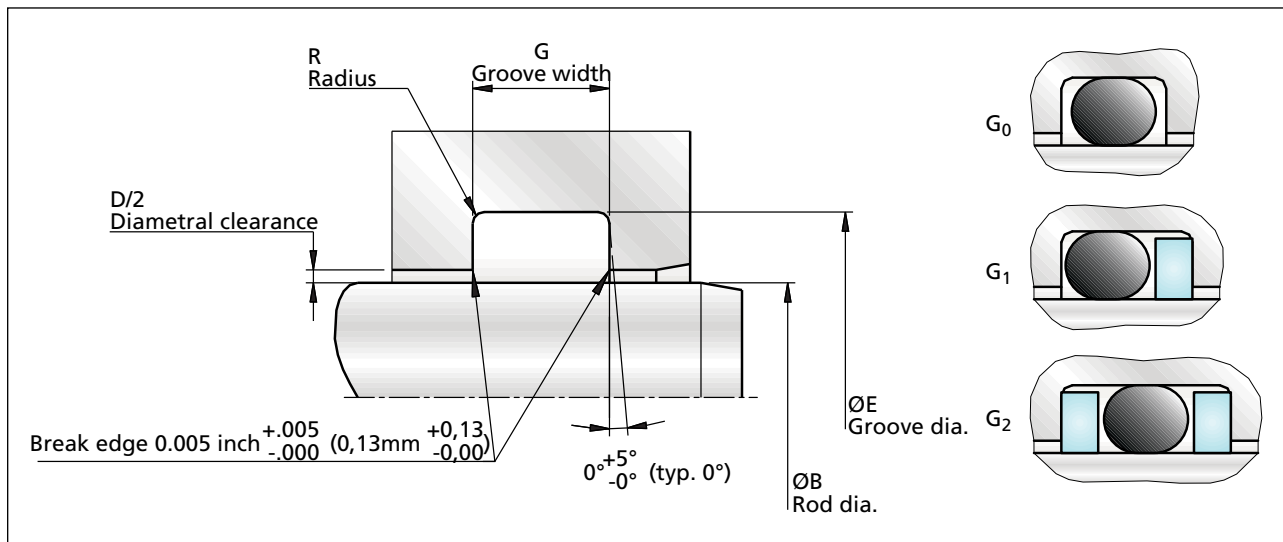


Figure 9 Installation Drawing for ROD

Table XI Groove Dimensions, ROD per AS5857

Dash No	Rod Sizes per AS5857																			
	Inch						mm													
	ØB Rod Diameter	ØE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			ØB Rod Diameter	ØE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00								
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂							
	+0.000 -0.001	+0.001 -0.000			+0.005 -0.000			+0.000 -0.025	+0.025 -0.000			+0.13 -0.00	-	-						
001	0.033	0.086	0.004	0.015 0.005	0.090	-	-	0.84	2.18	0.10	0.38	2.29	-	-						
002	0.048	0.118			0.095	-	-	1.22	3.00		2.41	-	-							
003	0.063	0.151			0.105	-	-	1.60	3.84		2.67	-	-							
004	0.076	0.184						1.93	4.67											
005	0.108	0.216			0.115	0.174	0.230	2.74	5.49		2.92	4.42	5.84							
006	0.123	0.231						3.12	5.87											
007	0.154	0.262			0.120	0.184	0.240	3.91	6.65		3.05	4.67	6.09							
008	0.185	0.293	0.004				4.70	7.44	0.10											
009	0.217	0.325														5.51	8.26			
010	0.248	0.356														6.30	9.04			
011	0.310	0.418														7.87	10.62			
012	0.373	0.481														9.47	12.22			
	+0.000 -0.002	+0.002 -0.000														+0.00 -0.05	+0.05 -0.00			
013	0.435	0.543	0.005	0.015 0.005	0.105	0.164	0.220	11.05	13.79	0.13	0.38 0.13	2.67	4.17	5.59						
014	0.498	0.606						12.65	15.39						2.79	4.42	5.84			
015	0.560	0.668						14.22	16.97											
016	0.623	0.731						15.82	18.57											
017	0.685	0.793						17.40	20.14											
018	0.748	0.856																		
019	0.810	0.918																		
020	0.873	0.981																		
021	0.935	1.043																		
022	0.998	1.106																		
023	1.060	1.168																		
024	1.123	1.231																		
025	1.185	1.293																		
026	1.248	1.356																		
027	1.310	1.418																		
028	1.373	1.481																		

Metric Sizes

Hardware Expertise

Dash No	Rod Sizes per AS5857													
	Inch					mm								
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
104 105 106 107 108 109	+0.000 -0.001	+0.001 -0.000	0.004		0.150	0.210	0.275	+0.000 -0.025	+0.025 -0.000	0.10		3.81	5.33	6.99
	0.123	0.288						3.12	7.32					
	0.154	0.319						3.91	8.10					
	0.185	0.350						4.70	8.89					
	0.217	0.382						5.51	9.70					
	0.248	0.413						6.30	10.49					
0.310	0.475	7.87	12.07											
110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126	+0.000 -0.002	+0.002 -0.000	0.005					+0.00 -0.05	+0.05 -0.00	0.13				
	0.373	0.538						9.47	13.67					
	0.435	0.600						11.05	15.24					
	0.498	0.663						12.65	16.84					
	0.560	0.725						14.22	18.42					
	0.623	0.788						15.82	20.02					
	0.685	0.850						17.40	21.59					
	0.748	0.913						19.00	23.19					
	0.810	0.975						20.57	24.77					
	0.873	1.038						22.17	26.37					
	0.935	1.100						23.75	27.94					
	0.998	1.163						25.35	29.54					
	1.060	1.225						26.92	31.12					
	1.123	1.288						28.52	32.72					
1.185	1.350	30.10	34.29											
1.248	1.413	31.70	35.89											
1.310	1.475	33.27	37.47											
1.373	1.538	34.87	39.07											
127 128 129	1.435 1.498 1.560	1.600 1.663 1.725	0.006	0.015 0.005	0.140	0.200	0.265	36.45 38.05 39.62	40.64 42.24 43.82	0.15		3.56	5.08	6.73
130 131 132	1.623 1.685 1.748	1.788 1.850 1.913						41.22 42.80 44.40	45.42 46.99 48.59					
133 134	1.810 1.873	1.975 2.038						45.97 47.57	50.17 51.77					
135 136 137 138 139	1.936 1.998 2.061 2.123 2.186	2.101 2.163 2.226 2.288 2.351	0.007					49.17 50.75 52.35 53.92 55.52	53.37 54.94 56.54 58.12 59.72	0.18				
140 141 142 143 144	2.248 2.311 2.373 2.436 2.498	2.413 2.476 2.538 2.601 2.663						57.10 58.70 60.27 61.87 63.45	61.29 62.89 64.47 66.07 67.64					
145 146 147 148 149	2.561 2.623 2.686 2.748 2.811	2.726 2.788 2.851 2.913 2.976						65.05 66.62 68.22 69.80 71.40	69.24 70.82 72.42 73.99 75.59					

Metric Sizes

Hardware Expertise

Hardware Expertise

Dash No	Rod Sizes per AS5857													
	Inch						mm							
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00		
					G ₀	G ₁	G ₂					G ₀	G ₁	G ₂
	+0.000 -0.002	+0.002 -0.000						+0.00 -0.05	+0.05 -0.00					
210	0.748	0.974						19.00	24.74					
211	0.810	1.036						20.57	26.31					
212	0.873	1.099						22.17	27.91					
213	0.935	1.161						23.75	29.49					
214	0.998	1.224						25.35	31.09					
215	1.060	1.286		0.025				26.92	32.66		0.64			
216	1.123	1.349	0.005	I	0.185	0.250	0.320	28.52	34.26	0.13	I	4.70	6.35	8.13
217	1.185	1.411		0.010				30.10	35.84		0.25			
218	1.248	1.474						31.70	37.44					
219	1.310	1.536						33.27	39.01					
220	1.373	1.599						34.87	40.61					
221	1.435	1.661						36.45	42.19					
222	1.498	1.724						38.05	43.79					
223	1.623	1.849	0.006					41.22	46.96					
224	1.748	1.974						44.40	50.14	0.15				
225	1.873	2.099						47.57	53.31					
226	1.998	2.224						50.75	56.49					
227	2.123	2.349						53.92	59.66					
228	2.248	2.474						57.10	62.84					
229	2.373	2.599						60.27	66.01					
230	2.498	2.724						63.45	69.19					
231	2.623	2.849						66.62	72.36					
232	2.748	2.974						69.80	75.54					
233	2.873	3.099						72.97	78.71					
234	2.997	3.223						76.12	81.86					
235	3.122	3.348	0.007					79.30	85.04	0.18				
236	3.247	3.473						82.47	88.21					
237	3.372	3.598						85.65	91.39					
238	3.497	3.723						88.82	94.56					
239	3.622	3.848						92.00	97.74					
240	3.747	3.973						95.17	100.91					
241	3.872	4.098						98.35	104.09					
242	3.997	4.223						101.52	107.26					
243	4.122	4.348						104.70	110.44					
244	4.247	4.473						107.87	113.61					
245	4.372	4.598						111.05	116.79					
246	4.497	4.723	0.008					114.22	119.96	0.20				
247	4.622	4.848						117.40	123.14					
325	1.498	1.846						38.05	46.89					
326	1.623	1.971	0.006					41.22	50.06	0.15				
327	1.748	2.096						44.40	53.24					
328	1.873	2.221						47.57	56.41					
329	1.998	2.346						50.75	59.59					
330	2.123	2.471						53.92	62.76					
331	2.248	2.596						57.10	65.94					
332	2.373	2.721		0.035				60.27	69.11		0.89			
333	2.498	2.846	0.007	I	0.270	0.360	0.455	63.45	72.29	0.18	I	6.86	9.14	11.56
334	2.623	2.971		0.020				66.62	75.46		0.51			
335	2.748	3.096						69.80	78.64					
336	2.873	3.221						72.97	81.81					
337	2.997	3.345						76.12	84.96					

Metric Sizes

Hardware Expertise

Dash No	Rod Sizes per AS5857																					
	Inch						mm															
	øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.010/-0.000			øB Rod Diameter	øE Groove Diameter	D Diameter Clearance Maximum	R Radius	Groove Width +0.25/-0.00										
				G ₀	G ₁	G ₂					G ₀	G ₁	G ₂									
338	+0.000 -0.002	+0.002 -0.000	0.007	0.035 0.020	0.270	0.360	0.455	+0.00 -0.05	+0.05 -0.00	0.18	0.89 0.51	6.86	9.14	11.56								
339	3.122	3.470						79.30	88.14													
340	3.247	3.595						82.47	91.31													
341	3.372	3.720						85.65	94.49													
342	3.497	3.845						88.82	97.66													
343	3.622	3.970						92.00	100.84													
344	3.747	4.095						95.17	104.01													
345	3.872	4.220						98.35	107.19													
346	3.997	4.345						101.52	110.36													
347	4.122	4.470						104.70	113.54													
348	4.247	4.595	107.87	116.71																		
349	4.372	4.720	111.05	119.89																		
349	4.497	4.845	114.22	123.06																		
425	+0.000 -0.003	+0.003 -0.000	0.009					+0.000 -0.076	+0.076 -0.000	0.23												
426	4.497	4.956						114.22	125.88													
427	4.622	5.081						117.40	129.06													
428	4.747	5.206						120.57	132.23													
429	4.872	5.331						123.75	135.41													
430	4.997	5.456						126.92	138.58													
431	5.122	5.581						130.10	141.76													
432	5.247	5.706						133.27	144.93													
433	5.372	5.831						136.45	148.11													
434	5.497	5.956						139.62	151.28													
435	5.622	6.081	142.80	154.46																		
436	5.747	6.206	145.97	157.63																		
437	5.872	6.331	149.15	160.81																		
438	5.997	6.456	152.32	163.98																		
438	6.247	6.706	158.67	170.33																		
439	6.497	6.956	0.035 0.020		0.345	0.475	0.610	165.02	176.68	0.89 0.51	8.76	12.07	15.49									
440	6.747	7.206						171.37	183.03													
441	6.997	7.456						177.72	189.38													
442	7.247	7.706						184.07	195.73													
443	7.497	7.956						190.42	202.08													
444	7.747	8.206						196.77	208.43													
445	7.997	8.456						203.12	214.78													
446	8.497	8.956						215.82	227.48													
447	+0.000 -0.003	+0.004 -0.000						0.010									+0.000 -0.076	+0.100 -0.000	0.25			
448	8.997	9.456															228.52	240.18				
449	9.497	9.956	241.22	252.88																		
450	9.997	10.456	253.92	265.58																		
451	10.497	10.956	266.62	278.28																		
452	10.997	11.456	279.32	290.98																		
453	11.497	11.956	292.02	303.68																		
454	11.997	12.456	304.72	316.38																		
455	12.497	12.956	317.42	329.08																		
456	12.997	13.456	330.12	341.78																		
457	13.497	13.956	342.82	354.48																		
458	13.997	14.456	355.52	367.18																		
459	14.497	14.956	368.22	379.88																		
460	14.997	15.456	380.92	392.58																		
460	15.497	15.956	393.62	405.28																		

Metric Sizes

The above dimensions are for reference only.

600 Series (3/8") cross section AS4832 recommended for diameters above -442.

Dash numbers are size codes

Hardware Expertise

Hardware Expertise

Industry Specific Products

■ Products designed for optimized performance

Trelleborg Sealing Solutions offers one of the widest product portfolios of any seal supplier including many proprietary designs. They range from multi-functional O-Rings to more complex Turcon® geometries, from custom molded designs to bonded products.

Sealing elements have a decisive influence on the function and service life of the aerospace systems into which they are fitted and in particular on cylinders, both hydraulic and pneumatic. It is important to select not only the correct sealing material to meet the performance parameters of an application but also the optimum seal configuration.

The most effective sealing solutions will offer:

- maximized leakage control
- low friction
- resistance to wear
- the ability to withstand the most aggressive chemicals
- broad operating temperatures into the extremes, both hot and cold
- extrusion resistance
- compact form
- ease of installation

For advice on the optimum solution for your application, contact your local Trelleborg Sealing Solutions marketing company.

Ordering seals

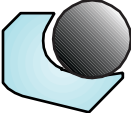
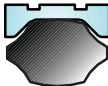
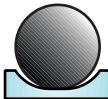


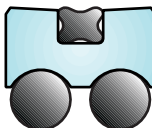
The multi-element seal assemblies presented in this catalog are supplied as complete sets. The assembly includes the seal and proprietary elastomer energizing element.

Older seal designs not included in this catalog continue to be available. Information on these parts and part number ordering details can be found in the "Aerospace Part Number Guide" chapter in the back of this catalog or in the stand-alone *Aerospace Part Number Guide*. For all new applications, we recommend you use the seal types and preferred sizes listed here.

Other combinations of Turcon® materials and special designs can be developed and supplied for individual applications. All intermediate sizes up to 10 ft/ 3000 mm diameter are available, provided there is a sufficient volume requirement. Sizes over 10 ft/ 3000 mm can be supplied in some seal designs.

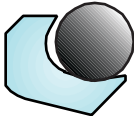




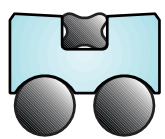
The sizes contained in the catalog are considered standard sizes. For non-standard sizes that include proprietary elastomer designs, a share of the tool cost may be charged if there is only limited demand for that size of seal.

Industry Specific Products

Seal	Features	Application								
		Gland	Movement		Pressure Direction	Piston	Rod	Speed Limit	Temperature Range*	Pressure**
 <p>Turcon® VL Seal®</p>	High performance uni-directional rod seal - Low friction - Leak-tight	MIL-G-5514F AS4716	R	S	U	No	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 MPa (10,000 psi 69 MPa with Zurcon® Back-up Ring)
 <p>Turcon® Plus Seal® II</p>	High performance slipper seal - Low constant friction - Resistance to wear - Optimized extrusion resistance - Easy installation - Recommended for high frequencies	AS4716	R	S	B	Yes	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 MPa (10,000 psi 69 MPa with Stakbak®)
			T							
			O							
			H							
 <p>Turcon® Double Delta® II</p>	The original slipper seal design - No stick-slip - Cost-effective - Can be made to suit any O-Ring size	AS4716	R	S	B	Yes	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 MPa (10,000 psi 69 MPa with Stakbak®)
 <p>Turcon® Wedgpak®</p>	Symmetrical seal with zero-leakage - Low-friction - Excellent extrusion and wear resistance - Preferred elastomer contact dynamic seal	AS4716	R	S	B	Yes	Yes	9.8 ft/s 3.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 MPa (10,000 psi 69 MPa in Wedgpak® EP configuration)
 <p>Turcon® T-Seal</p>	Excellent static seal - Geometry prevents spiraling or rolling of seal during installation and use	AS4716	R	S	B	Yes	Yes	3.3 ft/s 1.0 m/s	-65 to +390°F -54 to +200°C	5000 psi 35 MPa (10,000 psi 69 MPa in Tandem T-seal configuration)
 <p>Turcon® AQ-Seal® 5</p>	- Excellent sealability between gas and oil - Low-friction and leak-tight	AS4716 (only 300 and 400 series)	R	S	B	Yes	No	9.8 ft/s 3.0 m/s	-65 to +390°F -54 to +200°C	5000 psi 35 MPa

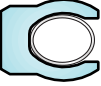


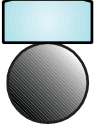
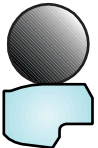

KEY TO MOVEMENT: Reciprocating = R Rotary = T Oscillating = O Helix = H Static = S
 KEY TO PRESSURE DIRECTION: Single acting (Unidirectional) = U Double acting (Bidirectional) = B
 * Temperature range is dependent upon material selection.
 ** Pressure is dependent upon material and gap dimension. Avoid combining extreme limits.

Industry Specific Products

Description	Seal
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 and proven through in-house testing and qualified in customer applications. Its unique back-pumping effect allows the seal to prevent pressure from being trapped between tandem un-vented seals or between seals and double-acting scrapers.	Turcon® VL Seal® 
A superior double acting slipper seal design has a contoured seal cap, formed to match the lemon shaped elastomer ring. The special elastomer allows more room for cap thickness, extending service life and activating the cap equally over the width of the seal. This reduces friction and the cap can be provided with grooves in order to reduce friction even further.	Turcon® Plus Seal® II 
The original slipper seal, it has a delta-shaped cap activated by an Turel® O-Ring. The seal has low friction and good leakage control in dynamic applications.	Turcon® Double Delta® II 
A triangular shaped elastomer part, protected against extrusion, rolling and spiraling by two delta rings. The minimized elastomer footprint on the dynamic surface ensures excellent leakage control with a reduced tendency to adhere to the sealing surface.	Turcon® Wedgpak® 
Primarily recommended for static application, the seal has good leakage control. Its unique shape prevents it from rolling or spiraling in the gland at installation.	Turcon® T-Seal 
This unique seal design was developed from the original Turcon® AQ-Seal®. Its enlarged cap allows it to be centrally positioned in the groove for a X-Ring seal. The seal has the excellent leakage control of an elastomer contact seal, but at the same time, a very low friction and long service life. This is because the X-Ring seal is energized by the squeeze and not by system pressure. Specially designed to separate fluids and gases in dynamic applications.	Turcon® AQ-Seal® 5 

Industry Specific Products

Industry Specific Products

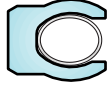


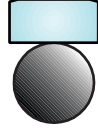


Seal	Features	Application								
		Gland	Movement		Pressure Direction	Piston	Rod	Speed Limit	Temperature Range*	Pressure**
Turcon® Variseal® 	<ul style="list-style-type: none"> - Spring-energized seal - Chemical-resistance optimized - Wide temperature range - Several spring designs available - Unlimited shelf life 	AS4716 (Groove may have to be split for installation)	R	S	U	Yes	Yes	49.2 ft/s 15.0 m/s	-460 to +500°F -273 to +260°C	5,000 psi 35 Mpa (10,000 psi 69 MPa with Zurcon® Back-up Ring)
		T								
		O								
		H								
Turcon® Back-up Ring 	<ul style="list-style-type: none"> - Spiral - Solid - Scarf-cut - Stakbak® design 	AS4716	R	S	B	Yes	Yes	-	-94 to +390°F -70 to +200°C	5,000 psi 35 Mpa (10,000 psi 69 MPa with Zurcon® Back-up Ring)
Turcon® Dual Piston Ring 	<ul style="list-style-type: none"> - Spring-energized seal - Low-friction - Metallic expander - Wide temperature range - Controlled leakage - Saves space by using narrow glands - Low hysteresis - Unlimited shelf life 	TSS gland standard which reflect AS4716 bore diameters	R		B	Yes	No	49.2 ft/s 15.0 m/s	-94 to +500°F -70 to +260°C	5,000 psi 35 MPa
Turcon® Glyd Ring® 	<ul style="list-style-type: none"> - Optimum slipper seal - Low-friction - Long service life - Saves space by using narrow gland 	TSS gland standard which reflect AS4716 rod & bore diameters	R	S	B	Yes	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 Mpa (10,000 psi 69 MPa with Zurcon® Back-up Ring, Corner Reinforced Version)
			T							
			O							
			H							
Turcon® Stepseal® 2K 	<ul style="list-style-type: none"> - Excellent primary seal - High-pressure capability - Pressure relieving effect 	TSS gland standard which reflect AS4716 rod & bore diameters	R		U	Yes	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	5,000 psi 35 MPa
Turcon® Roto Glyd Ring® 	<ul style="list-style-type: none"> - Rotary seal - Low speed - High-pressure 	TSS gland standard which reflect AS4716 rod & bore diameters	R		B	Yes	Yes	6.5 ft/s 2.0 m/s	-65 to +390°F -54 to +200°C	3,000 psi 21 MPa
			T							
			O							
			H							

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* Temperature range is dependent upon material selection.


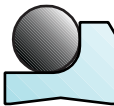



** Pressure is dependent upon material and gap dimension. Avoid combining extreme limits.

Industry Specific Products

Description	Seal
A single-acting slipper seal activated by a metal spring. The seal is often used in conditions where there are extreme temperatures, aggressive chemical media and a long storage life. It gives low-friction, no stick-slip, good leakage control and long service life. There are four types; M, W, H and SA.	<p>Turcon® Variseal®</p> 
All standards and sizes available in virgin as well as filled PTFE compounds. The patented Stakbak® design allows operation in an extended range of temperatures and pressures.	<p>Turcon® Back-up Ring</p> 
The seal is energized by a Stainless Steel wave-shaped spring. The characteristics of the seal are very low-friction, long service life and controlled leakage. Dual Piston Rings can be supplied with various spring types, depending upon application.	<p>Turcon® Dual Piston Ring</p> 
An all-round seal for hydraulic and pneumatic applications. The seal design combines the experience of years of field test and laboratory research into a highly efficient and reliable low-friction seal for both high and low pressure systems. It has the special advantage that gland width can be reduced, for example, in spool valves.	<p>Turcon® Glyd Ring®</p> 
The seal consists of a patented step cap, activated by an O-Ring. A further development of the slipper seal incorporating an active back-pumping effect when used with a secondary seal. This avoids pressure build-up during long strokes.	<p>Turcon® Stepseal® 2K</p> 
The seal is designed with chamfers, notches, and tangential or circumferential grooves. Energized by an O-Ring, the seal has no interference fit to reduce frictional heat generation. Suitable for high-pressure and low speed applications.	<p>Turcon® Roto Glyd Ring®</p> 


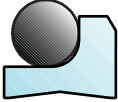
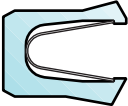


Industry Specific Products

Industry Specific Products

Seal	Features	Application								Pressure**
		Gland	Move- ment	Pressure Direction	Piston	Rod	Speed Limit	Temperature Range*		
Turcon® Varilip® PDR 	<ul style="list-style-type: none"> - Rotary seal - Low-friction - Dry running capability - Chemical resistance optimized - Outperforms traditional Oil seals 	Gland to suit application	T O H	U	No	Yes	65.6 ft/s 20.0 m/s	-76 to +390°F -60 to +200°C	290 psi 2 MPa	
Turcon® Excluder® DC 	<ul style="list-style-type: none"> - Optimum scraping effect - Dual lip for optimized effect - Vented version available 	AS4716, TSS & MS33675 Gland standards	R T O H	U	No	Yes	49.2 ft/s 15.0 m/s	-65 to +390°F -54 to +200°C	-	
Turcon® Variseal® Scraper 	<ul style="list-style-type: none"> - Spring-energized scraper - Wide temperature range - Chemical resistance optimized 	AS4716, AS4052 Rev. B Type II (Groove may have to be split for installation in small diameters)	R T O H	U	Yes	Yes	49.2 ft/s 15.0 m/s	-94 to +500°F -70 to +260°C	-	
Turcon® Slydring® Orkot® Wear Ring Zurcon® Wear Ring 	<ul style="list-style-type: none"> - High load bearing capability - Wear resistant - No rod scoring - Protects seals 	TSS Gland Standard which reflect AS4716 Rod and Bore diameters	R S T O H	B	Yes	Yes	(depending upon material choice)	-76 to +500°F -60 to +260°C	-	
Turcon® HST Seal 	<ul style="list-style-type: none"> - Flange seal - Absorbs pulsing and vibration - Internal and external version - Easy installation 	TSS Face Gland Standard	S	U	External	Internal	-	-65 to +390°F -54 to +200°C	10,000 psi 69 MPa	

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Industry Specific Products

Description	Seal
The metal or plastic casing of the seal incorporates one, two or three seal lips in the same or reversed directions, depending upon the chosen design and requirements for the application. Designed for fast rotating shafts the seal gives a long service life and minimal friction combined with very good leakage control.	<p>Turcon® Varilip® PDR</p> 
A solid ring with dual scraper lip contact, activated by an O-Ring, gives the excellent performance. In the Excluder®, the primary lip prevents dust and ice from penetrating the system during the in-stroke of the rod while the secondary lip stops the oil film from going out of the system during the out-stroke.	<p>Turcon® Excluder® DC</p> 
A spring-energized seal with optimized scraping angle, Variseal® Scraper is designed for extreme working temperatures, high speeds and for contact with aggressive media.	<p>Turcon® Variseal® Scraper</p> 
Wear rings made from polymeric materials offer many advantages over metallic bearings. Among these are low friction, long wear life, easy replacement and low cost. They also protect seals by providing a buffer for contamination and pressure peaks.	<p>Turcon® Slydring® Orkot® Wear Ring Zurcon® Wear Ring</p> 
A flange version of the standard T-seal, the optimized shape of the elastomer ring is leak-tight even in application situations where there is pulsing and vibration present. The ring of Turcon® or Zurcon® protects against extrusion.	<p>Turcon® HST Seal</p> 

Industry Specific Products

Industry Specific Products

Seals and Back-up Rings for AS4716 grooves

Turcon® VL Seal®	63
Turcon® Variseal®	69
Turcon® Plus Seal® II.....	103
Turcon® Double Delta® II	115
Turcon® Wedgpak® II.....	127
Turcon® T-Seal	137
Turcon® AQ-Seal® 5	145
Back-up Rings and Stakbak®	149



Features and benefits

- Tight leakage control
- Unique hydrodynamic back-pumping effect maximizes leakage control
- Avoids the trapping of pressure between tandem seal or between seals and scrapers
- Low friction due to a reduced contact area between seal and mating surface
- Continuously lubricated
- Long service life
- Simple design
- Uses standard size O-Ring as an energizer
- Most AS4716 gland sizes available (compatible with MIL-G-5514F)
- Not available in 000 Series
- US Patent No. 6,497,415

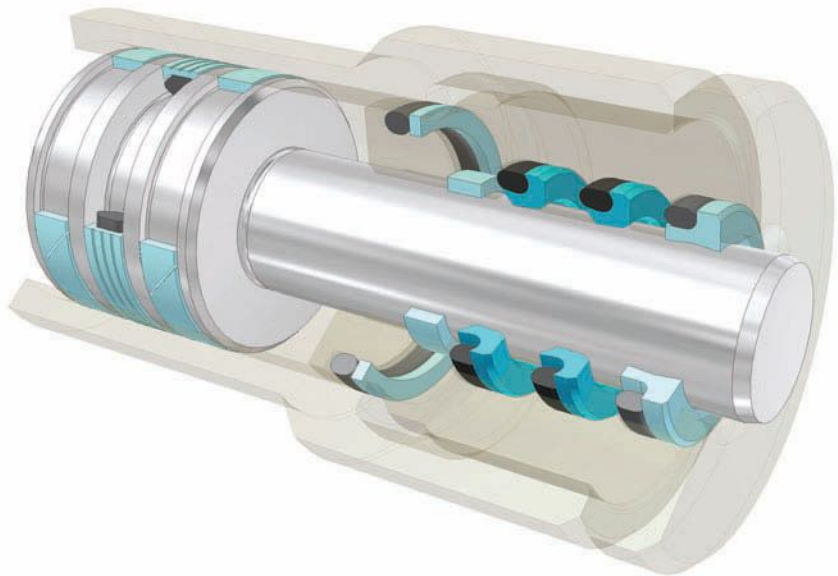


Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® VL Seal®.

Description

The Turcon® VL Seal® was developed as the next generation unidirectional rod seal. It incorporates leading-edge design and development techniques to optimize frictional behavior, leakage control and service life. Performance parameters are backed up with results from in-house testing and qualified customer applications.

Important to the function of the Turcon® VL Seal® is the Trelleborg Sealing Solutions unique back-pumping effect. This prevents pressure from being trapped between tandem seals or between seals and double-acting scrapers.

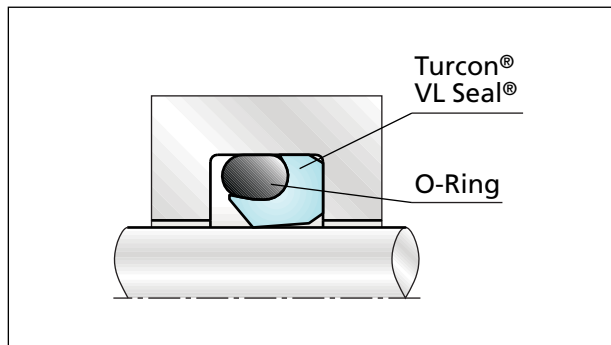


Figure 1 Turcon® VL Seal®

Method of Operation

The sealing mechanism of the Turcon® VL Seal® (Figure 1) 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. The micro-fluid layer that is carried out of the high-pressure chamber when the piston rod is extended is therefore prevented from causing leaks.

The return delivery property of the Turcon® VL Seal® prevents the build-up of the inter-stage pressure that is normally associated with tandem seal configurations (Figure 2). Inter-stage pressure depends on system pressure speed, stroke length and groove design.

The presence of hydraulic oil around the seal ensures a very long service life, as the seal will always be adequately lubricated.

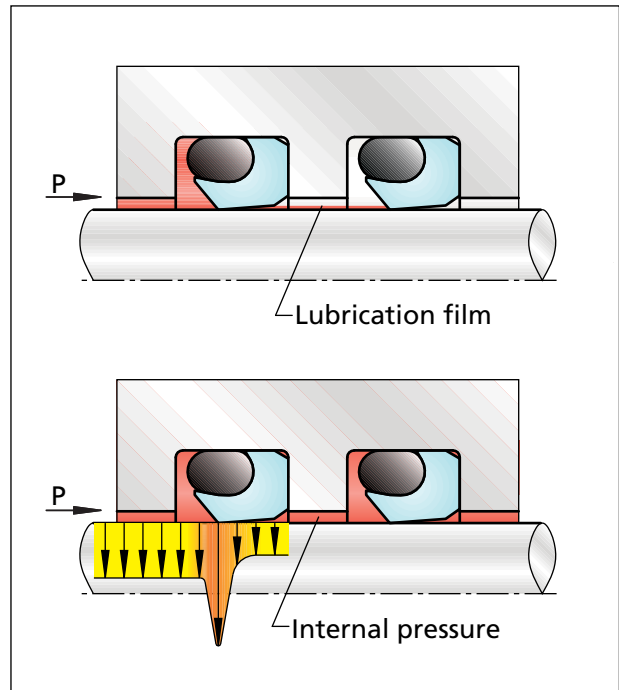


Figure 2 Pressure Distribution in Tandem Installation

Technical Data

Operation pressure: 5000 psi/ 35 MPa

Speed: Up to 49.2 ft/s/ 15.0 m/s with reciprocating movements

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer material












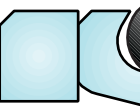
Clearance: Per AS4716 guidelines, larger clearances are possible.

Media: 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

Avoid combining extreme limits.

Turcon® VL Seal®

Table I Turcon® VL Seal® Types

Seal	Turcon® VL Seal®		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
100 Series	 REL10	 REL1_ ¹⁾	 REL1_ ²⁾
200 Series	 REL20	 REL2_ ¹⁾	 REL2_ ²⁾
300 Series	 REL30	 REL3_ ¹⁾	 REL3_ ²⁾
400 Series	 REL40	 REL4_ ¹⁾	 REL4_ ²⁾

- G denotes groove width; zero, one or two back-up width
- BUR - Back-up Ring
- Not recommended below 0.600 in/ 15 mm in closed grooves
- 1 or 2 B/U groove width recommended below 1.000 in/ 25 mm for installation

¹⁾ 5th character - Design characteristics codes for scarf cut Back-up Ring configuration:

- A = Cut BUR in Zurcon® Z43
- B = Cut BUR in same material as seal
- C = Cut BUR in Turcon® T29

²⁾ 5th character - Design characteristics codes for scarf cut Back-up Ring configuration:

- D = Cut BUR in Zurcon® Z43
- E = Cut BUR in same material as seal
- F = Cut BUR in Turcon® T29

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.
110	.373	.546	013	240	.3747	.5989	154
111	.435	.609	014	241	.3872	.4114	154
112	.456	.734	015	242	.4122	.4364	155
113	.506	.797	017	244	.4247	.4489	156
114	.623	.797	017	245	.4372	.4614	156
115	.685	.859	018	246	.4497	.4739	157
116	.748	.923	019	247	.4622	.4864	157
117	.810	.985	020	248	.4747	.4989	157
118	.873	1.048	021	249	.4872	.5114	158
119	.935	1.110	022	250	.4997	.5239	158
120	.998	1.173	023	325	1.498	1.870	223
121	1.060	1.235	024	326	1.623	1.995	224
122	1.123	1.298	025	327	1.748	2.120	225
123	1.185	1.360	026	328	1.873	2.245	226
124	1.248	1.423	027	329	1.998	2.370	227
125	1.310	1.485	028	330	2.123	2.495	228
126	1.373	1.548	029	331	2.248	2.620	229
127	1.435	1.610	029	332	2.373	2.745	230
128	1.498	1.673	029	333	2.498	2.870	231
129	1.560	1.735	030	334	2.623	2.995	232
130	1.623	1.798	030	335	2.748	3.120	233
131	1.685	1.860	031	336	2.873	3.245	234
132	1.748	1.923	031	337	2.998	3.370	235
133	1.810	1.985	032	338	3.123	3.495	236
134	1.873	2.048	032	339	3.248	3.620	237
135	1.935	2.110	033	340	3.373	3.745	238
136	1.998	2.173	033	341	3.498	3.870	239
137	2.060	2.235	034	342	3.623	4.000	240
138	2.123	2.298	034	343	3.748	4.125	241
139	2.185	2.360	035	344	3.873	4.250	242
140	2.248	2.423	035	345	3.998	4.375	243
141	2.310	2.485	036	346	4.123	4.500	244
142	2.373	2.548	036	347	4.248	4.625	245
143	2.435	2.610	037	348	4.373	4.750	246
144	2.498	2.673	037	349	4.498	4.875	247
145	2.560	2.735	038	425	4.497	4.974	350
146	2.623	2.798	038	426	4.622	5.099	351
147	2.685	2.860	039	427	4.747	5.224	352
148	2.748	2.923	039	428	4.872	5.349	353
149	2.810	2.985	040	429	4.997	5.474	354
210	.748	.989	117	430	5.122	5.599	355
211	.810	1.051	118	431	5.247	5.724	356
212	.873	1.113	119	432	5.372	5.849	357
213	.935	1.175	120	433	5.497	5.974	358
214	.998	1.240	121	434	5.622	6.099	359
215	1.060	1.302	122	435	5.747	6.224	360
216	1.123	1.365	123	436	5.872	6.349	361
217	1.185	1.427	124	437	5.997	6.474	362
218	1.248	1.490	125	438	6.122	6.599	363
219	1.310	1.552	126	440	6.247	6.724	364
220	1.373	1.615	127	441	6.372	6.849	365
221	1.435	1.677	128	442	6.497	6.974	366
222	1.498	1.740	129	443	6.622	7.099	367
223	1.560	1.802	130	444	6.747	7.224	368
224	1.623	1.865	131	445	6.872	7.349	369
225	1.685	1.927	132	446	6.997	7.474	370
226	1.748	1.990	133	447	7.122	7.599	371
227	1.810	2.052	134	448	7.247	7.724	372
228	1.873	2.115	135	449	7.372	7.849	373
229	1.935	2.177	136	450	7.497	7.974	374
230	2.000	2.240	137	451	7.622	8.099	375
231	2.060	2.302	138	452	7.747	8.224	376
232	2.123	2.365	139	453	7.872	8.349	377
233	2.185	2.427	140	454	7.997	8.474	378
234	2.248	2.490	141	455	8.122	8.599	379
235	2.310	2.552	142	456	8.247	8.724	380
236	2.373	2.615	143	457	8.372	8.849	381
237	2.435	2.677	144	458	8.497	8.974	382
238	2.498	2.740	145	459	8.622	9.099	383
239	2.560	2.802	146	460	8.747	9.224	384
240	2.623	2.865	147	461	8.872	9.349	385
241	2.685	2.927	148	462	8.997	9.474	386
242	2.748	2.990	149	463	9.122	9.599	387
243	2.810	3.052	150	464	9.247	9.724	388
244	2.873	3.115	151	465	9.372	9.849	389
245	2.935	3.177	152	466	9.497	9.974	390
246	3.000	3.240	153	467	9.622	10.099	391
247	3.060	3.302	154	468	9.747	10.224	392
248	3.123	3.365	155	469	9.872	10.349	393
249	3.185	3.427	156	470	9.997	10.474	394
250	3.248	3.490	157	471	10.122	10.599	395
251	3.310	3.552	158	472	10.247	10.724	396
252	3.373	3.615	159	473	10.372	10.849	397
253	3.435	3.677	160	474	10.497	10.974	398
254	3.498	3.740	161	475	10.622	11.099	399
255	3.560	3.802	162	476	10.747	11.224	400
256	3.623	3.865	163	477	10.872	11.349	401
257	3.685	3.927	164	478	10.997	11.474	402
258	3.748	3.990	165	479	11.122	11.599	403
259	3.810	4.052	166	480	11.247	11.724	404
260	3.873	4.115	167	481	11.372	11.849	405
261	3.935	4.177	168	482	11.497	11.974	406
262	4.000	4.240	169	483	11.622	12.099	407
263	4.060	4.302	170	484	11.747	12.224	408
264	4.123	4.365	171	485	11.872	12.349	409
265	4.185	4.427	172	486	11.997	12.474	410
266	4.248	4.490	173	487	12.122	12.599	411
267	4.310	4.552	174	488	12.247	12.724	412
268	4.373	4.615	175	489	12.372	12.849	413
269	4.435	4.677	176	490	12.497	12.974	414
270	4.498	4.740	177	491	12.622	13.099	415
271	4.560	4.802	178	492	12.747	13.224	416
272	4.623	4.865	179	493	12.872	13.349	417
273	4.685	4.927	180	494	12.997	13.474	418
274	4.748	4.990	181	495	13.122	13.599	419
275	4.810	5.052	182	496	13.247	13.724	420
276	4.873	5.115	183	497	13.372	13.849	421
277	4.935	5.177	184	498	13.497	13.974	422
278	5.000	5.240	185	499	13.622	14.099	423
279	5.060	5.302	186	500	13.747	14.224	424
280	5.123	5.365	187	501	13.872	14.349	425
281	5.185	5.427	188	502	13.997	14.474	426
282	5.248	5.490	189	503	14.122	14.599	427
283	5.310	5.552	190	504	14.247	14.724	428
284	5.373	5.615	191	505	14.372	14.849	429
285	5.435	5.677	192	506	14.497	14.974	430
286	5.498	5.740	193	507	14.622	15.099	431
287	5.560	5.802	194	508	14.747	15.224	432
288	5.623	5.865	195	509	14.872	15.349	433
289	5.685	5.927	196	510	14.997	15.474	434
290	5.748	5.990	197	511	15.122	15.599	435
291	5.810	6.052	198	512	15.247	15.724	436
292	5.873	6.115	199	513	15.372	15.849	437
293	5.935	6.177	200	514	15.497	15.974	438
294	6.000	6.240	201	515	15.622	16.099	439
295	6.060	6.302	202	516	15.747	16.224	440
296	6.123	6.365	203	517	15.872	16.349	441
297	6.185	6.427	204	518	15.997	16.474	442
298	6.248	6.490	205	519	16.122	16.599	443
299	6.310	6.552	206	520	16.247	16.724	444
300	6.373	6.615	207	521	16.372	16.849	445
301	6.435	6.677	208	522	16.497	16.974	446
302	6.498	6.740	209	523	16.622	17.099	447
303	6.560	6.802	210	524	16.747	17.224	448
304	6.623	6.865	211	525	16.872	17.349	449
305	6.685	6.927	212	526	16.997	17.474	450
306	6.748	6.990	213	527	17.122	17.599	451
307	6.810	7.052	214	528	17.247	17.724	452
308	6.873	7.115	215	529	17.372	17.849	453
309	6.935	7.177	216	530	17.497	17.974	454
310	7.000	7.240	217	531	17.622	18.099	455
311	7.060	7.302	218	532	17.747	18.224	456
312	7.123	7.365	219	533	17.872	18.349	457
313	7.185	7.427	220	534	17.997	18.474	458
314	7.248	7.490	221	535	18.122	18.599	459
315	7.310	7.552	222	536	18.247	18.724	460
316	7.373	7.615	223	537	18.372	18.849	461
317	7.435	7.677	224	538	18.497	18.974	462
318	7.498	7.740	225	539	18.622	19.099	463
319	7.560	7.802	226	540	18.747	19.224	464
320	7.623	7.865	227	541	18.872	19.349	465
321	7.685	7.927	228	542	18.997	19.474	466
322	7.748	7.990	229	543	19.122	19.599	467
323	7.810	8.052	230	544	19.247	19.724	468
324	7.873	8.115	231	545	19.372	19.849	469
325	7.935	8.177	232	546	19.497	19.974	470
326	8.000	8.240	233	547	19.622	20.099	471
327	8.060	8.302	234	548			

Turcon® VL Seal®

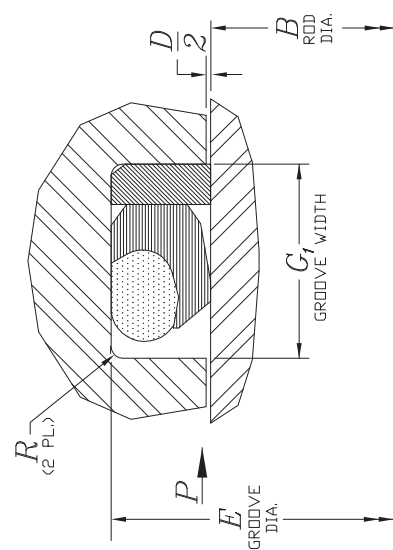
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+0.001 -0.001	+0.001 -0.001	+0.001 -0.001		+0.002 -0.002	+0.002 -0.002	+0.002 -0.002	
110	.373	.546	013	240	3.747	3.989	154
111	.435	.609	014	241	3.872	4.114	154
112	.498	.672	015	242	3.957	4.199	152
113	.561	.735	016	243	4.042	4.284	152
114	.623	.797	017	244	4.127	4.369	156
115	.685	.859	018	245	4.212	4.454	156
116	.748	.923	019	246	4.297	4.539	157
117	.810	.985	020	247	4.382	4.624	157
118	.873	1.048	021				
119	.935	1.110	022				
120	.998	1.173	023	325	14.98	18.70	223
121	1.060	1.235	024	326	16.23	19.95	224
122	1.123	1.298	025	327	17.48	21.20	225
123	1.185	1.360	026	328	18.73	22.45	226
124	1.248	1.423	027	329	19.98	23.70	227
125	1.310	1.485	028	330	21.23	24.95	228
126	1.373	1.548	029	331	22.48	26.20	229
127	1.435	1.610	029	332	23.73	27.45	230
128	1.498	1.673	029	333	24.98	28.70	231
129	1.560	1.735	029	334	26.23	29.95	232
130	1.623	1.798	030	335	27.48	31.20	233
131	1.685	1.860	031	336	28.73	32.45	234
132	1.748	1.923	031	337	29.98	33.70	235
133	1.810	1.985	032	338	31.23	34.95	236
134	1.873	2.047	032	339	32.48	36.20	237
135	1.935	2.110	033	340	33.73	37.45	238
136	1.998	2.172	033	341	34.98	38.70	239
137	2.060	2.235	034	342	36.23	40.00	240
138	2.123	2.297	034	343	37.48	41.25	241
139	2.185	2.360	035	344	38.73	42.50	242
140	2.248	2.422	035	345	39.98	43.75	243
141	2.310	2.485	036	346	41.23	45.00	244
142	2.373	2.547	036	347	42.48	46.25	245
143	2.435	2.610	037	348	43.73	47.50	246
144	2.498	2.672	037	349	44.98	48.75	247
145	2.561	2.735	038				
146	2.623	2.797	038	425	44.97	49.74	350
147	2.686	2.860	039	426	46.22	50.99	351
148	2.748	2.922	039	427	47.47	52.24	352
149	2.811	2.985	040	428	48.72	53.49	353
				429	49.97	54.74	354
				430	51.22	55.99	355
210	.748	.989	117	431	52.47	57.24	356
211	.810	1.051	118	432	53.72	58.49	357
212	.873	1.113	119	433	54.97	59.74	358
213	.935	1.175	120	434	56.22	60.99	359
214	.998	1.237	121	435	57.47	62.24	360
215	1.060	1.300	122	436	58.72	63.49	361
216	1.123	1.362	123	437	59.97	64.74	362
217	1.185	1.424	124	438	61.22	65.99	363
218	1.248	1.486	125	439	62.47	67.24	364
219	1.310	1.548	126	440	63.72	68.49	365
220	1.373	1.610	127	441	64.97	69.74	366
221	1.435	1.672	128	442	66.22	70.99	367
222	1.498	1.734	129	443	67.47	72.24	368
223	1.560	1.796	130	444	68.72	73.49	369
224	1.623	1.858	131	445	69.97	74.74	370
225	1.685	1.920	132	446	71.22	75.99	371
226	1.748	1.982	133				
227	1.810	2.044	134				
228	1.873	2.106	135				
229	1.935	2.168	136				
230	2.000	2.230	137				
231	2.060	2.292	138				
232	2.123	2.354	139				
233	2.185	2.416	140				
234	2.248	2.478	141				
235	2.310	2.540	142				
236	2.373	2.602	143				
237	2.435	2.664	144				
238	2.498	2.726	145				
239	2.561	2.788	146				

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VL SEAL® IN AS4716 REV A ROD GLANDS.
- ORDERING EXAMPLE:
REL 2 P M 214 A 119 NG
VL SEAL® ROD DESIGNATOR
CROSS SECTION:
1 = 100 SERIES
2 = 200 SERIES
3 = 300 SERIES
DESIGN CHARACTERISTICS
A SEE BELOW
GLAND STANDARD
M = AS4716 REVISION A
SIZE DESIGNATION
ACCORDING TO AS4716 REVISION A
QUALITY INDEX
TURCON® VL SEAL® MAT'L CODE
TURCON® D-RING MAT'L CODE
CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

DESIGN CODES FOR SCARF CUT BACKUP RING CONFIGURATION.

DESIGN CODE	BACKUP RING TYPE	MATERIAL
A	BACKUP RING	TURCON® 129
B	BACKUP RING	TURCON® 243
C	BACKUP RING	TURCON® 243



ROD SEAL INSTALLATION
FOR ONE BACKUP WIDTH GLAND PER AS4716 REVISION A

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INCH

TITLE: 2009_1

TRELLEBORG SEALING SOLUTIONS

VL SEAL®

REL1BMOO0

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.
110	+.001	+.001	013	240	+.002	+.002	154
111	-.001	-.001	014	241	-.002	-.002	154
112	.546	.546	015	3747	3.989	3.989	373
113	4.35	4.35	016	3872	4.114	4.114	381
114	6.23	6.23	017	4132	4.364	4.364	413
				424	4.489	4.489	424
115	.685	.685	018	245	4.372	4.614	156
116	.748	.748	019	246	4.497	4.739	157
117	.810	.985	020	247	4.622	4.864	157
118	1.033	1.046	021				
119	.935	1.110	022				
120	.998	1.173	023	325	1.498	1.870	223
121	1.060	1.235	024	326	1.623	1.995	224
122	1.123	1.298	025	327	1.748	2.120	225
123	1.185	1.360	026	328	1.873	2.245	226
124	1.248	1.423	027	329	1.998	2.370	227
125	1.310	1.485	028	330	2.123	2.495	228
126	1.373	1.548	029	331	2.248	2.620	229
127	1.435	1.610	029	332	2.373	2.745	230
128	1.498	1.673	029	333	2.498	2.870	231
129	1.560	1.735	030	334	2.623	2.995	232
130	1.623	1.798	030	335	2.748	3.120	233
131	1.685	1.860	031	336	2.873	3.245	234
132	1.748	1.923	031	337	2.998	3.370	235
133	1.810	1.985	032	338	3.123	3.495	236
134	1.873	2.048	032	339	3.248	3.620	237
135	1.935	2.110	033	340	3.373	3.745	238
136	1.998	2.172	033	341	3.498	3.870	239
137	2.060	2.235	034	342	3.623	4.000	240
138	2.123	2.297	034	343	3.748	4.125	241
139	2.185	2.360	035	344	3.873	4.250	242
140	2.248	2.422	035	345	3.998	4.375	243
141	2.310	2.485	036	346	4.123	4.500	244
142	2.373	2.547	036	347	4.248	4.625	245
143	2.435	2.610	037	348	4.373	4.750	246
144	2.498	2.672	037	349	4.498	4.875	247
145	2.560	2.735	038				
146	2.623	2.797	038	425	4.497	4.974	350
147	2.685	2.860	039	426	4.622	5.099	351
148	2.748	2.922	039	427	4.747	5.224	352
149	2.810	2.985	040	428	4.872	5.349	353
				429	4.997	5.474	354
210	+.002	+.002	117	435	5.747	6.224	360
211	.748	.989	117	431	5.247	5.724	356
212	.873	1.115	118	432	5.372	5.849	357
213	.935	1.177	119	433	5.497	5.974	358
214	.998	1.240	120	434	5.622	6.099	359
215	1.060	1.302	122	435	5.747	6.224	360
216	1.123	1.365	123	436	5.872	6.349	361
217	1.185	1.427	124	437	5.997	6.474	361
218	1.248	1.490	125	438	6.247	6.724	362
219	1.310	1.552	126	439	6.497	6.974	363
				440	6.747	7.224	364
220	1.373	1.615	127	441	6.997	7.474	365
221	1.435	1.677	128	442	7.247	7.724	366
222	1.498	1.740	129	443	7.497	7.974	367
223	1.560	1.802	130	444	7.747	8.224	368
224	1.623	1.865	131				
225	1.685	1.927	132	445	7.997	8.474	369
226	1.748	1.990	133	446	8.247	8.724	371
227	1.810	2.052	134				
228	1.873	2.115	135				
229	1.935	2.177	136				
230	2.000	2.240	137				
231	2.060	2.302	138				
232	2.123	2.365	139				
233	2.185	2.427	140				
234	2.248	2.490	141				
235	2.310	2.552	142				
236	2.373	2.615	143				
237	2.435	2.677	144				
238	2.498	2.740	145				
239	2.560	2.802	146				
240	2.623	2.865	147				
241	2.685	2.927	148				
242	2.748	2.990	149				
243	2.810	3.052	150				
244	2.873	3.115	151				
245	2.935	3.177	152				
246	2.998	3.240	153				
247	3.060	3.302	154				
248	3.123	3.365	155				
249	3.185	3.427	156				
250	3.248	3.490	157				
251	3.310	3.552	158				
252	3.373	3.615	159				
253	3.435	3.677	160				
254	3.498	3.740	161				
255	3.560	3.802	162				
256	3.623	3.865	163				
257	3.685	3.927	164				
258	3.748	3.990	165				
259	3.810	4.052	166				
260	3.873	4.115	167				
261	3.935	4.177	168				
262	3.998	4.240	169				
263	4.060	4.302	170				
264	4.123	4.365	171				
265	4.185	4.427	172				
266	4.248	4.490	173				
267	4.310	4.552	174				
268	4.373	4.615	175				
269	4.435	4.677	176				
270	4.498	4.740	177				
271	4.560	4.802	178				
272	4.623	4.865	179				
273	4.685	4.927	180				
274	4.748	4.990	181				
275	4.810	5.052	182				
276	4.873	5.115	183				
277	4.935	5.177	184				
278	4.998	5.240	185				
279	5.060	5.302	186				
280	5.123	5.365	187				
281	5.185	5.427	188				
282	5.248	5.490	189				
283	5.310	5.552	190				
284	5.373	5.615	191				
285	5.435	5.677	192				
286	5.498	5.740	193				
287	5.560	5.802	194				
288	5.623	5.865	195				
289	5.685	5.927	196				
290	5.748	5.990	197				
291	5.810	6.052	198				
292	5.873	6.115	199				
293	5.935	6.177	200				
294	5.998	6.240	201				
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296	6.123	6.365	203				
297	6.185	6.427	204				
298	6.248	6.490	205				
299	6.310	6.552	206				
300	6.373	6.615	207				
301	6.435	6.677	208				
302	6.498	6.740	209				
303	6.560	6.802	210				
304	6.623	6.865	211				
305	6.685	6.927	212				
306	6.748	6.990	213				
307	6.810	7.052	214				
308	6.873	7.115	215				
309	6.935	7.177	216				
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336	8.623	8.865	243				
337	8.685	8.927	244				
338	8.748	8.990	245				
339	8.810	9.052	246				
340	8.873	9.115	247				
341	8.935	9.177	248				
342	8.998	9.240	249				
343	9.060	9.302	250				
344	9.123	9.365	251				
345	9.185	9.427	252				
346	9.248	9.490	253				
347	9.310	9.552	254				
348	9.373	9.615	255				
349	9.435	9.677	256				
350	9.498	9.740	257				
351	9.560	9.802	258				
352	9.623	9.865	259				
353	9.685	9.927	260				
354	9.748	9.990					

Features and benefits

- Good dynamic and static sealing
- Very low coefficient of friction
- Very good dry-running properties
- Operating temperature of -423°F to +500°F/ -253°C up to +260°C
- Very good thermal resistance
- Almost universal chemical compatibility
- Permanent elasticity unaffected by contact with chemicals
- Capable of sealing at high speeds up to 49 ft/sec/ 15 m/s
- Capable of withstanding high pressures above 29,000 psi/ 200 MPa when using Back-up Rings
- Excellent leak tightness
- High resistance to wear
- No extrusion into gaps
- Low compression set
- Withstands aggressive and abrasive process media
- Good aging characteristics
- Compact form
- Simple installation
- Can be installed in grooves according to MIL-G-5514F and DIN 3771
- Standard products are available from 0.079 in/ 2 mm up to 8 ft 2 in/ 2,500 mm in diameter along with custom manufactured intermediate sizes, inch sizes or special geometries.

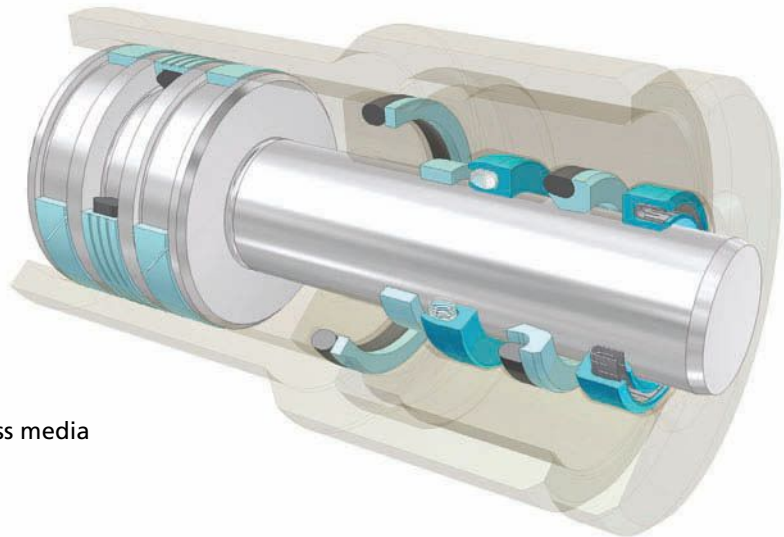


Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Variseal® of different types.

Description

The Turcon® Variseal® range is made up of single-acting spring-energized seals that are used in dynamic and static situations. Turcon® Variseal® is available in a range of geometries and designs that allow the optimum profile to be selected for a wide range of applications.

Turcon® Variseal® is chosen when high resistance to chemical media is required, if the seal needs to operate in extremes of temperature and where good extrusion or compression characteristics are needed.

Turcon® Variseal® has three main design characteristics:

1. Application specific U-shaped seal profile
2. Spring geometry suited to the particular application
3. Proven high-performance Turcon® or Zurcon® polymers

Method of Operation

All Turcon® Variseal® included in this catalog have the same operating principle and differ only in their profile form and type of metallic spring used.

The Turcon® Variseal® spring supplies the load required for sealing at low pressures (Figure 1). The U-shaped jacket allows fluid pressure to energize the sealing lips, so total sealing pressure rises with increasing operating pressure (Figure 2).

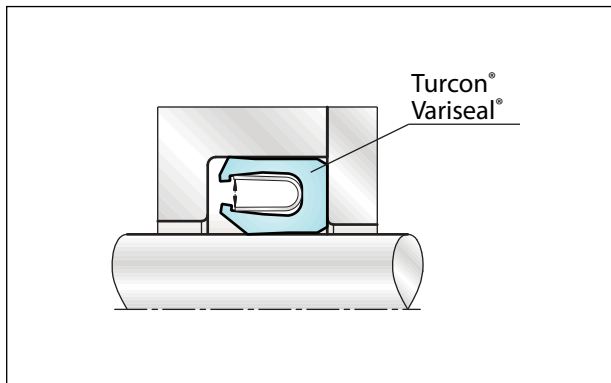


Figure 1 Turcon® Variseal® without system pressure

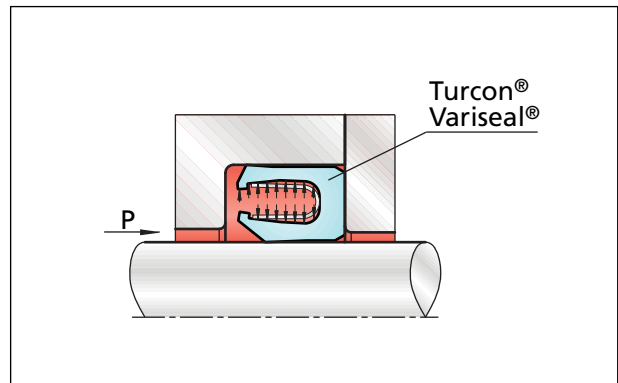


Figure 2 Turcon® Variseal® with system pressure

Spring Types

A metal spring is incorporated into Turcon® Variseal® to provide elasticity to the seal. This makes the seal permanently elastic, despite changes in operating temperature, pressure or chemicals processed. Each of the three spring types used in Turcon® Variseal® has unique properties that give them their performance characteristics. The two most important properties of the spring, besides the corrosion resistance of the metal, are load value and deflection range. The spring load affects sealing ability, friction and the wear rate of the seal. The deflection range determines the ability of Turcon® Variseal® to withstand wear and compensates for variations in gland dimensions.

V Spring

V Spring is the standard spring type for Turcon® Variseal® M2, Turcon® Variseal® M2S and Turcon® Roto Variseal®. It operates as a set of cantilever beams, extending from an arc at the bottom of the spring. The shape of the spring causes the load to be focused on the front edge of the sealing lip, giving the seal a positive wiping action. The V spring has a moderate load and deflection range.

Helical Spring

The Helical spring, used in Turcon® Variseal® H and Turcon® Variseal® HF, is made from a flat strip formed into a helical coil spring. It has a much higher unit

load and a shorter deflection range than the other spring types. Therefore, it is best suited to static or slow dynamic applications, where friction and wear are not the key issues. Variseal® H and Variseal® HF are the best choices for vacuum, gas and low-temperature applications.

Slantcoil® Spring

The proprietary Slantcoil® spring used in Turcon® Variseal® W consists of round wire formed into slanted coils and has a relatively constant load over a wide deflection range. This allows accurate control of friction during the working life of the seal. Its unique design makes it almost impossible to damage the spring by excessive deformation of the seal.

Spring Materials

The standard spring material for Turcon® Variseal® is Stainless Steel AISI 301 (spring code S). In addition, Hastelloy® (spring code H) and Elgiloy® (spring code E) are available for specific applications.

Note:

Hastelloy® is a registered trademark of Cabot Corporation.

Elgiloy® is a registered trademark of Elgiloy Company.

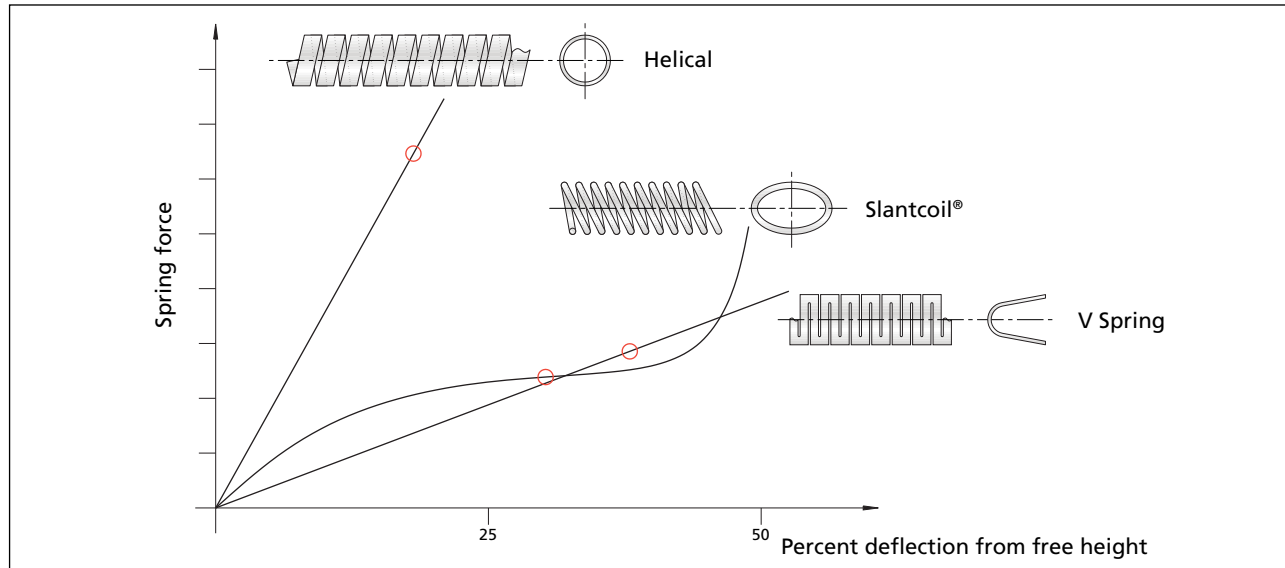


Figure 3 Comparison of load curves for the three spring types. The "o" represents the load point when the seals are installed in the gland.

Turcon® Variseal®

Table I Turcon® Variseal® Rod Seals

TYPE	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
M2	RVA_0	RVA_1)	RVA_2)
Helical	RVE_0	RVE_1)	RVE_2)
W2	RVJ_0	RVJ_1)	RVJ_2)
Slantcoil® SA	RVP_0	RVP_1)	RVP_2)

Table II Turcon® Variseal® Piston Seals

TYPE	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
M2	PVA_0	PVA_1)	PVA_2)
Helical	PVE_0	PVE_1)	PVE_2)
W2	PVJ_0	PVJ_1)	PVJ_2)
Slantcoil® SA	PVP_0	PVP_1)	PVP_2)

- G denotes groove width; zero, one or two back-up width
- BUR - Back-up Ring

1) 5th character - Design characteristics codes for scarf cut Back-up Ring configuration:

- A = Cut BUR in Zurcon® Z43
- B = Cut BUR in same material as seal
- C = Cut BUR in Turcon® T29

2) 5th character - Design characteristics codes for scarf cut Back-up Ring configuration:

- D = Cut BUR in Zurcon® Z43
- E = Cut BUR in same material as seal
- F = Cut BUR in Turcon® T29

■ Turcon® Variseal® M2



Description

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

Turcon® 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.

Areas of Application

- Hydraulic actuators and Cylinders
- Spindles
- Pumps
- Valves

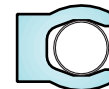
Advantages

- Suitable for reciprocating and rotary applications
- Low coefficient of friction
- Stick-slip-free operating
- High abrasion resistance
- Withstands rapid changes in temperature
- Available in Hi-Clean® (Silicone-filled) version
- Excellent resistance to aging
- Interchangeable with O-Ring and Back-up Ring combinations to AS4716

Technical Data

Operating Pressure:	
Maximum dynamic:	6,527 psi/ 45 MPa
Maximum static:	8,700 psi/ 60 MPa
Speed:	Reciprocating up to 49 ft/s/ 15 m/s Rotating up to 3 ft/s/ 1 m/s
Operating Temperature:	-94°F to +500°F/ -70°C to +260°C
Media:	Virtually all fluids, chemicals and gases
Note:	At high temperatures, operating pressures and speeds are lower.

■ Turcon® Variseal® Helical



Description

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

The helical ribbon spring of Turcon® Variseal® H has high spring-loading, which gives excellent sealing integrity at low pressure and even in a vacuum. Variseal® H is suitable for static applications and ideal in low speed situations.

Areas of Application

- Compressors
- Ball valves
- Vacuum or gas-tight sealing
- Very low temperatures

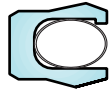
Advantages

- High contact pressure
- Excellent sealing integrity in gas and fluid applications
- Withstands rapid changes in temperature
- Good sealing ability when surfaces are not ideal
- No assembly tools are required for larger diameter seals
- Excellent resistance to aging
- Interchangeable with O-Ring and Back-up Ring combinations to AS4716

Technical Data

Operating Pressure:	
Maximum dynamic:	2,900 psi/ 20 MPa
Maximum static:	11,600 psi/ 80 MPa
Speed:	Reciprocating up to 16 ft/s/ 5 m/s Rotating up to 0.3 ft/s/ 0.1 m/s
Operating Temperature:	-248°F to +500°F/ -120°C to +260°C
Media:	Virtually all fluids, chemicals and gases
Note:	At high temperatures, operating pressures and speeds are lower.

■ Turcon® Variseal® W2



Description

Turcon® Variseal® W2 is a single-acting seal consisting of a U-shaped jacket and a corrosion-resistant Slantcoil® spring. The Slantcoil® spring in the Turcon® Variseal® W2 provides an almost constant load regardless of hardware, tolerances, eccentricity and seal wear.

The Variseal® W2 is designed for reciprocating and rotary applications over a wide range of surface speeds and temperatures. It is virtually resistant to fatigue or compression set since the internal stresses of the Slantcoil® spring geometry are very low.

Areas of Application

- Hydraulic actuators and cylinders
- Servo valves
- Pressure switches
- Electronic equipment

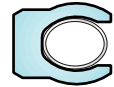
Advantages

- Suitable for reciprocating and rotary applications
- Constant initial squeeze of spring over a large control area
- Almost constant friction for low-pressure applications
- Stick-slip-free operation
- High abrasion resistance
- Withstands rapid changes in temperature
- Interchangeable with O-Ring and Back-up Ring combinations to AS4716

Technical Data

Operating Pressure:	
Maximum dynamic:	2,900 psi/ 20 MPa
Maximum static:	8,700 psi/ 60 MPa
Speed:	Reciprocating up to 49 ft/s/ 15 m/s Rotating up to 3 ft/s/ 1 m/s
Operating Temperature:	-94°F to +446°F/ -70°C to +230°C
Media:	Virtually all fluids, chemicals and gases
Note:	At high temperatures, operating pressures and speeds are lower.

■ Turcon® Variseal® SA



Description

Turcon® Variseal® SA is a single-acting seal with a Slantcoil® spring energizer. The seal was developed for aerospace hydraulic applications, particularly those requiring installation into closed groove gland positions. The special seal jacket profile and Slantcoil® spring enable the seal to more readily withstand the damage and deformation that other spring-energized seals can suffer when fitted into closed grooves.

Turcon® Variseal® SA is designed for reciprocating and rotary applications over a wide range of surface speeds and temperatures. The round sealing lip profile gives a wide contact area, which enhances sealing function when good leakage control is needed.

Areas of Application

- Hydraulic actuators and cylinders
- Spindles
- Pumps
- Valves

Advantages

- Suitable for installation into small diameter closed glands
- Constant initial squeeze of spring over a large control area
- Stick-slip-free operation
- Withstands rapid changes in temperature
- Interchangeable with O-Ring and Back-up Ring combinations to AS4716

Technical Data

Operating Pressure:	
Maximum dynamic:	5,000 psi/ 35 MPa
Maximum static:	11,600 psi/ 80 MPa
Speed:	Reciprocating up to 16 ft/s/ 5 m/s Rotating up to 0.3 ft/s/ 0.1 m/s
Operating Temperature:	-94°F to +446°F/ -70°C to +230°C
Media:	Virtually all fluids, chemicals and gases
Note:	At high temperatures, operating pressures and speeds are lower.

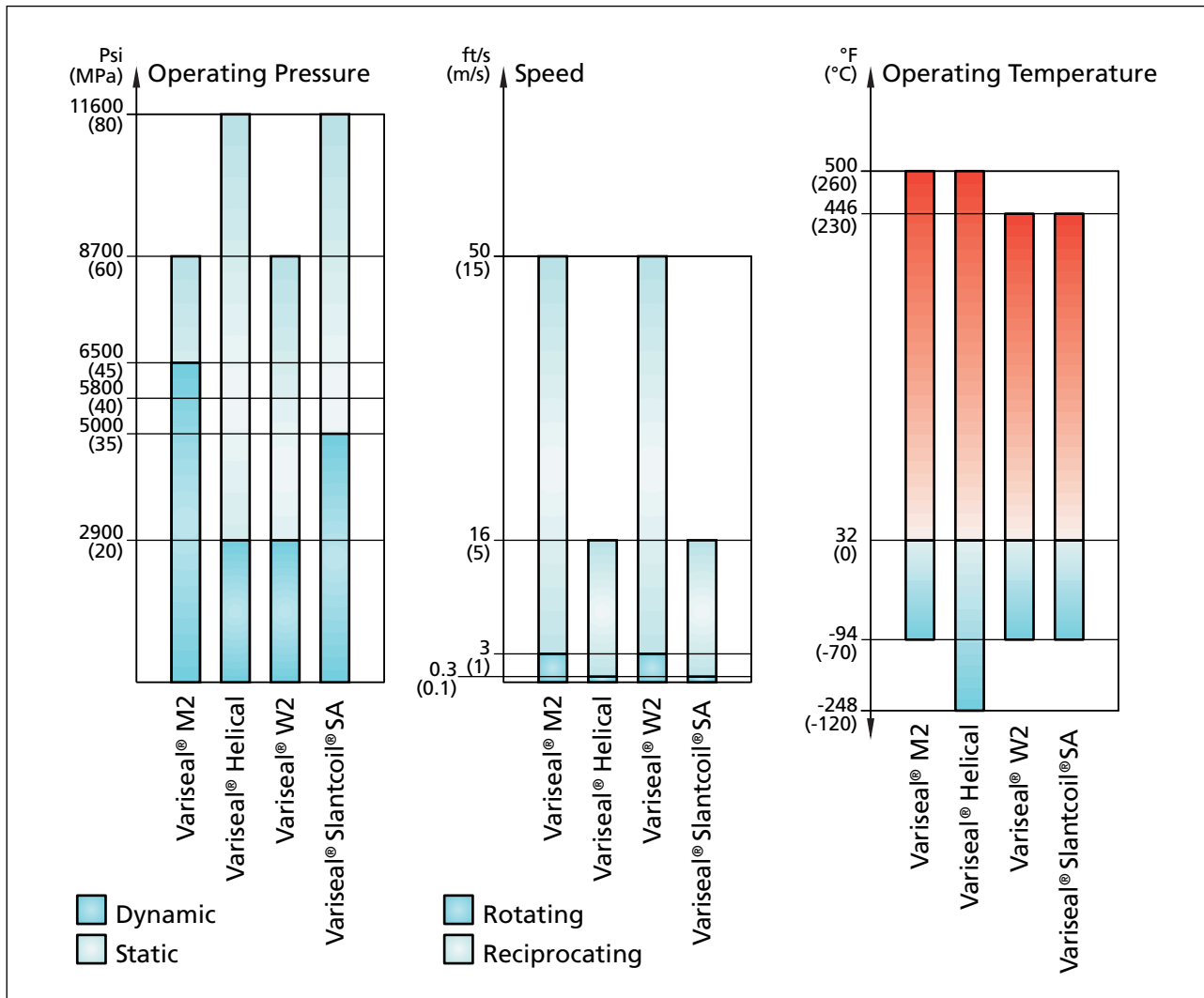


Figure 4 Main performance characteristics

Seals/Back-up Rings for AS4716

Turcon® Variseal®

Series

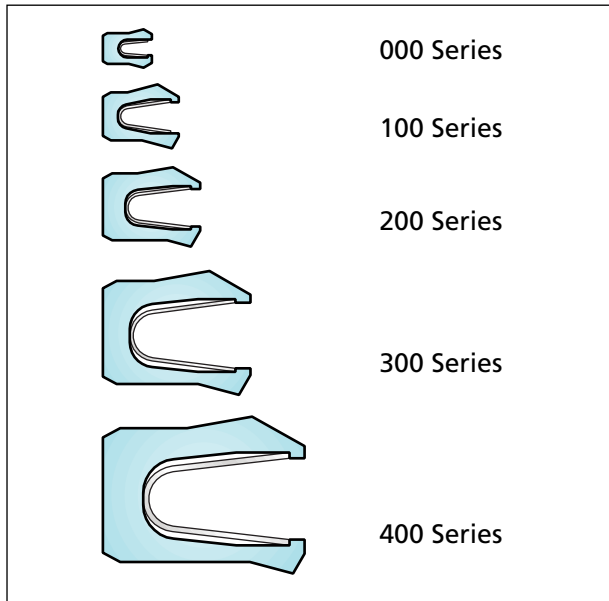


Figure 5 Relative Size of Turcon® Variseal® M2 Cross Section

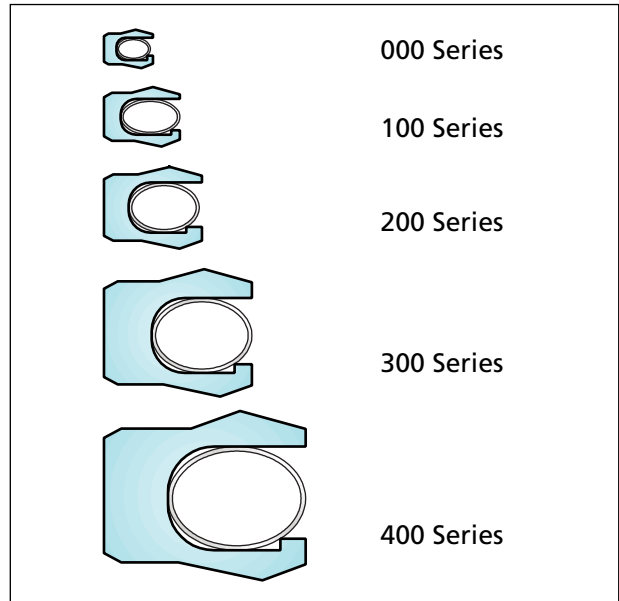


Figure 7 Relative Size of Turcon® Variseal® W2 Cross Section

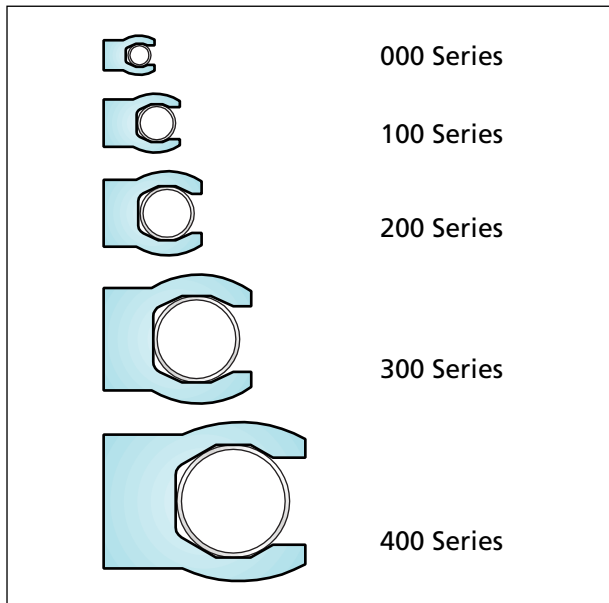


Figure 6 Relative Size of Turcon® Variseal® Helical Cross Section

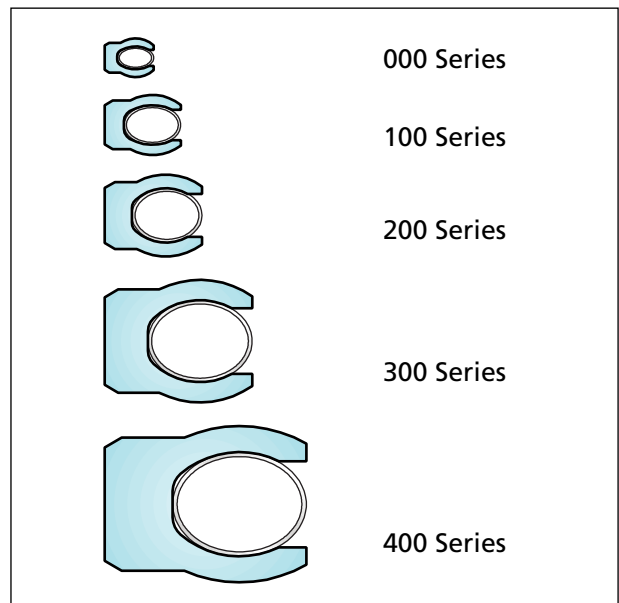


Figure 8 Relative Size of Turcon® Variseal® SA Cross Section

Installation in Closed Grooves

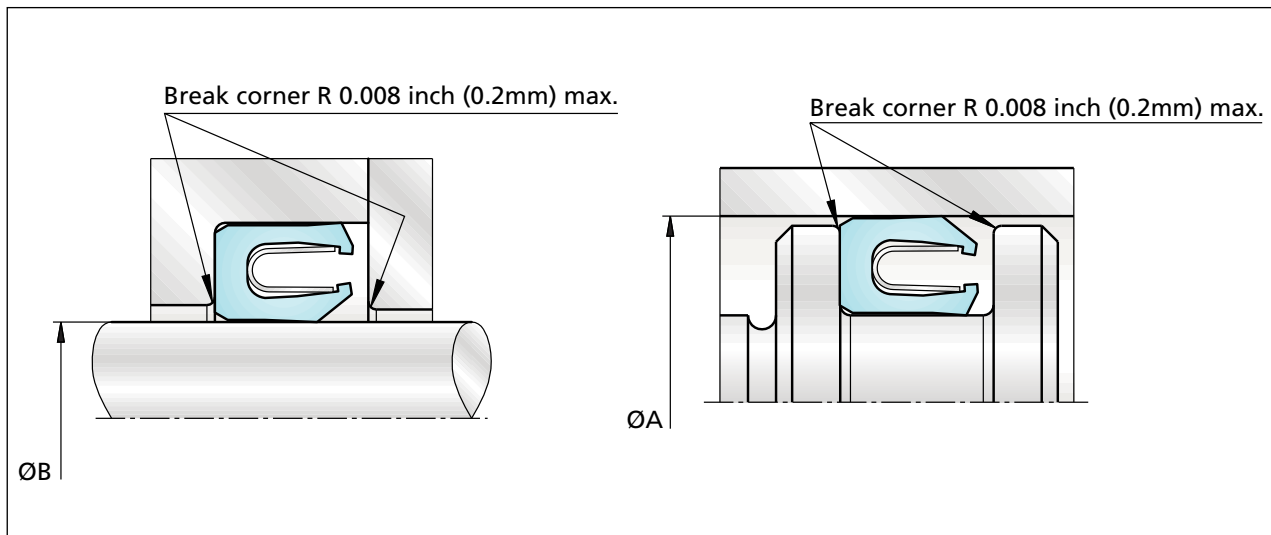


Figure 9 Installation in Closed Grooves

Installation in split or lipped grooves is recommended. Installation in closed grooves is possible for rod and bore diameters according to the following tables.

Rod Seals

Installation of Variseal® M2 Types into Closed Grooves, Rod Seals, Inch sizes

Rod Seals - Table of Minimum Rod dia. B				
Type	M2	Helical	Slantcoil®	SA
Series	RVA	RVE	RVJ	RVP
000	1.250	1.000	1.000	0.750
100	2.750	2.500	2.500	0.873
200	4.375	4.250	4.250	1.000
300	11.750	9.000	9.000	1.250
400	19.500	15.750	15.750	3.000
500	27.560	27.560	27.560	5.000

Seals can be fitted into Closed Groove Rod diameter B Gland designs at these sizes and above.

Piston Seals

Installation of Variseal® M2 Types into Closed Grooves, Piston Seals, Inch sizes

Piston Seals - Table of Minimum Bore dia. A				
Type	M2	Helical	Slantcoil®	SA
Series	PVA	PVE	PVJ	PVP
000	1.375	0.750	0.750	0.750
100	2.000	1.380	1.380	1.380
200	2.750	1.750	1.750	1.750
300	4.125	2.375	2.375	2.375
400	5.500	3.750	3.750	3.750
500	11.800	11.800	11.800	11.800

Seals can be fitted into Closed Groove Bore diameter A Gland designs at these sizes and above.

Installation in Stepped Grooves

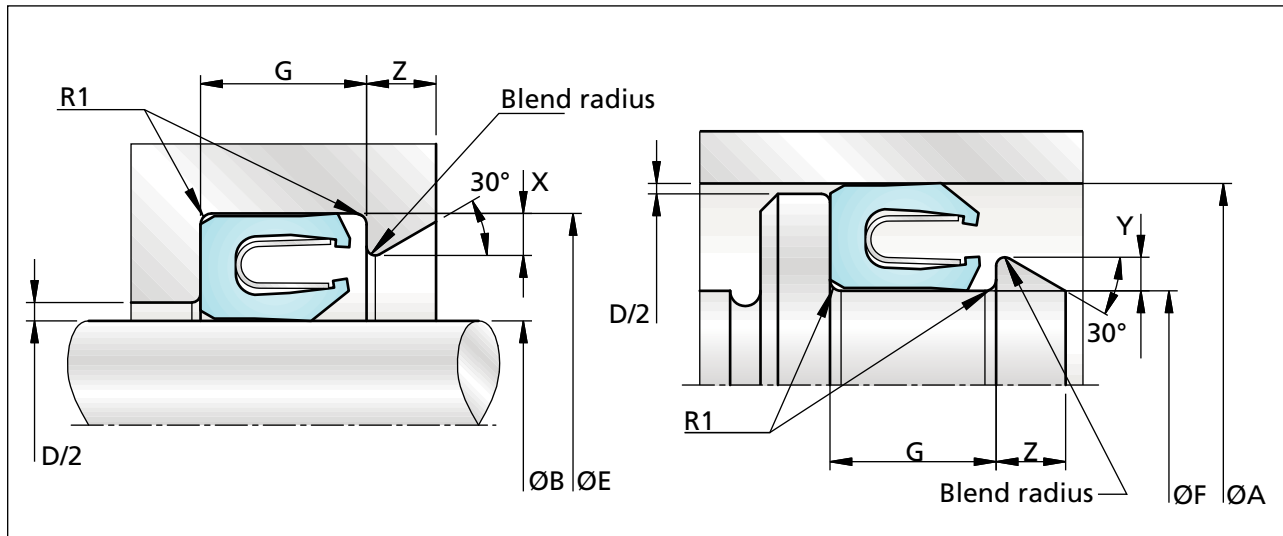


Figure 10 Stepped Grooves, Rod

Rod Seals

Groove Dimensions, Inch Sizes, Rod Seals

Series	M2	W2	H	SA	Lip Height X ¹⁾	Chamfer Length Z min.	Radius Max r1	Rod Dia. B (min.)
000	RVA0	RVJ0	RVE0	RVP0	.015	.098	.010	0.250
100	RVA1	RVJ1	RVE1	RVP1	.024	.138	.015	0.375
200	RVA2	RVJ2	RVE2	RVP2	.028	.138	.015	0.750
300	RVA3	RVJ3	RVE3	RVP3	.031	.177	.015	1.000
400	RVA4	RVJ4	RVE4	RVP4	.035	.295	.020	2.000
500	RVA5	RVJ5	RVE5	RVP5	.060	.295	.030	2.250

¹⁾ X max = 0.02 x ØB

Note: The recommended dimensions for "Y", "X" and "Z" cannot always be achieved.

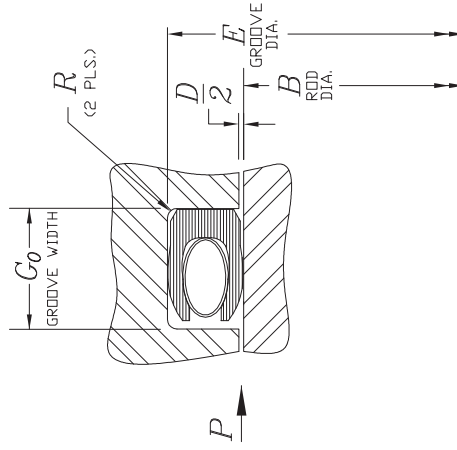
Piston Seals

Groove Dimensions, Inch Sizes, Piston Seals

Series	M2	W2	H	SA	Lip Height Y ¹⁾	Chamfer Length Z min.	Radius Max r1	Bore Dia. A (min.)
000	PVA0	PVJ0	PVE0	PVP0	.015	.098	.010	0.375
100	PVA1	PVJ1	PVE1	PVP1	.024	.138	.015	0.562
200	PVA2	PVJ2	PVE2	PVP2	.028	.138	.015	1.000
300	PVA3	PVJ3	PVE3	PVP3	.031	.177	.015	1.375
400	PVA4	PVJ4	PVE4	PVP4	.035	.295	.020	2.500
500	PVA5	PVJ5	PVE5	PVP5	.060	.295	.030	3.000

¹⁾ Y max = 0.035 x ØF

Turcon® Variseal®



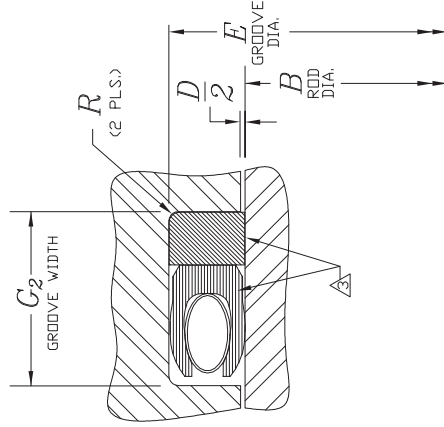
ROD SEAL INSTALLATION
FOR ZERO BACKUP WIDTH GLAND PER AS4716 REVISION A

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INCH	2009_1
TITLE	VARISEAL® SA, ROD
DRAWING NO.	RVP20G000
TRELLEBORG SEALING SOLUTIONS	

DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₀ ZERO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	1.23	2.35	1610	1.748	2.887	425	4.497	4.974	0.094/104	0.005/015	0.004
1007	1.54	2.66	1611	1.851	3.051	426	4.524	5.022			
1008	1.85	2.94	1612	1.953	3.215	427	4.551	5.249			
1009	2.17	3.27	1613	2.056	3.380	428	4.578	5.476			
1010	2.48	3.59	1614	2.158	3.544	429	4.605	5.703			
1011	2.79	3.91	1615	2.260	3.708	430	4.632	5.930			
1012	3.11	4.23	1616	2.362	3.872	431	4.659	6.157			
1013	3.42	4.55	1617	2.464	4.036	432	4.686	6.384			
1014	3.74	4.87	1618	2.566	4.200	433	4.713	6.611			
1015	4.05	5.19	1619	2.668	4.364	434	4.740	6.838			
1016	4.37	5.51	1620	2.770	4.528	435	4.767	7.065			
1017	4.68	5.83	1621	2.872	4.692	436	4.794	7.292			
1018	5.00	6.15	1622	2.974	4.856	437	4.821	7.519			
1019	5.31	6.47	1623	3.076	5.020	438	4.848	7.746			
1020	5.63	6.79	1624	3.178	5.184	439	4.875	7.973			
1021	5.94	7.11	1625	3.280	5.348	440	4.902	8.200			
1022	6.26	7.43	1626	3.382	5.512	441	4.929	8.427			
1023	6.57	7.75	1627	3.484	5.676	442	4.956	8.654			
1024	6.89	8.07	1628	3.586	5.840	443	4.983	8.881			
1025	7.20	8.39	1629	3.688	6.004	444	5.010	9.108			
1026	7.52	8.71	1630	3.790	6.168	445	5.037	9.335			
1027	7.83	9.03	1631	3.892	6.332	446	5.064	9.562			
1028	8.15	9.35	1632	3.994	6.496	447	5.091	9.789			
1029	8.46	9.67	1633	4.096	6.660	448	5.118	10.016			
1030	8.78	9.99	1634	4.198	6.824	449	5.145	10.243			
1031	9.09	10.31	1635	4.300	6.988	450	5.172	10.470			
1032	9.41	10.63	1636	4.402	7.152	451	5.199	10.697			
1033	9.72	10.95	1637	4.504	7.316	452	5.226	10.924			
1034	10.04	11.27	1638	4.606	7.480	453	5.253	11.151			
1035	10.35	11.59	1639	4.708	7.644	454	5.280	11.378			
1036	10.67	11.91	1640	4.810	7.808	455	5.307	11.605			
1037	10.98	12.23	1641	4.912	7.972	456	5.334	11.832			
1038	11.30	12.55	1642	5.014	8.136	457	5.361	12.059			
1039	11.61	12.87	1643	5.116	8.300	458	5.388	12.286			
1040	11.93	13.19	1644	5.218	8.464	459	5.415	12.513			
1041	12.24	13.51	1645	5.320	8.628	460	5.442	12.740			
1042	12.56	13.83	1646	5.422	8.792		5.469	12.967			
1043	12.87	14.15	1647	5.524	8.956		5.496	13.194			
1044	13.19	14.47	1648	5.626	9.120		5.523	13.421			
1045	13.50	14.79	1649	5.728	9.284		5.550	13.648			
1046	13.82	15.11	1650	5.830	9.448		5.577	13.875			
1047	14.13	15.43	1651	5.932	9.612		5.604	14.102			
1048	14.45	15.75	1652	6.034	9.776		5.631	14.329			
1049	14.76	16.07	1653	6.136	9.940		5.658	14.556			
1050	15.08	16.39	1654	6.238	10.104		5.685	14.783			
1051	15.39	16.71	1655	6.340	10.268		5.712	15.010			
1052	15.71	17.03	1656	6.442	10.432		5.739	15.237			
1053	16.02	17.35	1657	6.544	10.596		5.766	15.464			
1054	16.34	17.67	1658	6.646	10.760		5.793	15.691			
1055	16.65	17.99	1659	6.748	10.924		5.820	15.918			
1056	16.97	18.31	1660	6.850	11.088		5.847	16.145			
1057	17.28	18.63	1661	6.952	11.252		5.874	16.372			
1058	17.60	18.95	1662	7.054	11.416		5.901	16.599			
1059	17.91	19.27	1663	7.156	11.580		5.928	16.826			
1060	18.23	19.59	1664	7.258	11.744		5.955	17.053			
1061	18.54	19.91	1665	7.360	11.908		5.982	17.280			
1062	18.86	20.23	1666	7.462	12.072		6.009	17.507			
1063	19.17	20.55	1667	7.564	12.236		6.036	17.734			
1064	19.49	20.87	1668	7.666	12.400		6.063	17.961			
1065	19.80	21.19	1669	7.768	12.564		6.090	18.188			
1066	20.12	21.51	1670	7.870	12.728		6.117	18.415			
1067	20.43	21.83	1671	7.972	12.892		6.144	18.642			
1068	20.75	22.15	1672	8.074	13.056		6.171	18.869			
1069	21.06	22.47	1673	8.176	13.220		6.198	19.096			
1070	21.38	22.79	1674	8.278	13.384		6.225	19.323			
1071	21.69	23.11	1675	8.380	13.548		6.252	19.550			
1072	22.01	23.43	1676	8.482	13.712		6.279	19.777			
1073	22.32	23.75	1677	8.584	13.876		6.306	20.004			
1074	22.64	24.07	1678	8.686	14.040		6.333	20.231			
1075	22.95	24.39	1679	8.788	14.204		6.360	20.458			
1076	23.27	24.71	1680	8.890	14.368		6.387	20.685			
1077	23.58	25.03	1681	8.992	14.532		6.414	20.912			
1078	23.90	25.35	1682	9.094	14.696		6.441	21.139			
1079	24.21	25.67	1683	9.196	14.860		6.468	21.366			
1080	24.53	25.99	1684	9.298	15.024		6.495	21.593			
1081	24.84	26.31	1685	9.400	15.188		6.522	21.820			
1082	25.16	26.63	1686	9.502	15.352		6.549	22.047			
1083	25.47	26.95	1687	9.604	15.516		6.576	22.274			
1084	25.79	27.27	1688	9.706	15.680		6.603	22.501			
1085	26.10	27.59	1689	9.808	15.844		6.630	22.728			
1086	26.42	27.91	1690	9.910	16.008		6.657	22.955			
1087	26.73	28.23	1691	10.012	16.172		6.684	23.182			
1088	27.05	28.55	1692	10.114	16.336		6.711	23.409			
1089	27.36	28.87	1693	10.216	16.500		6.738	23.636			
1090	27.68	29.19	1694	10.318	16.664		6.765	23.863			
1091	27.99	29.51	1695	10.420	16.828		6.792	24.090			
1092	28.31	29.83	1696	10.522	16.992		6.819	24.317			
1093	28.62	30.15	1697	10.624	17.156		6.846	24.544			
1094	28.94	30.47	1698	10.726	17.320		6.873	24.771			
1095	29.25	30.79	1699	10.828	17.484		6.900	25.000			
1096	29.57	31.11	1700	10.930	17.648		6.927	25.227			
1097	29.88	31.43	1701	11.032	17.812		6.954	25.454			
1098	30.20	31.75	1702	11.134	17.976		6.981	25.681			
1099	30.51	32.07	1703	11.236	18.140		7.008	25.908			
1100	30.83	32.39	1704	11.338	18.304		7.035	26.135			
1101	31.14	32.71	1705	11.440	18.468		7.062	26.362			
1102	31.46	33.03	1706	11.542	18.632		7.089	26.589			
1103	31.77	33.35	1707	11.644	18.796		7.116	26.816			
1104	32.09	33.67	1708	11.746	18.960		7.143	27.043			
1105	32.40	33.99	1709	11.848	19.124		7.170	27.270			
1106	32.72	34.31	1710	11.950	19.288		7.197	27.497			
1107	33.03	34.63	1711	12.052	19.452		7.224	27.724			
1108	33.35	34.95	1712	12.154	19.616		7.251	27.951			
1109	33.66	35.27	1713	12.256	19.780		7.278	28.178			
1110	33.98	35.59	1714	12.358	19.944		7.305	28.405			
1111	34.29	35.91	1715	12.460	20.108		7.332	28.632			
1112	34.61	36.23	1716	12.562	20.272		7.359	28.859			
1113	34.92	36.55	1717	12.664	20.436		7.386	29.086			
1114	35.24	36.87	1718	12.766	20.600		7.413	29.313			
1115	35.55	37.19	1719	12.868	20.764		7.440	29.540			
1116	35.87	37.51	1720	12.970	20.928		7.467	29.767			
1117	36.18	37.83	1721	13.072	21.092		7.494	29.994			
1118	36.50	38.15	1722	13.174	21.256		7.521	30.221			
1119	36.81	38.47	1723	13.276	21.420		7.548	30.448			
1120	37.13	38.79	1724	13.378	21.584		7.575	30.675			
1121	37.44	39.11	172								

Turcon® Variseal®



ROD SEAL INSTALLATION
FOR TWO BACKUP WIDTH GLAND PER AS4716 REVISION A

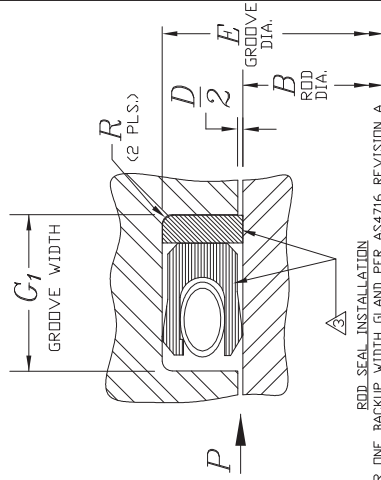
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INCH	2009_1
TITLE	VARISEAL® SA, ROD
DRAWING NO.	RVP2EG00
TRELLEBORG SEALING SOLUTIONS	

DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	+0.00	+0.01	1610	+0.002	+0.008	425	006-012	.005/.015	.004
1007	-0.01	-0.00	1611	.748	.989	426	.207/.217	.005/.015	.005
1008	.185	.266	1612	1.051	1.051	427		.005/.015	.005
1009	.185	.266	1613	1.177	1.177	428	110-126	.005/.015	.006
1010	.248	.329	1614	.998	1.240	429	127-132	.005/.015	.007
1011	.370	.461	1615	1.060	1.305	430	133-149	.010/.025	.008
1012	+0.00	+0.00	1616	1.123	1.427	431	210-222	.010/.025	.009
1013	.345	.345	1617	1.185	1.427	432	223-224	.010/.025	.010
1014	.560	.570	1618	1.248	1.490	433	225-245		
1015	.623	.733	1619	1.310	1.552	434	246-247		
1016	.685	.795	1620	1.373	1.615	435	325-327		
1017	.748	.858	1621	1.435	1.677	436	328-349		
1018	.810	.920	1622	1.498	1.740	437	425-438		
1019	.873	.983	1623	1.562	1.805	438	439-460		
1020	.935	1.045	1624	1.625	1.870	439			
1021	.998	1.108	1625	1.688	1.935	440			
1022	1.060	1.170	1626	1.752	2.000	441			
1023	1.123	1.233	1627	1.815	2.065	442			
1024	1.185	1.295	1628	1.878	2.130	443			
1025	1.248	1.358	1629	1.942	2.195	444			
1026	1.310	1.420	1630	2.005	2.260	445			
1027	1.373	1.483	1631	2.068	2.325	446			
1028	1.435	1.545	1632	2.132	2.390	447			
1029	1.498	1.608	1633	2.195	2.455	448			
1030	1.560	1.673	1634	2.258	2.520	449			
1031	1.623	1.733	1635	2.322	2.585	450			
1032	1.685	1.798	1636	2.385	2.650	451			
1033	1.748	1.863	1637	2.448	2.715	452			
1034	1.810	1.928	1638	2.512	2.780	453			
1035	1.873	1.993	1639	2.575	2.845	454			
1036	1.935	2.058	1640	2.638	2.910	455			
1037	2.000	2.123	1641	2.702	2.975	456			
1038	2.062	2.188	1642	2.765	3.040	457			
1039	2.125	2.253	1643	2.828	3.105	458			
1040	2.188	2.318	1644	2.892	3.170	459			
1041	2.250	2.383	1645	2.955	3.235	460			
1042	2.313	2.448	1646	3.018	3.300				
1043	2.375	2.513	1647	3.082	3.365				
1044	2.438	2.578	1648	3.145	3.430				
1045	2.500	2.643	1649	3.208	3.495				
1046	2.563	2.708	1650	3.272	3.560				
1047	2.625	2.773	1651	3.335	3.625				
1048	2.688	2.838	1652	3.398	3.690				
1049	2.750	2.903	1653	3.462	3.755				
1050	2.813	2.968	1654	3.525	3.820				
1051	2.875	3.033	1655	3.588	3.885				
1052	2.938	3.098	1656	3.652	3.950				
1053	3.000	3.163	1657	3.715	4.015				
1054	3.063	3.228	1658	3.778	4.080				
1055	3.125	3.293	1659	3.842	4.145				
1056	3.188	3.358	1660	3.905	4.210				
1057	3.250	3.423	1661	3.968	4.275				
1058	3.313	3.488	1662	4.032	4.340				
1059	3.375	3.553	1663	4.095	4.405				
1060	3.438	3.618	1664	4.158	4.470				
1061	3.500	3.683	1665	4.222	4.535				
1062	3.563	3.748	1666	4.285	4.600				
1063	3.625	3.813	1667	4.348	4.665				
1064	3.688	3.878	1668	4.412	4.730				
1065	3.750	3.943	1669	4.475	4.795				
1066	3.813	4.008	1670	4.538	4.860				
1067	3.875	4.073	1671	4.602	4.925				
1068	3.938	4.138	1672	4.665	4.990				
1069	4.000	4.203	1673	4.728	5.055				
1070	4.063	4.268	1674	4.792	5.120				
1071	4.125	4.333	1675	4.855	5.185				
1072	4.188	4.398	1676	4.918	5.250				
1073	4.250	4.463	1677	4.982	5.315				
1074	4.313	4.528	1678	5.045	5.380				
1075	4.375	4.593	1679	5.108	5.445				
1076	4.438	4.658	1680	5.172	5.510				
1077	4.500	4.723	1681	5.235	5.575				
1078	4.563	4.788	1682	5.298	5.640				
1079	4.625	4.853	1683	5.362	5.705				
1080	4.688	4.918	1684	5.425	5.770				
1081	4.750	4.983	1685	5.488	5.835				
1082	4.813	5.048	1686	5.552	5.900				
1083	4.875	5.113	1687	5.615	5.965				
1084	4.938	5.178	1688	5.678	6.030				
1085	5.000	5.243	1689	5.742	6.095				
1086	5.063	5.308	1690	5.805	6.160				
1087	5.125	5.373	1691	5.868	6.225				
1088	5.188	5.438	1692	5.932	6.290				
1089	5.250	5.503	1693	5.995	6.355				
1090	5.313	5.568	1694	6.058	6.420				
1091	5.375	5.633	1695	6.122	6.485				
1092	5.438	5.698	1696	6.185	6.550				
1093	5.500	5.763	1697	6.248	6.615				
1094	5.563	5.828	1698	6.312	6.680				
1095	5.625	5.893	1699	6.375	6.745				
1096	5.688	5.958	1700	6.438	6.810				
1097	5.750	6.023	1701	6.502	6.875				
1098	5.813	6.088	1702	6.565	6.940				
1099	5.875	6.153	1703	6.628	7.005				
1100	5.938	6.218	1704	6.692	7.070				
1101	6.000	6.283	1705	6.755	7.135				
1102	6.063	6.348	1706	6.818	7.200				
1103	6.125	6.413	1707	6.882	7.265				
1104	6.188	6.478	1708	6.945	7.330				
1105	6.250	6.543	1709	7.008	7.395				
1106	6.313	6.608	1710	7.072	7.460				
1107	6.375	6.673	1711	7.135	7.525				
1108	6.438	6.738	1712	7.198	7.590				
1109	6.500	6.803	1713	7.262	7.655				
1110	6.563	6.868	1714	7.325	7.720				
1111	6.625	6.933	1715	7.388	7.785				
1112	6.688	6.998	1716	7.452	7.850				
1113	6.750	7.063	1717	7.515	7.915				
1114	6.813	7.128	1718	7.578	7.980				
1115	6.875	7.193	1719	7.642	8.045				
1116	6.938	7.258	1720	7.705	8.110				
1117	7.000	7.323	1721	7.768	8.175				
1118	7.063	7.388	1722	7.832	8.240				
1119	7.125	7.453	1723	7.895	8.305				
1120	7.188	7.518	1724	7.958	8.370				
1121	7.250	7.583	1725	8.022	8.435				
1122	7.313	7.648	1726	8.085	8.500				
1123	7.375	7.713	1727	8.148	8.565				
1124	7.438	7.778	1728	8.212	8.630				
1125	7.500	7.843	1729	8.275	8.695				
1126	7.563	7.908	1730	8.338	8.760				
1127	7.625	7.973	1731	8.402	8.825				
1128	7.688	8.038	1732	8.465	8.890				
1129	7.750	8.103	1733	8.528	8.955				
1130	7.813	8.168	1734	8.592	9.020				
1131	7.875	8.233	1735	8.655	9.085				
1132	7.938	8.298	1736	8.718	9.150				
1133	8.000	8.363	1737	8.782	9.215				
1134	8.063	8.428	1738	8.845	9.280				
1135	8.125	8.493	1739	8.908	9.345				
1136	8.188	8.558	1740	8.972	9.410				
1137	8.250	8.623	1741	9.035	9.475				
1138	8.313	8.688	1742	9.098	9.540				
1139	8.375	8.753	1743	9.162	9.605				
1140	8.438	8.818	1744	9.225	9.670				
1141	8.500	8.883	1745	9.288	9.735				
1142	8.563	8.948	1746	9.352	9.800				
1143	8.625	9.013	1747	9.415	9.865				
1144	8.688	9.078	1748	9.478	9.930				
1145	8.750	9.143	1749	9.542	9.995				
1146	8.813	9.208	1750	9.605	10.060				
1147	8.875	9.273							
1148	8.938	9.338							
1149	9.000	9.403							

NOTES:
1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VARISEAL® SA IN AS4716 REVISION A ROD GLANDS.
2. ORDERING EXAMPLE: VARISEAL SA, ROD DESIGNATOR CROSS SECTIONS 1 = 100 SERIES 2 = 200 SERIES 3 = 30

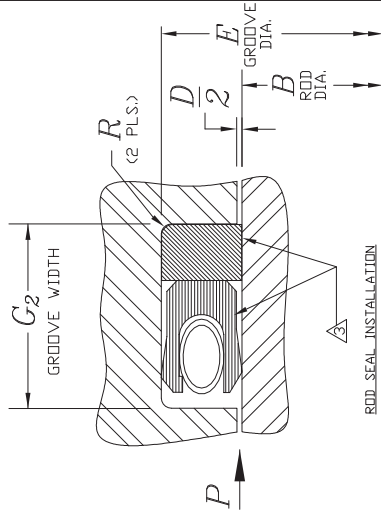
Turcon® Variseal®



FOR ONE BACKUP WIDTH GLAND PER AS4716 REVISION A

DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G1 ONE BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	+0.01	-0.00	1610	+0.008	-0.008	425	4.497	4.974	006-012	0.150/160	0.005/015	0.004		
1007	+0.01	-0.00	1611	0.748	0.989	426	4.571	5.024	013-028			0.005		
1008	+0.01	-0.00	1612	0.810	1.051	427	4.747	5.224	108-126			0.005		
1009	+0.01	-0.00	1613	0.854	1.113	428	4.872	5.349	127-132			0.005		
1010	+0.01	-0.00	1614	0.935	1.177	429	4.997	5.474	133-149			0.005		
1011	+0.01	-0.00	1615	1.006	1.240	430	5.122	5.599	210-222			0.005		
1012	+0.01	-0.00	1616	1.061	1.305	431	5.247	5.724	223-224			0.006		
1013	+0.01	-0.00	1617	1.115	1.369	432	5.372	5.849	225-245			0.007		
1014	+0.01	-0.00	1618	1.185	1.427	433	5.497	5.974	246-247			0.008		
1015	+0.01	-0.00	1619	1.248	1.490	434	5.622	6.099	325-327			0.006		
1016	+0.01	-0.00	1620	1.373	1.615	435	5.747	6.224	328-349			0.007		
1017	+0.01	-0.00	1621	1.435	1.677	436	5.872	6.349	425-438			0.009		
1018	+0.01	-0.00	1622	1.498	1.740	437	5.997	6.474	439-460			0.010		
1019	+0.01	-0.00	1623	1.528	1.795	438	6.122	6.599						
1020	+0.01	-0.00	1624	1.598	1.858	439	6.247	6.724						
1021	+0.01	-0.00	1625	1.661	1.921	440	6.372	6.849						
1022	+0.01	-0.00	1626	1.724	1.984	441	6.497	7.024						
1023	+0.01	-0.00	1627	1.787	2.047	442	6.622	7.149						
1024	+0.01	-0.00	1628	1.850	2.110	443	6.747	7.274						
1025	+0.01	-0.00	1629	1.913	2.173	444	6.872	7.399						
1026	+0.01	-0.00	1630	1.976	2.236	445	6.997	7.524						
1027	+0.01	-0.00	1631	2.039	2.299	446	7.122	7.649						
1028	+0.01	-0.00	1632	2.102	2.362	447	7.247	7.774						
1029	+0.01	-0.00	1633	2.165	2.425	448	7.372	7.899						
1030	+0.01	-0.00	1634	2.228	2.488	449	7.497	8.024						
1031	+0.01	-0.00	1635	2.291	2.551	450	7.622	8.149						
1032	+0.01	-0.00	1636	2.354	2.614	451	7.747	8.274						
1033	+0.01	-0.00	1637	2.417	2.677	452	7.872	8.399						
1034	+0.01	-0.00	1638	2.480	2.740	453	7.997	8.524						
1035	+0.01	-0.00	1639	2.543	2.803	454	8.122	8.649						
1036	+0.01	-0.00	1640	2.606	2.866	455	8.247	8.774						
1037	+0.01	-0.00	1641	2.669	2.929	456	8.372	8.899						
1038	+0.01	-0.00	1642	2.732	3.000	457	8.497	9.024						
1039	+0.01	-0.00	1643	2.795	3.063	458	8.622	9.149						
1040	+0.01	-0.00	1644	2.858	3.126	459	8.747	9.274						
1041	+0.01	-0.00	1645	2.921	3.189	460	8.872	9.399						
1042	+0.01	-0.00	1646	2.984	3.252		8.997	9.524						
1043	+0.01	-0.00	1647	3.047	3.315		9.122	9.649						
1044	+0.01	-0.00	1648	3.110	3.378		9.247	9.774						
1045	+0.01	-0.00	1649	3.173	3.441		9.372	9.899						
1046	+0.01	-0.00	1650	3.236	3.504		9.497	10.024						
1047	+0.01	-0.00	1651	3.299	3.567		9.622	10.149						
1048	+0.01	-0.00	1652	3.362	3.630		9.747	10.274						
1049	+0.01	-0.00	1653	3.425	3.693		9.872	10.399						
1050	+0.01	-0.00	1654	3.488	3.756		9.997	10.524						
1051	+0.01	-0.00	1655	3.551	3.819		10.122	10.649						
1052	+0.01	-0.00	1656	3.614	3.882		10.247	10.774						
1053	+0.01	-0.00	1657	3.677	3.945		10.372	10.899						
1054	+0.01	-0.00	1658	3.740	4.008		10.497	11.024						
1055	+0.01	-0.00	1659	3.803	4.071		10.622	11.149						
1056	+0.01	-0.00	1660	3.866	4.134		10.747	11.274						
1057	+0.01	-0.00	1661	3.929	4.197		10.872	11.399						
1058	+0.01	-0.00	1662	3.992	4.260		10.997	11.524						
1059	+0.01	-0.00	1663	4.055	4.323		11.122	11.649						
1060	+0.01	-0.00	1664	4.118	4.386		11.247	11.774						
1061	+0.01	-0.00	1665	4.181	4.449		11.372	11.899						
1062	+0.01	-0.00	1666	4.244	4.512		11.497	12.024						
1063	+0.01	-0.00	1667	4.307	4.575		11.622	12.149						
1064	+0.01	-0.00	1668	4.370	4.638		11.747	12.274						
1065	+0.01	-0.00	1669	4.433	4.701		11.872	12.399						
1066	+0.01	-0.00	1670	4.496	4.764		11.997	12.524						
1067	+0.01	-0.00	1671	4.559	4.827		12.122	12.649						
1068	+0.01	-0.00	1672	4.622	4.890		12.247	12.774						
1069	+0.01	-0.00	1673	4.685	4.953		12.372	12.899						
1070	+0.01	-0.00	1674	4.748	5.016		12.497	13.024						
1071	+0.01	-0.00	1675	4.811	5.079		12.622	13.149						
1072	+0.01	-0.00	1676	4.874	5.142		12.747	13.274						
1073	+0.01	-0.00	1677	4.937	5.205		12.872	13.399						
1074	+0.01	-0.00	1678	5.000	5.268		12.997	13.524						
1075	+0.01	-0.00	1679	5.063	5.331		13.122	13.649						
1076	+0.01	-0.00	1680	5.126	5.394		13.247	13.774						
1077	+0.01	-0.00	1681	5.189	5.457		13.372	13.899						
1078	+0.01	-0.00	1682	5.252	5.520		13.497	14.024						
1079	+0.01	-0.00	1683	5.315	5.583		13.622	14.149						
1080	+0.01	-0.00	1684	5.378	5.646		13.747	14.274						
1081	+0.01	-0.00	1685	5.441	5.709		13.872	14.399						
1082	+0.01	-0.00	1686	5.504	5.772		13.997	14.524						
1083	+0.01	-0.00	1687	5.567	5.835		14.122	14.649						
1084	+0.01	-0.00	1688	5.630	5.898		14.247	14.774						
1085	+0.01	-0.00	1689	5.693	5.961		14.372	14.899						
1086	+0.01	-0.00	1690	5.756	6.024		14.497	15.024						
1087	+0.01	-0.00	1691	5.819	6.087		14.622	15.149						
1088	+0.01	-0.00	1692	5.882	6.150		14.747	15.274						
1089	+0.01	-0.00	1693	5.945	6.213		14.872	15.399						
1090	+0.01	-0.00	1694	6.008	6.276		14.997	15.524						
1091	+0.01	-0.00	1695	6.071	6.339		15.122	15.649						
1092	+0.01	-0.00	1696	6.134	6.402		15.247	15.774						
1093	+0.01	-0.00	1697	6.197	6.465		15.372	15.899						
1094	+0.01	-0.00	1698	6.260	6.528		15.497	16.024						
1095	+0.01	-0.00	1699	6.323	6.591		15.622	16.149						
1096	+0.01	-0.00	1700	6.386	6.654		15.747	16.274						
1097	+0.01	-0.00	1701	6.449	6.717		15.872	16.399						
1098	+0.01	-0.00	1702	6.512	6.780		15.997	16.524						
1099	+0.01	-0.00	1703	6.575	6.843		16.122	16.649						
1100	+0.01	-0.00	1704	6.638	6.906		16.247	16.774						
1101	+0.01	-0.00	1705	6.701	6.969		16.372	16.899						
1102	+0.01	-0.00	1706	6.764	7.032		16.497	17.024						
1103	+0.01	-0.00	1707	6.827	7.095		16.622	17.149						
1104	+0.01	-0.00	1708	6.890	7.158		16.747	17.274						
1105	+0.01	-0.00	1709	6.953	7.221		16.872	17.399						
1106	+0.01	-0.00	1710	7.016	7.284		16.997	17.524						
1107	+0.01	-0.00	1711	7.079	7.347		17.122	17.649						
1108	+0.01	-0.00	1712	7.142	7.410		17.247	17.774						
1109	+0.01	-0.00	1713	7.205	7.473		17.372	17.899						
1110	+0.01	-0.00	1714	7.268	7.536		17.497	18.024						
1111	+0.01	-0.00	1715	7.331										

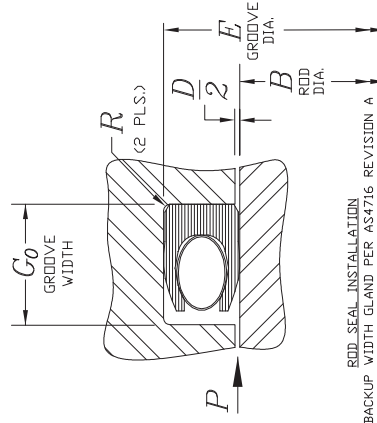
Turcon® Variseal®



FOR TWO BACKUP WIDTH GLAND PER AS4716 REVISION A

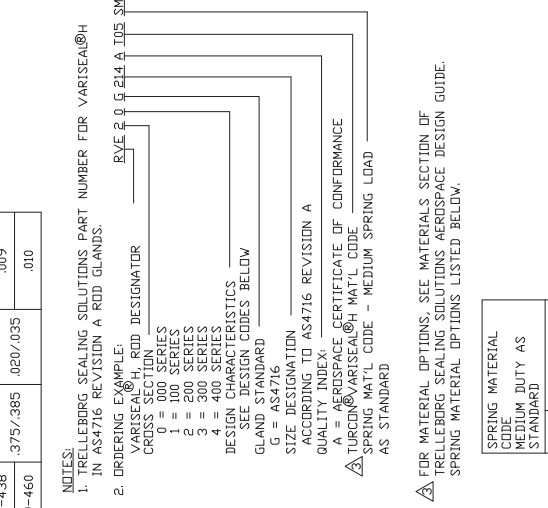
DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	+0.01	-0.00	1006	+0.00	-0.00	1006	+0.00	-0.00	.207/.217	.005/.015	.004
1007	.123	.235	1007	.748	.899	1007	.465	4.957			
1008	.154	.266	1008	.870	1.051	1008	.487	4.947			
1009	.185	.294	1009	.935	1.177	1009	.428	4.872			.005
1010	.217	.327	1010	.998	1.240	1010	.429	4.957			.005
1011	.248	.359	1011	1.060	1.302	1011	.430	5.122	.245/.255	.005/.015	.006
1012	.279	.391	1012	1.123	1.365	1012	.431	5.247			.007
1013	.311	.424	1013	1.185	1.427	1013	.432	5.372			.005
1014	.343	.456	1014	1.248	1.490	1014	.433	5.497			.005
1015	.375	.488	1015	1.310	1.552	1015	.434	5.622			.007
1016	.407	.520	1016	1.373	1.615	1016	.435	5.747			.005
1017	.439	.552	1017	1.435	1.677	1017	.436	5.872	.304/.314	.010/.025	.007
1018	.471	.584	1018	1.498	1.740	1018	.438	6.247			.007
1019	.503	.616	1019	1.561	1.802	1019	.439	6.497			.008
1020	.535	.648	1020	1.624	1.864	1020	.440	6.747			.006
1021	.567	.680	1021	1.687	1.926	1021	.441	6.997	.424/.434	.020/.035	.006
1022	.599	.712	1022	1.750	1.988	1022	.442	7.247			.007
1023	.631	.744	1023	1.813	2.050	1023	.443	7.497			.007
1024	.663	.776	1024	1.876	2.112	1024	.444	7.747			.009
1025	.695	.808	1025	1.939	2.174	1025	.445	7.997	.579/.589	.020/.035	.009
1026	.727	.840	1026	2.002	2.236	1026	.446	8.247			.010
1027	.759	.872	1027	2.065	2.298	1027	.447	8.497			
1028	.791	.904	1028	2.128	2.360	1028	.448	8.747			
1029	.823	.936	1029	2.191	2.422	1029	.449	8.997			
1030	.855	.968	1030	2.254	2.484	1030	.450	9.247			
1031	.887	1.000	1031	2.317	2.546	1031	.451	9.497			
1032	.919	1.032	1032	2.380	2.608	1032	.452	9.747			
1033	.951	1.064	1033	2.443	2.670	1033	.453	10.000			
1034	.983	1.096	1034	2.506	2.732	1034	.454	10.250			
1035	1.015	1.128	1035	2.569	2.794	1035	.455	10.500			
1036	1.047	1.160	1036	2.632	2.856	1036	.456	10.750			
1037	1.079	1.192	1037	2.695	2.918	1037	.457	11.000			
1038	1.111	1.224	1038	2.758	2.980	1038	.458	11.250			
1039	1.143	1.256	1039	2.821	3.042	1039	.459	11.500			
1040	1.175	1.288	1040	2.884	3.104	1040	.460	11.750			
1041	1.207	1.320	1041	2.947	3.166	1041	.461	12.000			
1042	1.239	1.352	1042	3.010	3.228	1042	.462	12.250			
1043	1.271	1.384	1043	3.073	3.290	1043	.463	12.500			
1044	1.303	1.416	1044	3.136	3.352	1044	.464	12.750			
1045	1.335	1.448	1045	3.199	3.414	1045	.465	13.000			
1046	1.367	1.480	1046	3.262	3.476	1046	.466	13.250			
1047	1.399	1.512	1047	3.325	3.538	1047	.467	13.500			
1048	1.431	1.544	1048	3.388	3.600	1048	.468	13.750			
1049	1.463	1.576	1049	3.451	3.662	1049	.469	14.000			
1050	1.495	1.608	1050	3.514	3.724	1050	.470	14.250			
1051	1.527	1.640	1051	3.577	3.786	1051	.471	14.500			
1052	1.559	1.672	1052	3.640	3.848	1052	.472	14.750			
1053	1.591	1.704	1053	3.703	3.910	1053	.473	15.000			
1054	1.623	1.736	1054	3.766	3.972	1054	.474	15.250			
1055	1.655	1.768	1055	3.829	4.034	1055	.475	15.500			
1056	1.687	1.800	1056	3.892	4.096	1056	.476	15.750			
1057	1.719	1.832	1057	3.955	4.158	1057	.477	16.000			
1058	1.751	1.864	1058	4.018	4.220	1058	.478	16.250			
1059	1.783	1.896	1059	4.081	4.282	1059	.479	16.500			
1060	1.815	1.928	1060	4.144	4.344	1060	.480	16.750			
1061	1.847	1.960	1061	4.207	4.406	1061	.481	17.000			
1062	1.879	1.992	1062	4.270	4.468	1062	.482	17.250			
1063	1.911	2.024	1063	4.333	4.530	1063	.483	17.500			
1064	1.943	2.056	1064	4.396	4.592	1064	.484	17.750			
1065	1.975	2.088	1065	4.459	4.654	1065	.485	18.000			
1066	2.007	2.120	1066	4.522	4.716	1066	.486	18.250			
1067	2.039	2.152	1067	4.585	4.778	1067	.487	18.500			
1068	2.071	2.184	1068	4.648	4.840	1068	.488	18.750			
1069	2.103	2.216	1069	4.711	4.902	1069	.489	19.000			
1070	2.135	2.248	1070	4.774	4.964	1070	.490	19.250			
1071	2.167	2.280	1071	4.837	5.026	1071	.491	19.500			
1072	2.199	2.312	1072	4.900	5.088	1072	.492	19.750			
1073	2.231	2.344	1073	4.963	5.150	1073	.493	20.000			
1074	2.263	2.376	1074	5.026	5.212	1074	.494	20.250			
1075	2.295	2.408	1075	5.089	5.274	1075	.495	20.500			
1076	2.327	2.440	1076	5.152	5.336	1076	.496	20.750			
1077	2.359	2.472	1077	5.215	5.398	1077	.497	21.000			
1078	2.391	2.504	1078	5.278	5.460	1078	.498	21.250			
1079	2.423	2.536	1079	5.341	5.522	1079	.499	21.500			
1080	2.455	2.568	1080	5.404	5.584	1080	.500	21.750			
1081	2.487	2.600	1081	5.467	5.646	1081	.501	22.000			
1082	2.519	2.632	1082	5.530	5.708	1082	.502	22.250			
1083	2.551	2.664	1083	5.593	5.770	1083	.503	22.500			
1084	2.583	2.696	1084	5.656	5.832	1084	.504	22.750			
1085	2.615	2.728	1085	5.719	5.894	1085	.505	23.000			
1086	2.647	2.760	1086	5.782	5.956	1086	.506	23.250			
1087	2.679	2.792	1087	5.845	6.018	1087	.507	23.500			
1088	2.711	2.824	1088	5.908	6.080	1088	.508	23.750			
1089	2.743	2.856	1089	5.971	6.142	1089	.509	24.000			
1090	2.775	2.888	1090	6.034	6.204	1090	.510	24.250			
1091	2.807	2.920	1091	6.097	6.266	1091	.511	24.500			
1092	2.839	2.952	1092	6.160	6.328	1092	.512	24.750			
1093	2.871	2.984	1093	6.223	6.390	1093	.513	25.000			
1094	2.903	3.016	1094	6.286	6.452	1094	.514	25.250			
1095	2.935	3.048	1095	6.349	6.514	1095	.515	25.500			
1096	2.967	3.080	1096	6.412	6.576	1096	.516	25.750			
1097	2.999	3.112	1097	6.475	6.638	1097	.517	26.000			
1098	3.031	3.144	1098	6.538	6.700	1098	.518	26.250			
1099	3.063	3.176	1099	6.601	6.762	1099	.519	26.500			
1100	3.095	3.208	1100	6.664	6.824	1100	.520	26.750			
1101	3.127	3.240	1101	6.727	6.886	1101	.521	27.000			
1102	3.159	3.272	1102	6.790	6.948	1102	.522	27.250			
1103	3.191	3.304	1103	6.853	7.010	1103	.523	27.500			
1104	3.223	3.336	1104	6.916	7.072	1104	.524	27.750			
1105	3.255	3.368	1105	6.979	7.134	1105	.525	28.000			
1106	3.287	3.400	1106	7.042	7.196	1106	.526	28.250			
1107	3.319	3.432	1107	7.105	7.258	1107	.527	28.500			
1108	3.351	3.464	1108	7.168	7.320	1108	.528	28.750			
1109	3.383	3.496	1109	7.231	7.382	1109	.529	29.000			
1110	3.415	3.528	1110	7.294	7.444	1110	.530	29.250			
1111	3.447	3.560	1111	7.357	7.506	1111	.531	29.500			
1112	3.479	3.592	1112	7.420	7.568	1112	.532	29.750			
1113	3.511	3.624	1113	7.483	7.630	1113	.533	30.000			
1114	3.543	3.656	1114	7.546	7.692	1114	.534	30.250			
1115	3.575	3.688	1115	7.609	7.754	1115	.535	30.500			
1116	3.607	3.720	1116	7.672	7.816	1116	.536	30.750			
1117	3.639	3.752	1117	7.735	7.878	1117	.537	31.000			
1118	3.671	3.784	1118	7.798	7.940	1118	.538	31.250			
1119	3.703	3.816	1119	7.861	7.999	1119	.539	31.500			
1120	3.735	3.848	1120	7.924	8.061	1120	.540	31.750			
1121	3.767	3.880	1121	7.987	8.123	1121	.541	32.000			
1122	3.799	3.912</									

Turcon® Variseal®



DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₀ ZERO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	+0.01	+0.00	1610	+0.008	+0.008	165	+0.008	+0.008	465	4.497	4.974	.094/.104	.005/.015	.004
1007	-0.001	-0.001	1611	0.748	.899	166	1.051	1.254	167	1.405	1.608			.005
1008			1612	1.051	1.254	168	1.405	1.608	169	1.748	1.951			.005
1009			1613	1.405	1.608	169	1.748	1.951	170	2.143	2.346			.005
1010			1614	1.748	1.951	170	2.143	2.346	171	2.538	2.741			.005
1011			1615	2.143	2.346	171	2.538	2.741	172	2.933	3.136			.005
1012			1616	2.538	2.741	172	2.933	3.136	173	3.328	3.531			.007
1013			1617	2.933	3.136	173	3.328	3.531	174	3.723	3.926			.007
1014			1618	3.328	3.531	174	3.723	3.926	175	4.118	4.321			.008
1015			1619	3.723	3.926	175	4.118	4.321	176	4.513	4.716			.008
1016			1620	4.118	4.321	176	4.513	4.716	177	4.908	5.111			.006
1017			1621	4.513	4.716	177	4.908	5.111	178	5.303	5.506			.006
1018			1622	4.908	5.111	178	5.303	5.506	179	5.698	5.901			.007
1019			1623	5.303	5.506	179	5.698	5.901	180	6.093	6.296			.007
1020			1624	5.698	5.901	180	6.093	6.296	181	6.488	6.691			.009
1021			1625	6.093	6.296	181	6.488	6.691	182	6.883	7.086			.009
1022			1626	6.488	6.691	182	6.883	7.086	183	7.278	7.481			.010
1023			1627	6.883	7.086	183	7.278	7.481	184	7.673	7.876			.010
1024			1628	7.278	7.481	184	7.673	7.876	185	8.068	8.271			.010
1025			1629	7.673	7.876	185	8.068	8.271	186	8.463	8.666			.010
1026			1630	8.068	8.271	186	8.463	8.666	187	8.858	9.061			.010
1027			1631	8.463	8.666	187	8.858	9.061	188	9.253	9.456			.010
1028			1632	8.858	9.061	188	9.253	9.456	189	9.648	9.851			.010
1029			1633	9.253	9.456	189	9.648	9.851	190	10.043	10.246			.010
1030			1634	9.648	9.851	190	10.043	10.246	191	10.438	10.641			.010
1031			1635	10.043	10.246	191	10.438	10.641	192	10.833	11.036			.010
1032			1636	10.438	10.641	192	10.833	11.036	193	11.228	11.431			.010
1033			1637	10.833	11.036	193	11.228	11.431	194	11.623	11.826			.010
1034			1638	11.228	11.431	194	11.623	11.826	195	12.018	12.221			.010
1035			1639	11.623	11.826	195	12.018	12.221	196	12.413	12.616			.010
1036			1640	12.018	12.221	196	12.413	12.616	197	12.808	13.011			.010
1037			1641	12.413	12.616	197	12.808	13.011	198	13.203	13.406			.010
1038			1642	12.808	13.011	198	13.203	13.406	199	13.598	13.801			.010
1039			1643	13.203	13.406	199	13.598	13.801	200	13.993	14.196			.010
1040			1644	13.598	13.801	200	13.993	14.196	201	14.388	14.591			.010
1041			1645	13.993	14.196	201	14.388	14.591	202	14.783	14.986			.010
1042			1646	14.388	14.591	202	14.783	14.986	203	15.178	15.381			.010
1043			1647	14.783	14.986	203	15.178	15.381	204	15.573	15.776			.010
1044			1648	15.178	15.381	204	15.573	15.776	205	15.968	16.171			.010
1045			1649	15.573	15.776	205	15.968	16.171	206	16.363	16.566			.010
1046			1650	15.968	16.171	206	16.363	16.566	207	16.758	16.961			.010
1047			1651	16.363	16.566	207	16.758	16.961	208	17.153	17.356			.010
1048			1652	16.758	16.961	208	17.153	17.356	209	17.548	17.751			.010
1049			1653	17.153	17.356	209	17.548	17.751	210	17.943	18.146			.010
1050			1654	17.548	17.751	210	17.943	18.146	211	18.338	18.541			.010

NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VARISEAL[®]H
 IN AS4716 REVISION A ROD GLANDS.
 2. ORDERING EXAMPLE:
 VARISEAL[®]H ROD DESIGNATOR
 CROSS SECTION
 0 = 100 SERIES
 1 = 200 SERIES
 2 = 300 SERIES
 3 = 400 SERIES
 4 = 500 SERIES
 DESIGN CHARACTERISTICS
 SEE DESIGN CODES BELOW
 GLAND STANDARD
 G = AS4716
 SIZE DESIGNATION
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX
 A = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 B = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 C = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 D = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 E = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 F = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 G = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 H = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 I = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 J = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 K = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 L = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 M = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 N = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 O = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 P = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 Q = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 R = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 S = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 T = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 U = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 V = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 W = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 X = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 Y = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE
 Z = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE



FOR ZERO BACKUP WIDTH INSTALLATION PER AS4716 REVISION A
 ROD SEAL INSTALLATION
 ROD DIA.
 GROOVE DIA.
 GROOVE WIDTH
 P

SPRING MATERIAL CODE	MEDIUM DUTY AS STANDARD CODE	MATERIAL CODE
S	301	STAINLESS
H		HASTELLOY
E		ELGLOY

FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE. SPRING MATERIAL OPTIONS LISTED BELOW.

4. DASH SIZES -006 TO -028, -108 TO -128, AND -210 TO -221 REQUIRE SPLIT DR STEPPED GLAND CONFIGURATION. PLEASE CONSULT YOUR TRELLEBORG SEALING SOLUTIONS SALES ENGINEER FOR DETAILED INFORMATION.

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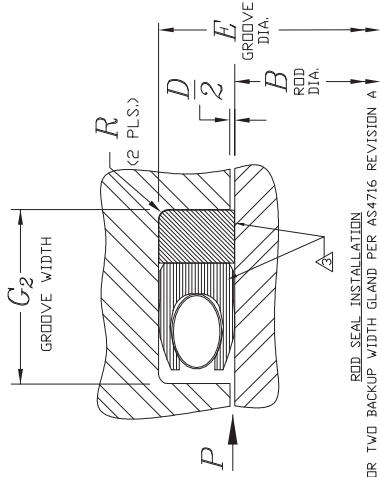
TRELLEBORG SEALING SOLUTIONS

TITLE VARISEAL[®]H, ROD

REV: 200900

WORLD AEROSPACE TITLE BLOCK REV.

DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRICAL CLEARANCE MAX.
1006	+0.01	-0.00	1006	+0.008	-0.008	1006	+0.008	-0.008	1006	+0.008	-0.008	.207	.005	.004
1007	+0.01	-0.00	1007	+0.008	-0.008	1007	+0.008	-0.008	1007	+0.008	-0.008	.207	.005	.004
1008	+0.01	-0.00	1008	+0.008	-0.008	1008	+0.008	-0.008	1008	+0.008	-0.008	.207	.005	.004
1009	+0.01	-0.00	1009	+0.008	-0.008	1009	+0.008	-0.008	1009	+0.008	-0.008	.207	.005	.004
1010	+0.01	-0.00	1010	+0.008	-0.008	1010	+0.008	-0.008	1010	+0.008	-0.008	.207	.005	.004
1011	+0.01	-0.00	1011	+0.008	-0.008	1011	+0.008	-0.008	1011	+0.008	-0.008	.207	.005	.004
1012	+0.01	-0.00	1012	+0.008	-0.008	1012	+0.008	-0.008	1012	+0.008	-0.008	.207	.005	.004
1013	+0.01	-0.00	1013	+0.008	-0.008	1013	+0.008	-0.008	1013	+0.008	-0.008	.207	.005	.004
1014	+0.01	-0.00	1014	+0.008	-0.008	1014	+0.008	-0.008	1014	+0.008	-0.008	.207	.005	.004
1015	+0.01	-0.00	1015	+0.008	-0.008	1015	+0.008	-0.008	1015	+0.008	-0.008	.207	.005	.004
1016	+0.01	-0.00	1016	+0.008	-0.008	1016	+0.008	-0.008	1016	+0.008	-0.008	.207	.005	.004
1017	+0.01	-0.00	1017	+0.008	-0.008	1017	+0.008	-0.008	1017	+0.008	-0.008	.207	.005	.004
1018	+0.01	-0.00	1018	+0.008	-0.008	1018	+0.008	-0.008	1018	+0.008	-0.008	.207	.005	.004
1019	+0.01	-0.00	1019	+0.008	-0.008	1019	+0.008	-0.008	1019	+0.008	-0.008	.207	.005	.004
1020	+0.01	-0.00	1020	+0.008	-0.008	1020	+0.008	-0.008	1020	+0.008	-0.008	.207	.005	.004
1021	+0.01	-0.00	1021	+0.008	-0.008	1021	+0.008	-0.008	1021	+0.008	-0.008	.207	.005	.004
1022	+0.01	-0.00	1022	+0.008	-0.008	1022	+0.008	-0.008	1022	+0.008	-0.008	.207	.005	.004
1023	+0.01	-0.00	1023	+0.008	-0.008	1023	+0.008	-0.008	1023	+0.008	-0.008	.207	.005	.004
1024	+0.01	-0.00	1024	+0.008	-0.008	1024	+0.008	-0.008	1024	+0.008	-0.008	.207	.005	.004
1025	+0.01	-0.00	1025	+0.008	-0.008	1025	+0.008	-0.008	1025	+0.008	-0.008	.207	.005	.004
1026	+0.01	-0.00	1026	+0.008	-0.008	1026	+0.008	-0.008	1026	+0.008	-0.008	.207	.005	.004
1027	+0.01	-0.00	1027	+0.008	-0.008	1027	+0.008	-0.008	1027	+0.008	-0.008	.207	.005	.004
1028	+0.01	-0.00	1028	+0.008	-0.008	1028	+0.008	-0.008	1028	+0.008	-0.008	.207	.005	.004
1029	+0.01	-0.00	1029	+0.008	-0.008	1029	+0.008	-0.008	1029	+0.008	-0.008	.207	.005	.004
1030	+0.01	-0.00	1030	+0.008	-0.008	1030	+0.008	-0.008	1030	+0.008	-0.008	.207	.005	.004
1031	+0.01	-0.00	1031	+0.008	-0.008	1031	+0.008	-0.008	1031	+0.008	-0.008	.207	.005	.004
1032	+0.01	-0.00	1032	+0.008	-0.008	1032	+0.008	-0.008	1032	+0.008	-0.008	.207	.005	.004
1033	+0.01	-0.00	1033	+0.008	-0.008	1033	+0.008	-0.008	1033	+0.008	-0.008	.207	.005	.004
1034	+0.01	-0.00	1034	+0.008	-0.008	1034	+0.008	-0.008	1034	+0.008	-0.008	.207	.005	.004
1035	+0.01	-0.00	1035	+0.008	-0.008	1035	+0.008	-0.008	1035	+0.008	-0.008	.207	.005	.004
1036	+0.01	-0.00	1036	+0.008	-0.008	1036	+0.008	-0.008	1036	+0.008	-0.008	.207	.005	.004
1037	+0.01	-0.00	1037	+0.008	-0.008	1037	+0.008	-0.008	1037	+0.008	-0.008	.207	.005	.004
1038	+0.01	-0.00	1038	+0.008	-0.008	1038	+0.008	-0.008	1038	+0.008	-0.008	.207	.005	.004
1039	+0.01	-0.00	1039	+0.008	-0.008	1039	+0.008	-0.008	1039	+0.008	-0.008	.207	.005	.004
1040	+0.01	-0.00	1040	+0.008	-0.008	1040	+0.008	-0.008	1040	+0.008	-0.008	.207	.005	.004
1041	+0.01	-0.00	1041	+0.008	-0.008	1041	+0.008	-0.008	1041	+0.008	-0.008	.207	.005	.004
1042	+0.01	-0.00	1042	+0.008	-0.008	1042	+0.008	-0.008	1042	+0.008	-0.008	.207	.005	.004
1043	+0.01	-0.00	1043	+0.008	-0.008	1043	+0.008	-0.008	1043	+0.008	-0.008	.207	.005	.004
1044	+0.01	-0.00	1044	+0.008	-0.008	1044	+0.008	-0.008	1044	+0.008	-0.008	.207	.005	.004
1045	+0.01	-0.00	1045	+0.008	-0.008	1045	+0.008	-0.008	1045	+0.008	-0.008	.207	.005	.004
1046	+0.01	-0.00	1046	+0.008	-0.008	1046	+0.008	-0.008	1046	+0.008	-0.008	.207	.005	.004
1047	+0.01	-0.00	1047	+0.008	-0.008	1047	+0.008	-0.008	1047	+0.008	-0.008	.207	.005	.004
1048	+0.01	-0.00	1048	+0.008	-0.008	1048	+0.008	-0.008	1048	+0.008	-0.008	.207	.005	.004
1049	+0.01	-0.00	1049	+0.008	-0.008	1049	+0.008	-0.008	1049	+0.008	-0.008	.207	.005	.004



- NOTES:
- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR VARISEAL H® IN AS4716 REVISION A ROD GLANDS.
 - ORDERING EXAMPLE:
 RVE 2 E G 214 A 105 3M
 VARISEAL® H, ROD DESIGNATOR
 CROSS SECTION
 0 = 100 SERIES
 1 = 200 SERIES
 2 = 300 SERIES
 3 = 400 SERIES
 4 = 500 SERIES
 Δ DESIGN CHARACTERISTICS
 SEE DESIGN CODES BELOW
 GLAND STANDARD
 G = AS4716
 SIZE DESIGNATION
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 Δ TRELLEBERG SEALING SOLUTIONS MATERIAL CODE
 SPRING MATERIAL CODE - MEDIUM SPRING LOAD
 AS STANDARD

FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE. SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL CODE	MATERIAL
S	301 STAINLESS STEEL
H	HASTELLOY
E	ELBLOY

- DASH SIZES -006 TO -028, -108 TO -128, AND -210 TO -221 REQUIRE SPLIT DR STEPPED GLAND CONFIGURATION, PLEASE CONSULT YOUR TRELLEBERG SEALING SOLUTIONS SALES ENGINEER FOR DETAILED INFORMATION.

DESIGN CODES FOR CUT BACKUP RING CONFIGURATION TWO BACKUP WIDTH GLANDS

DESIGN CODE	BACKUP CUT RING TYPE	MATERIAL
B	SCARP CUT	TURCON® T29
D	BACKUP CUT	VARISEAL® H
E	BACKUP CUT	TURCON® T24
F	BACKUP CUT	VARISEAL® H

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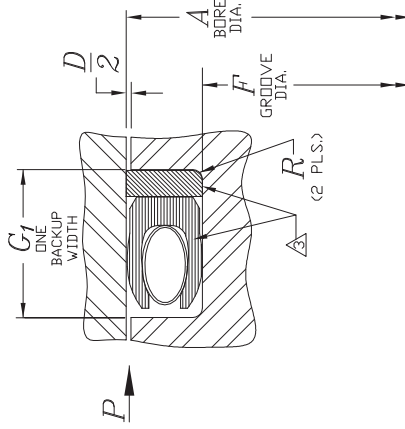
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TRELLEBERG
SEALING SOLUTIONS

VARISEAL® H, ROD

DRAWING NO. **RVE2EG00**



FOR ONE BACKUP WIDTH GLAND PER AS4716 REVISION A

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	G1 ONE BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
104	+0.01	-0.00	104	+0.02	-0.00	104	002-009	0.05/015	0.04
105	1.90	0.76	105	1.91	0.75	105	154Z/164	0.05/015	0.04
106	2.55	1.29	106	1.03	0.84	106	002-008	0.05/015	0.04
107	2.66	1.58	107	1.178	0.936	107	150/160	0.05/015	0.04
108	2.97	1.89	108	1.241	1.044	108	110-126	0.05/015	0.04
109	3.29	2.50	109	1.303	1.061	109	183/193	0.05/015	0.05
110	3.60	3.50	110	1.366	1.124	110	127-129	0.05/015	0.05
111	4.22	3.12	111	1.428	1.166	111	133-140	0.05/015	0.05
112	4.85	3.75	112	1.491	1.249	112	141-149	0.05/015	0.07
113	+0.02	-0.00	113	1.553	1.311	113	210-222	0.05/015	0.06
114	5.50	4.41	114	1.616	1.374	114	228-243	0.10/025	0.07
115	6.13	5.04	115	1.678	1.436	115	244-245	0.10/025	0.08
116	6.76	5.66	116	1.741	1.499	116	246-249	0.10/025	0.08
117	7.39	6.29	117	1.804	1.562	117	328-329	0.02/035	0.08
118	8.02	6.92	118	1.867	1.625	118	334/344	0.02/035	0.07
119	8.65	7.55	119	1.930	1.688	119	475/485	0.02/035	0.09
120	9.28	8.18	120	2.000	1.751	120	447-460	0.01	0.11
121	9.91	8.81	121	2.063	1.814	121			
122	10.54	9.44	122	2.126	1.877	122			
123	11.17	10.07	123	2.189	1.940	123			
124	11.80	10.70	124	2.252	1.999	124			
125	12.43	11.33	125	2.315	2.062	125			
126	13.06	11.96	126	2.378	2.125	126			
127	13.69	12.59	127	2.441	2.188	127			
128	14.32	13.22	128	2.504	2.251	128			
129	14.95	13.85	129	2.567	2.314	129			
130	15.58	14.48	130	2.630	2.377	130			
131	16.21	15.11	131	2.693	2.440	131			
132	16.84	15.74	132	2.756	2.503	132			
133	17.47	16.37	133	2.819	2.566	133			
134	18.10	17.00	134	2.882	2.629	134			
135	18.73	17.63	135	2.945	2.692	135			
136	19.36	18.26	136	3.008	2.755	136			
137	19.99	18.89	137	3.071	2.818	137			
138	20.62	19.52	138	3.134	2.881	138			
139	21.25	20.15	139	3.197	2.944	139			
140	21.88	20.78	140	3.260	2.999	140			
141	22.51	21.41	141	3.323	3.062	141			
142	23.14	22.04	142	3.386	3.125	142			
143	23.77	22.67	143	3.449	3.188	143			
144	24.40	23.30	144	3.512	3.251	144			
145	25.03	23.93	145	3.575	3.314	145			
146	25.66	24.56	146	3.638	3.377	146			
147	26.29	25.19	147	3.701	3.440	147			
148	26.92	25.82	148	3.764	3.503	148			
149	27.55	26.45	149	3.827	3.566	149			
150	28.18	27.08	150	3.890	3.629	150			

NOTES:
 1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR VARISEAL® SA IN AS4716 REVISION A PISTON GLANDS.
 2. ORDERING EXAMPLE:
 VARISEAL® SA PISTON DESIGNATOR PVP 2 R G 214 A IUS SM
 CROSS SECTION 100 SERIES
 1 = 100 SERIES
 2 = 200 SERIES
 3 = 300 SERIES
 4 = 400 SERIES
 DESIGN CHARACTERISTICS SEE DESIGN CODES BELOW
 GLAND STANDARD REVISION A
 SIZE DESIGNING TO AS4716 REVISION A
 QUALITY INDEX: A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON®/VARISEAL® SA MAT'L CODE
 SPRING MAT'L CODE - MEDIUM SPRING LOAD AS STANDARD

5. DASH SIZES -004 TO -018, -104 TO -116, AND -210 TO -213 REQUIRE SPLIT DR STEPPED GLAND CONFIGURATION, PLEASE CONSULT YOUR TRELLEBERG SEALING SOLUTIONS SALES ENGINEER FOR DETAILED INFORMATION.
 FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE.
 SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL CODE	STANDARD
S	301 STAINLESS STEEL
H	HASTELLOY
E	ELGILOY

DESIGN CODES FOR CUT BACKUP RING CONFIGURATION
 ONE BACKUP WIDTH GLANDS

DESIGN CODE	BACKUP RING TYPE	MATERIAL
A	SCARP CUT BACKUP RING	TURCON® 129
B	SCARP CUT BACKUP RING	ZURCON® N243
C	SCARP CUT BACKUP RING	AS SEAL RING
	BACKUP RING	TURCON® 129
	MATERIAL	ZURCON® N243
	MATERIAL	AS SEAL RING

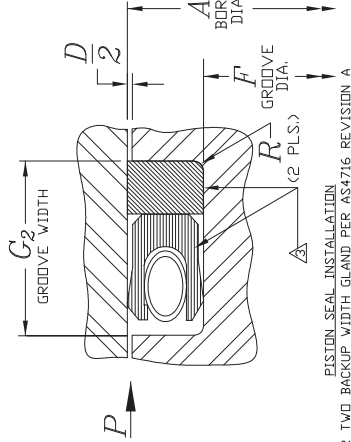
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TRELLEBERG SEALING SOLUTIONS

VARISEAL® SA, PISTON
 DRAWING NO. PVP2BG000

Turcon® Variseal®



Piston Seal Installation
FDR TWO BACKUP WIDTH GLAND PER AS4716 REVISION A

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
1006	+0.01	+0.00	435	+0.03	+0.00	447	9.474	8.997	.004-.009	.210/.220	.004
1007	+0.01	+0.00	436	+0.03	+0.00	448	9.974	9.497	.004-.009	.210/.220	.004
1008	+0.01	+0.00	437	+0.03	+0.00	449	10.474	9.997	.004-.009	.207/.217	.005/.015
1009	+0.01	+0.00	438	+0.03	+0.00	450	10.974	10.497	.004-.009	.245/.255	.005/.015
1010	+0.01	+0.00	439	+0.03	+0.00	451	11.474	10.997	.004-.009	.304/.314	.010/.025
1011	+0.01	+0.00	440	+0.03	+0.00	452	11.974	11.497	.004-.009	.424/.434	.020/.035
1012	+0.01	+0.00	441	+0.03	+0.00	453	12.474	11.997	.004-.009	.579/.589	.020/.035
1013	+0.01	+0.00	442	+0.03	+0.00	454	12.974	12.497	.004-.009	.446	.010
1014	+0.01	+0.00	443	+0.03	+0.00	455	13.474	12.997	.004-.009		
1015	+0.01	+0.00	444	+0.03	+0.00	456	13.974	13.497	.004-.009		
1016	+0.01	+0.00	445	+0.03	+0.00	457	14.474	13.997	.004-.009		
1017	+0.01	+0.00	446	+0.03	+0.00	458	14.974	14.497	.004-.009		
1018	+0.01	+0.00	447	+0.03	+0.00	459	15.474	14.997	.004-.009		
1019	+0.01	+0.00	448	+0.03	+0.00	460	15.974	15.497	.004-.009		
1020	+0.01	+0.00	449	+0.03	+0.00						
1021	+0.01	+0.00	450	+0.03	+0.00						
1022	+0.01	+0.00	451	+0.03	+0.00						
1023	+0.01	+0.00	452	+0.03	+0.00						
1024	+0.01	+0.00	453	+0.03	+0.00						
1025	+0.01	+0.00	454	+0.03	+0.00						
1026	+0.01	+0.00	455	+0.03	+0.00						
1027	+0.01	+0.00	456	+0.03	+0.00						
1028	+0.01	+0.00	457	+0.03	+0.00						
1029	+0.01	+0.00	458	+0.03	+0.00						
1030	+0.01	+0.00	459	+0.03	+0.00						
1031	+0.01	+0.00	460	+0.03	+0.00						
1032	+0.01	+0.00									
1033	+0.01	+0.00									
1034	+0.01	+0.00									
1035	+0.01	+0.00									
1036	+0.01	+0.00									
1037	+0.01	+0.00									
1038	+0.01	+0.00									
1039	+0.01	+0.00									
1040	+0.01	+0.00									
1041	+0.01	+0.00									
1042	+0.01	+0.00									
1043	+0.01	+0.00									
1044	+0.01	+0.00									
1045	+0.01	+0.00									
1046	+0.01	+0.00									
1047	+0.01	+0.00									
1048	+0.01	+0.00									
1049	+0.01	+0.00									
1050	+0.01	+0.00									

NOTES:
 1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FDR VARISEAL®V2 IN AS4716 REVISION A PISTON GLANDS.
 2. ORDERING EXAMPLE: PVJ2EG214A105SM
 VARISEAL®V2 PISTON DESIGNATOR
 CROSS SECTION
 0 = 000 SERIES
 1 = 200 SERIES
 2 = 300 SERIES
 3 = 400 SERIES
 4 = 500 SERIES
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON®VARISEAL®V2 MAT'L CODE
 SPRING MAT'L CODE - MEDIUM SPRING LOAD AS STANDARD
 G = AS4716
 SIZE DESIGNATION
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX:
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON®VARISEAL®V2 MAT'L CODE
 SPRING MAT'L CODE - MEDIUM SPRING LOAD AS STANDARD

FDR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE. SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL CODE	MEDIUM DUTY AS STANDARD
S	301 STAINLESS STEEL
H	HASTELLOY
E	ELGILDY

5. DASH SIZES -006 TO -028, -106 TO -128, AND -210 TO -221 REQUIRE SPLIT DR STEPPED GLAND CONFIGURATION. PLEASE CONSULT YOUR TRELLEBERG SEALING SOLUTIONS SALES ENGINEER FOR DETAILED INFORMATION.

DESIGN CODES FOR CUT BACKUP RING CONFIGURATION TWO BACKUP WIDTH GLANDS

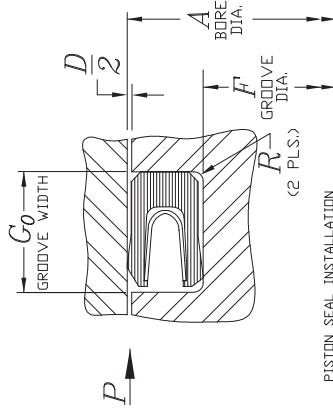
DESIGN CODE	BACKUP RING TYPE	MATERIAL
D	SCARF CUT	TURCON®
E	BACKUP RING	TURCON®
F	BACKUP RING	TURCON®

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TRELLEBERG SEALING SOLUTIONS

THE VARISEAL® V2, PISTON DRAWING NO. PVJ2EG000



PISTON SEAL INSTALLATION
FOR ZERO BACKUP WIDTH GLAND PER AS4716 REVISION A
(2 PLS.)

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INCH 2011_6

THE VARISEAL® M2, PISTON SEALING NO. PVA20G000

TRELLEBORG SEALING SOLUTIONS

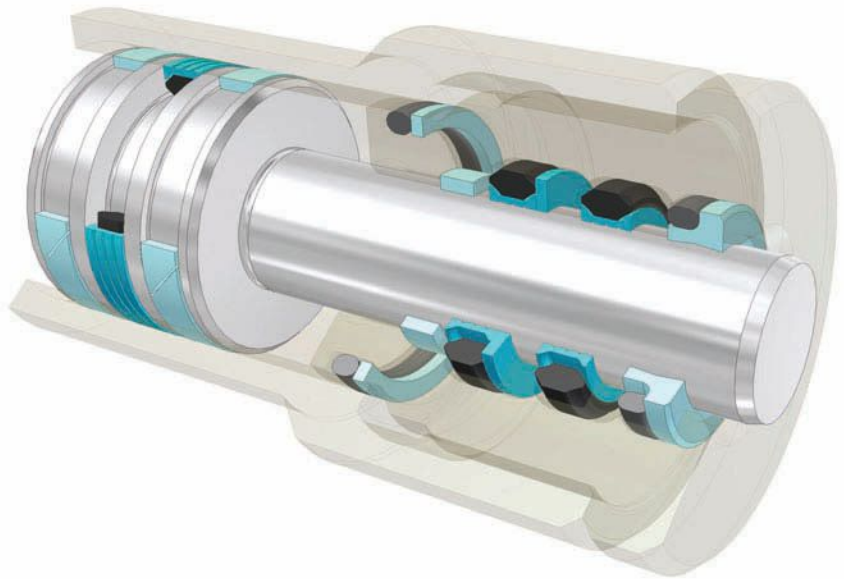
DASH NO.	A DIA.	F DIA.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	A DIA.	F DIA.	DASH NO.	Go ZEROD BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
+006	+0.01	+0.00	+0.02	+0.00	435	6.224	5.747	6.224	5.747	004-002	.098/.103	.005/.015	.004
+007	+0.01	+0.00	-.001	-.003	436	6.224	5.747	6.224	5.747	004-003	.098/.103	.005/.015	.004
+008	+0.01	+0.00	-.001	-.003	437	6.224	5.747	6.224	5.747	004-004	.094/.099	.005/.015	.004
+009	+0.01	+0.00	-.001	-.003	438	6.224	5.747	6.224	5.747	004-005	.094/.099	.005/.015	.004
+010	+0.01	+0.00	-.001	-.003	439	6.224	5.747	6.224	5.747	110-156	.141/.151	.005/.015	.005
+011	+0.01	+0.00	-.001	-.003	440	6.224	5.747	6.224	5.747	127-183	.141/.151	.005/.015	.005
+012	+0.01	+0.00	-.001	-.003	441	6.224	5.747	6.224	5.747	133-146	.141/.151	.005/.015	.005
+013	+0.01	+0.00	-.001	-.003	442	6.224	5.747	6.224	5.747	210-222	.188/.198	.010/.025	.005
+014	+0.01	+0.00	-.001	-.003	443	6.224	5.747	6.224	5.747	228-243	.188/.198	.010/.025	.005
+015	+0.01	+0.00	-.001	-.003	444	6.224	5.747	6.224	5.747	244-245	.188/.198	.010/.025	.005
+016	+0.01	+0.00	-.001	-.003	445	6.224	5.747	6.224	5.747	246-249	.188/.198	.010/.025	.005
+017	+0.01	+0.00	-.001	-.003	446	6.224	5.747	6.224	5.747	330-345	.281/.291	.020/.035	.005
+018	+0.01	+0.00	-.001	-.003	447	6.224	5.747	6.224	5.747	346-349	.281/.291	.020/.035	.005
+019	+0.01	+0.00	-.001	-.003	448	6.224	5.747	6.224	5.747	433-446	.375/.385	.020/.035	.010
+020	+0.01	+0.00	-.001	-.003	449	6.224	5.747	6.224	5.747	447-460	.375/.385	.020/.035	.010
+021	+0.01	+0.00	-.001	-.003	450	6.224	5.747	6.224	5.747				.011
+022	+0.01	+0.00	-.001	-.003	451	6.224	5.747	6.224	5.747				.011
+023	+0.01	+0.00	-.001	-.003	452	6.224	5.747	6.224	5.747				.011
+024	+0.01	+0.00	-.001	-.003	453	6.224	5.747	6.224	5.747				.011
+025	+0.01	+0.00	-.001	-.003	454	6.224	5.747	6.224	5.747				.011
+026	+0.01	+0.00	-.001	-.003	455	6.224	5.747	6.224	5.747				.011
+027	+0.01	+0.00	-.001	-.003	456	6.224	5.747	6.224	5.747				.011
+028	+0.01	+0.00	-.001	-.003	457	6.224	5.747	6.224	5.747				.011
+029	+0.01	+0.00	-.001	-.003	458	6.224	5.747	6.224	5.747				.011
+030	+0.01	+0.00	-.001	-.003	459	6.224	5.747	6.224	5.747				.011
+031	+0.01	+0.00	-.001	-.003	460	6.224	5.747	6.224	5.747				.011
+032	+0.01	+0.00	-.001	-.003									
+033	+0.01	+0.00	-.001	-.003									
+034	+0.01	+0.00	-.001	-.003									
+035	+0.01	+0.00	-.001	-.003									
+036	+0.01	+0.00	-.001	-.003									
+037	+0.01	+0.00	-.001	-.003									
+038	+0.01	+0.00	-.001	-.003									
+039	+0.01	+0.00	-.001	-.003									
+040	+0.01	+0.00	-.001	-.003									
+041	+0.01	+0.00	-.001	-.003									
+042	+0.01	+0.00	-.001	-.003									
+043	+0.01	+0.00	-.001	-.003									
+044	+0.01	+0.00	-.001	-.003									
+045	+0.01	+0.00	-.001	-.003									
+046	+0.01	+0.00	-.001	-.003									
+047	+0.01	+0.00	-.001	-.003									
+048	+0.01	+0.00	-.001	-.003									
+049	+0.01	+0.00	-.001	-.003									
+050	+0.01	+0.00	-.001	-.003									
+051	+0.01	+0.00	-.001	-.003									
+052	+0.01	+0.00	-.001	-.003									
+053	+0.01	+0.00	-.001	-.003									
+054	+0.01	+0.00	-.001	-.003									
+055	+0.01	+0.00	-.001	-.003									
+056	+0.01	+0.00	-.001	-.003									
+057	+0.01	+0.00	-.001	-.003									
+058	+0.01	+0.00	-.001	-.003									
+059	+0.01	+0.00	-.001	-.003									
+060	+0.01	+0.00	-.001	-.003									
+061	+0.01	+0.00	-.001	-.003									
+062	+0.01	+0.00	-.001	-.003									
+063	+0.01	+0.00	-.001	-.003									
+064	+0.01	+0.00	-.001	-.003									
+065	+0.01	+0.00	-.001	-.003									
+066	+0.01	+0.00	-.001	-.003									
+067	+0.01	+0.00	-.001	-.003									
+068	+0.01	+0.00	-.001	-.003									
+069	+0.01	+0.00	-.001	-.003									
+070	+0.01	+0.00	-.001	-.003									
+071	+0.01	+0.00	-.001	-.003									
+072	+0.01	+0.00	-.001	-.003									
+073	+0.01	+0.00	-.001	-.003									
+074	+0.01	+0.00	-.001	-.003									
+075	+0.01	+0.00	-.001	-.003									
+076	+0.01	+0.00	-.001	-.003									
+077	+0.01	+0.00	-.001	-.003									
+078	+0.01	+0.00	-.001	-.003									
+079	+0.01	+0.00	-.001	-.003									
+080	+0.01	+0.00	-.001	-.003									
+081	+0.01	+0.00	-.001	-.003									
+082	+0.01	+0.00	-.001	-.003									
+083	+0.01	+0.00	-.001	-.003									
+084	+0.01	+0.00	-.001	-.003									
+085	+0.01	+0.00	-.001	-.003									
+086	+0.01	+0.00	-.001	-.003									
+087	+0.01	+0.00	-.001	-.003									
+088	+0.01	+0.00	-.001	-.003									
+089	+0.01	+0.00	-.001	-.003									
+090	+0.01	+0.00	-.001	-.003									
+091	+0.01	+0.00	-.001	-.003									
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+093	+0.01	+0.00	-.001	-.003									
+094	+0.01	+0.00	-.001	-.003									
+095	+0.01	+0.00	-.001	-.003									
+096	+0.01	+0.00	-.001	-.003									
+097	+0.01	+0.00	-.001	-.003									
+098	+0.01	+0.00	-.001	-.003									
+099	+0.01	+0.00	-.001	-.003									
+100	+0.01	+0.00	-.001	-.003									
+101	+0.01	+0.00	-.001	-.003									
+102	+0.01	+0.00	-.001	-.003									
+103	+0.01	+0.00	-.001	-.003									
+104	+0.01	+0.00	-.001	-.003									
+105	+0.01	+0.00	-.001	-.003									
+106	+0.01	+0.00	-.001	-.003									
+107	+0.01	+0.00	-.001	-.003									
+108	+0.01	+0.00	-.001	-.003									
+109	+0.01	+0.00	-.001	-.003									
+110	+0.01	+0.00	-.001	-.003									
+111	+0.01	+0.00	-.001	-.003									
+112	+0.01	+0.00	-.001	-.003									
+113	+0.01	+0.00	-.001	-.003									
+114	+0.01	+0.00	-.001	-.003									
+115	+0.01	+0.00	-.001	-.003									
+116	+0.01	+0.00	-.001	-.003									
+117	+0.01	+0.00	-.001	-.003									
+118	+0.01	+0.00	-.001	-.003									
+119	+0.01	+0.00	-.001	-.003									
+120	+0.01	+0.00	-.001	-.003									
+121	+0.01	+0.00	-.001	-.003									
+122	+0.01	+0.00	-.001	-.003									
+123	+0.01	+0.00	-.001	-.003									
+124	+0.01	+0.00	-.001	-.003									
+125	+0.01	+0.00	-.001	-.003									
+126	+0.01	+0.00	-.001	-.003									
+127	+0.01	+0.00	-.001	-.003									
+128	+0.01	+0.00	-.001	-.003									
+129	+0.01	+0.00	-.001	-.003									
+130	+0.01	+0.00	-.001	-.003		</							

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	G ₂	R	D
+006	-000	+000	-000	+002	-002	+003	-003	+003	-003	+003	-003	0.04-0.09	0.005/0.015	0.004
+006	235	129	420	991	750	5747	6224	435	6224	5747	6224	210/220	0.005/0.015	0.004
+006	265	159	420	1053	812	5907	6379	436	6379	5907	6379	207/217	0.005/0.015	0.004
+006	295	189	420	1115	874	6043	6541	437	6541	6043	6541		0.005/0.015	0.004
+009	325	220	420	1178	936	6247	6724	438	6724	6247	6724		0.005/0.015	0.004
+010	350	250	420	1241	999								0.005/0.015	0.005
+010	360	250	420	1303	1061	6497	6974	439	6974	6497	6974	245/255	0.005/0.015	0.005
+012	465	375	420	1366	1124	6697	7174	440	7174	6697	7174		0.005/0.015	0.005
+002	+000	+000	+000	1428	1186	6897	7451	441	7451	6897	7451		0.005/0.015	0.005
-000	-000	-000	-000	1491	1249	7097	7707	442	7707	7097	7707		0.005/0.015	0.005
+013	570	504	420	1553	1311	7297	7974	443	7974	7297	7974		0.005/0.015	0.005
+014	600	534	420	1616	1374	7497	8224	444	8224	7497	8224	304/314	0.010/0.025	0.005
+015	675	566	420	1678	1436	7697	8474	445	8474	7697	8474		0.005/0.015	0.005
+016	738	629	420	1741	1499	7897	8724	446	8724	7897	8724		0.005/0.015	0.005
+017	800	691	420	1804	1562	8097	8974	447	8974	8097	8974		0.005/0.015	0.005
+018	863	753	420	1867	1625	8297	9224	448	9224	8297	9224	424/434	0.020/0.035	0.005
+019	925	815	420	1930	1688	8497	9474	449	9474	8497	9474		0.005/0.015	0.005
+020	991	881	420	1993	1751	8697	9724	450	9724	8697	9724		0.005/0.015	0.005
+021	1053	943	420	2056	1814	8897	10000	451	10000	8897	10000		0.005/0.015	0.005
+022	1115	1005	420	2119	1877	9097	10246	452	10246	9097	10246		0.005/0.015	0.005
+023	1178	1068	420	2182	1940	9297	10492	453	10492	9297	10492		0.005/0.015	0.005
+024	1241	1131	420	2245	2003	9497	10738	454	10738	9497	10738		0.005/0.015	0.005
+025	1303	1194	420	2308	2066	9697	10984	455	10984	9697	10984		0.005/0.015	0.005
+026	1366	1256	420	2371	2129	9897	11230	456	11230	9897	11230		0.005/0.015	0.005
+027	1428	1318	420	2434	2192	10097	11476	457	11476	10097	11476		0.005/0.015	0.005
+028	1491	1381	420	2497	2255	10297	11722	458	11722	10297	11722		0.005/0.015	0.005
+001	+000	+000	+000	2560	2318	10497	11968	459	11968	10497	11968		0.005/0.015	0.010
+105	-000	-000	-000	2623	2381	10697	12214	460	12214	10697	12214		0.005/0.015	0.010
+107	-000	-000	-000	2686	2444	10897	12460	461	12460	10897	12460		0.005/0.015	0.010
+108	-000	-000	-000	2749	2507	11097	12706	462	12706	11097	12706		0.005/0.015	0.010
+109	-000	-000	-000	2812	2570	11297	12952	463	12952	11297	12952		0.005/0.015	0.010
+110	-000	-000	-000	2875	2633	11497	13198	464	13198	11497	13198		0.005/0.015	0.010
+110	379	240	330	3993	3751	13397	13444	465	13444	13397	13444		0.005/0.015	0.010
+111	412	273	330	4126	4084	13597	13690	466	13690	13597	13690		0.005/0.015	0.010
+112	445	306	330	4259	4417	13797	13936	467	13936	13797	13936		0.005/0.015	0.010
+113	478	339	330	4392	4750	13997	14182	468	14182	13997	14182		0.005/0.015	0.010
+114	511	372	330	4525	5083	14197	14428	469	14428	14197	14428		0.005/0.015	0.010
+115	544	405	330	4658	5416	14397	14674	470	14674	14397	14674		0.005/0.015	0.010
+116	577	438	330	4791	5749	14597	14920	471	14920	14597	14920		0.005/0.015	0.010
+117	610	471	330	4924	6082	14797	15166	472	15166	14797	15166		0.005/0.015	0.010
+118	643	504	330	5057	6415	14997	15412	473	15412	14997	15412		0.005/0.015	0.010
+119	676	537	330	5190	6748	15197	15658	474	15658	15197	15658		0.005/0.015	0.010
+120	709	570	330	5323	7081	15397	15904	475	15904	15397	15904		0.005/0.015	0.010
+121	742	603	330	5456	7414	15597	16150	476	16150	15597	16150		0.005/0.015	0.010
+122	775	636	330	5589	7747	15797	16396	477	16396	15797	16396		0.005/0.015	0.010
+123	808	669	330	5722	8080	15997	16642	478	16642	15997	16642		0.005/0.015	0.010
+124	841	702	330	5855	8413	16197	16888	479	16888	16197	16888		0.005/0.015	0.010
+125	874	735	330	5988	8746	16397	17134	480	17134	16397	17134		0.005/0.015	0.010
+126	907	768	330	6121	9079	16597	17380	481	17380	16597	17380		0.005/0.015	0.010
+127	940	801	330	6254	9412	16797	17626	482	17626	16797	17626		0.005/0.015	0.010
+128	973	834	330	6387	9745	16997	17872	483	17872	16997	17872		0.005/0.015	0.010
+129	1006	867	330	6520	10078	17197	18118	484	18118	17197	18118		0.005/0.015	0.010
+130	1039	900	330	6653	10411	17397	18364	485	18364	17397	18364		0.005/0.015	0.010
+131	1072	933	330	6786	10744	17597	18610	486	18610	17597	18610		0.005/0.015	0.010
+132	1105	966	330	6919	11077	17797	18856	487	18856	17797	18856		0.005/0.015	0.010
+133	1138	999	330	7052	11410	17997	19102	488	19102	17997	19102		0.005/0.015	0.010
+134	1171	1032	330	7185	11743	18197	19348	489	19348	18197	19348		0.005/0.015	0.010
+135	1204	1065	330	7318	12076	18397	19594	490	19594	18397	19594		0.005/0.015	0.010
+136	1237	1098	330	7451	12409	18597	19840	491	19840	18597	19840		0.005/0.015	0.010
+137	1270	1131	330	7584	12742	18797	20086	492	20086	18797	20086		0.005/0.015	0.010
+138	1303	1164	330	7717	13075	18997	20332	493	20332	18997	20332		0.005/0.015	0.010
+139	1336	1197	330	7850	13408	19197	20578	494	20578	19197	20578		0.005/0.015	0.010
+140	1369	1230	330	7983	13741	19397	20824	495	20824	19397	20824		0.005/0.015	0.010
+141	1402	1263	330	8116	14074	19597	21070	496	21070	19597	21070		0.005/0.015	0.010
+142	1435	1296	330	8249	14407	19797	21316	497	21316	19797	21316		0.005/0.015	0.010
+143	1468	1329	330	8382	14740	19997	21562	498	21562	19997	21562		0.005/0.015	0.010
+144	1501	1362	330	8515	15073	20197	21808	499	21808	20197	21808		0.005/0.015	0.010
+145	1534	1395	330	8648	15406	20397	22054	500	22054	20397	22054		0.005/0.015	0.010
+146	1567	1428	330	8781	15739	20597	22300	501	22300	20597	22300		0.005/0.015	0.010
+147	1600	1461	330	8914	16072	20797	22546	502	22546	20797	22546		0.005/0.015	0.010
+148	1633	1494	330	9047	16405	20997	22792	503	22792	20997	22792		0.005/0.015	0.010
+149	1666	1527	330	9180	16738	21197	23038	504	23038	21197	23038		0.005/0.015	0.010
+150	1699	1560	330	9313	17071	21397	23284	505	23284	21397	23284		0.005/0.015	0.010
+151	1732	1593	330	9446	17404	21597	23530	506	23530	21597	23530		0.005/0.015	0.010
+152	1765	1626	330	9579	17737	21797	23776	507	23776	21797	23776		0.005/0.015	0.010
+153	1798	1659	330	9712	18070	21997	24022	508	24022	21997	24022		0.005/0.015	0.010
+154	1831	1692	330	9845	18403	22197	24268	509	24268	22197	24268		0.005/0.015	0.010
+155	1864	1725	330	9978	18736	22397	24514	510	24514	22397	24514		0.005/0.015	0.010
+156	1897	1758	330	10111	19069	22597	24760	511	24760	22597	24760		0.005/0.015	0.010
+157	1930	1791	330	10244	19402	22797	25006	512	25006	22797	25006		0.005/0.015	0.010
+158	1963	1824	330	10377	19735	22997	25252	513	25252	22997	25252		0.005/0.015	0.010
+159	1996	1857	330	10510	20068	23197	25498	514	25498	23197	25498		0.005/0.015	0.010
+160	2029	1890	330	10643	20401	23397	25744	515	25744	23397	25744		0.005/0.015	0.010
+161	2062	1923	330	10776	20734	23597	25990	516	25990	23597	25990		0.005/0.015	0.010
+162	2095	1956	330	10909	21067	23797	26236	517	26					

Turcon® Plus Seal® II

Features and benefits

- Good static and dynamic sealing effect
- Low friction, high efficiency
- Operating temperatures of -65°F to +390°F/ -54°C to +200°C
- Good chemical compatibility depending on elastomer
- Leak-tight reliable sealing performance
- High abrasion resistance
- Continuously lubricated
- Long service life
- Stick-slip-free starting
- No adhesion even after extended periods of rest
- Simple installation
- Sizes to suit all MIL-G-5514F and AS4716 glands
- If required Turcon® Plus Seal® II is interchangeable with Turcon® Double Delta® II in most applications



Seals/Back-up
Rings for AS4716

Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Plus Seal® II with and without Back-up Ring.

Turcon® Plus Seal® II

Description

The double-acting Turcon® Plus Seal® II is a superior slipper seal. Its contoured seal cap is formed to match a lemon-shaped elastomer ring. This allows more room for cap thickness that extends service life. Friction is reduced by activating the cap equally over its width and through the grooves in the cap. A full range of sizes is offered to suit all MIL-G-5514F and AS4716 glands and the seal is fully interchangeable with Turcon® Double Delta® II in most applications.

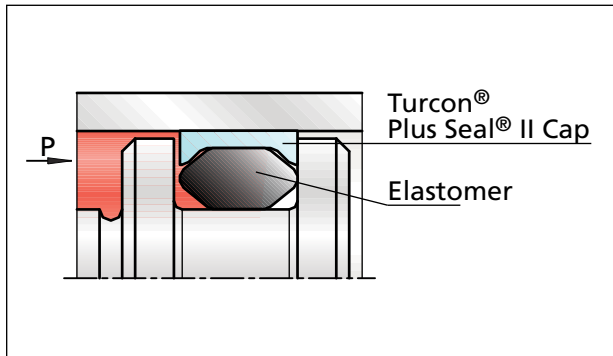


Figure 1 Turcon® Plus Seal® II

Method of Operation

The sealing effect of the Turcon® Plus Seal® II comes from the slight interference of the seal cap with the rod or bore combined with the preload from the compressed elastomer. As the pressure increases, the system pressure joins forces with the elastomer and increases the loading of the seal cap significantly. The resultant load produces a shear effect on the fluid film and provides leak-tight reliable sealing performance.

Instead of a traditional O-Ring, a proprietary lemon-shaped elastomer ring is used under the Turcon® Plus Seal® II cap. This allows the cap to be thicker for increased wear life.

In addition, the elastomer element activates the seal cap over a wider axial area compared to the original slipper seal, providing a lower unit loading. See Figure 2. It also supports the corners to prevent them from sinking away from the sealing surface. This reduces the oil film under the seal to an absolute minimum. See Figure 3.

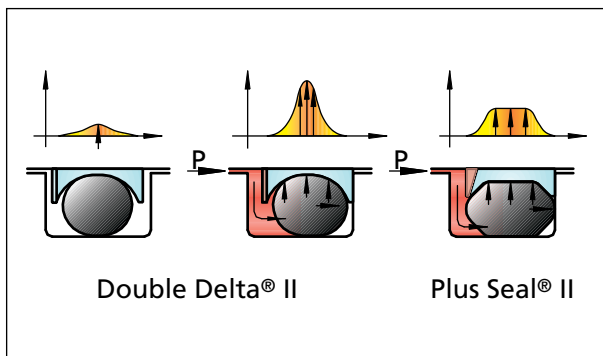


Figure 2 Pressure Distribution

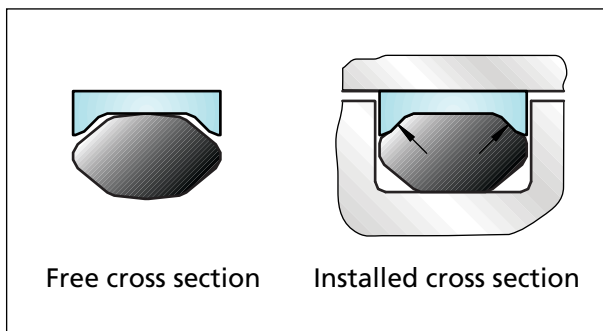


Figure 3 Turcon® Plus Seal® II Cross section

By choosing the grooved version, a further decrease in the film thickness can be achieved. The grooves increase the number of pressure peaks that the oil film must pass under. Another advantage of the grooved seal is that the grooves serve as an oil reservoir when the seal is static. When the seal starts to move dynamically, the oil film is quickly re-established under the sliding surface to lubricate the seal and maintain seal friction at a minimum. This is especially important in applications where the stroke is shorter than the seal width and it provides a general improvement in wear-life. See Figure 4.

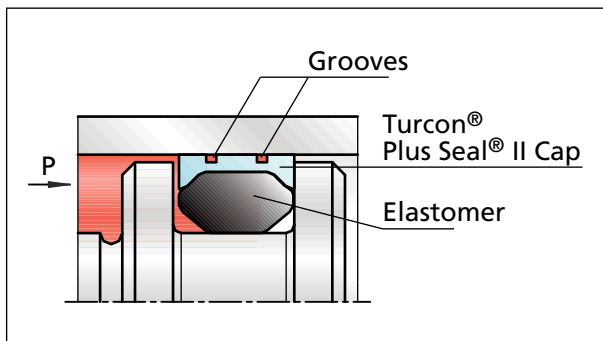


Figure 4 Grooved Turcon® Plus Seal® II

Turcon® Plus Seal® II

The zero back-up width of the seal is generally preferred, even if a wider groove is available in smaller diameters. The extra space in a wider groove is used more efficiently when filled with Back-up Rings. This increases the seal life without notably affecting the friction.

Where Turcon® Plus Seal® II is subjected bi-directional pressure, pressure from both sides alternately, it should always be equipped with sidewall notches. See Figure 5. These allow the pressure to properly activate the elastomer. See Figure 6. For piston use Turcon® Plus Seal® II is equipped with notches as standard. The rod version must be specified with notches if they are deemed necessary.

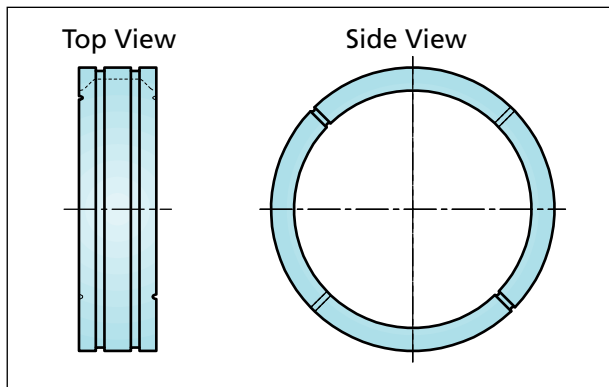


Figure 5 Turcon® Plus Seal® II Notches

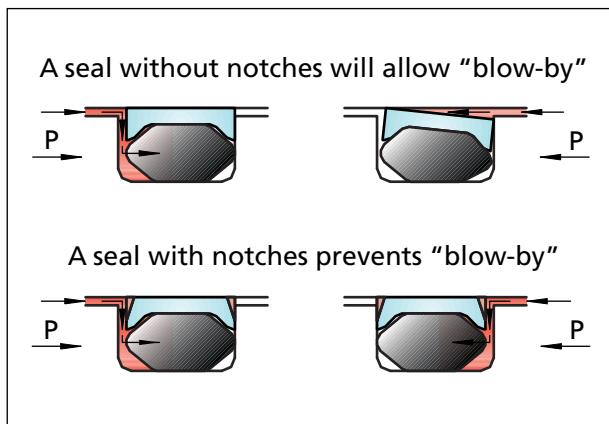


Figure 6 Turcon® Plus Seal® II with notches, function

Using a seal without notches may allow blow-by, where the pressure shoots over the top of the Turcon® Plus Seal® II cap and forces the seal down into the groove. See SAE International document AIR 1243 for more information on this topic.

Technical Data

Operation pressure:	5,000 psi/ 35 MPa Up to 10,000 psi/ 70 MPa with Stakbak®
Speed:	Up to 49.2 ft/s/ 15.0 m/s
Temperature range:	-65°F to +390°F/ -54°C to +200°C depending on elastomer material
Clearance:	As per AS4716 recommendations Larger clearance possible with Stakbak®
Media:	Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally safe hydraulic fluids (bio-oils), phosphate ester- based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Turcon® Plus Seal® II Series

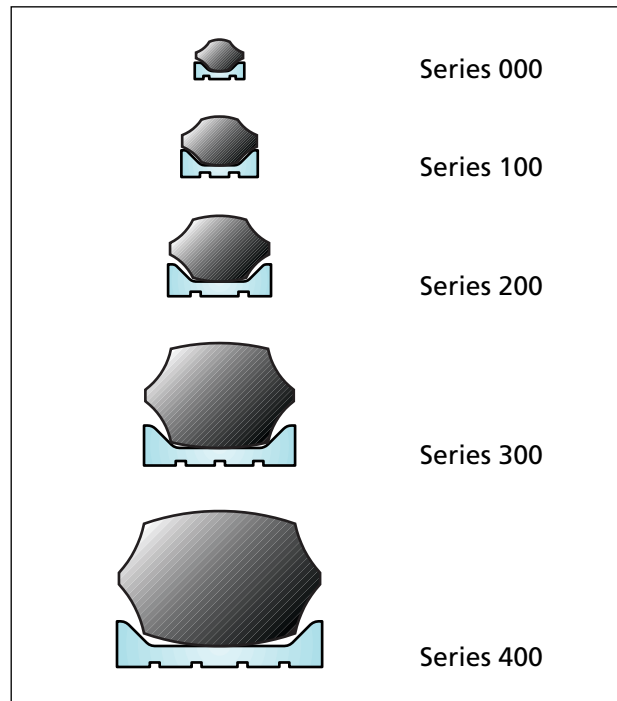
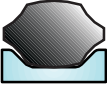


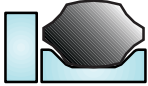
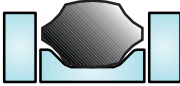
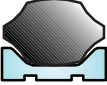



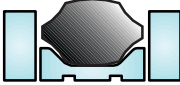












Figure 7 Relationship between Turcon® Plus Seal® II Cross Sections

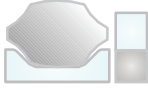
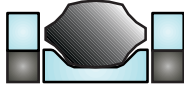

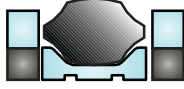




Turcon® Plus Seal® II

Table I Turcon® Plus Seal® II Types

Seal	Turcon® Plus Seal® II		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
Rod	 RPB0_	 RPB1_	 RPB2_
Rod With BUR	N/A	 RPB1A	 RPB2A
Grooved Rod	 RPA0_	 RPA1_	 RPA2_
Grooved Rod With BUR	N/A	 RPA1A	 RPA2A
Piston	 PPB0_	 PPB1_	 PPB2_
Piston With BUR	N/A	 PPB1A	 PPB2A
Grooved Piston	 PPA0_	 PPA1_	 PPA2_
Grooved Piston With BUR	N/A	 PPA1A	 PPA2A

Turcon® Plus Seal® II

Table II Turcon® Plus Seal® II Types with Stakbak®

Seal	Turcon® Plus Seal® II		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
Rod with Stakbak®	N/A	 RPB18G	 RPB28G
Grooved Rod with Stakbak®	N/A	 RPA18G	 RPA28G
Piston with Stakbak®	N/A	 PPB18G	 PPB28G
Grooved Piston with Stakbak®	N/A	 PPA18G	 PPA28G

- G denotes groove width; zero, one or two back-up width
- BUR - Back-up Ring

Piston seals are always delivered as standard with notch. Rod seals are always delivered without a notch. Turcon® Plus Seal® II are not available with notches in the -000 series, 0 back-up width seals. Piston seal part numbers PPB0 and PPA0 can be ordered without a notch, insert a "W" as the 5th digit, example PPB0W. Rod seal part number RPB0 and RPA0 can be ordered with a notch, insert a "N" as the 5th digit, example RPB0N.

Review the individual product drawings in this catalog section for the limits on the individual part number and groove or notching feature availability.

The Plus Seal® II follows the series as laid out in AS4716. We recommend that the guidelines for static and dynamic sizes are followed to ensure a good service life for the seal.

Profiles in full color are recommended configurations.

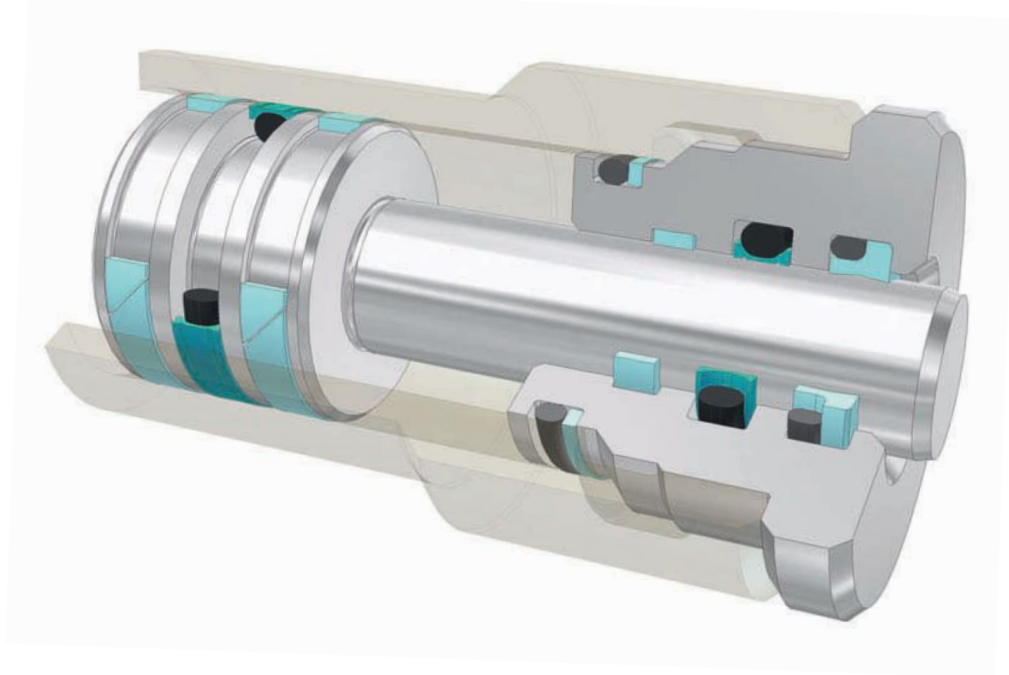
Seals/Back-up Rings for AS4716

Turcon® Plus Seal® II

Turcon® Double Delta® II

Features and benefits

- Good static and dynamic sealing effect
- Low friction, high efficiency
- Operating temperatures of -65°F to +390°F/ -54°C to +200°C
- Good chemical compatibility depending on elastomer
- Leak-tight reliable sealing performance
- No adhesion even after extended periods of rest
- Sizes to suit all O-Ring glands including MIL-G-5514F and AS4716
- High abrasion resistance
- Continuously lubricated
- Long service life
- Stick-slip-free starting
- Simple installation



Seals/Back-up
Rings for AS4716

Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Double Delta® II.

Turcon® Double Delta® II

Description

Turcon® Double Delta® II is the original slipper seal developed to improve the performance of O-Rings and Back-up Rings used in MIL-G-5514F and older versions of the gland standard. It is a double-acting seal energized by an elastomer O-Ring. Demonstrating good friction properties, Turcon® Double Delta® II provides stick-slip-free starting and excellent dry running. A full range of sizes is offered to suit all MIL-G-5514F and AS4716 glands along with custom designs.

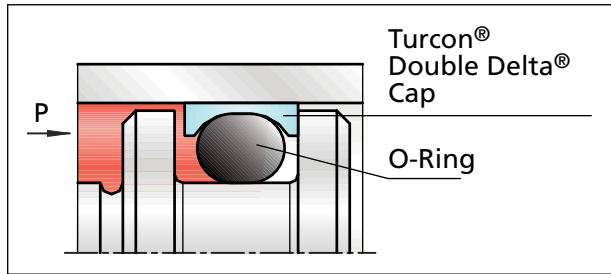


Figure 1 Turcon® Double Delta® II

Method of Operation

The O-Ring in Turcon® Double Delta® II preloads the seal cap in the thin, flexible middle section. This provides good leakage control even at low pressures.

In addition, when there is system pressure, the oil film under the seal is further reduced. Double Delta® II will always allow an oil film to be dragged across the sealing surface. This oil film is necessary to ensure a long service life.

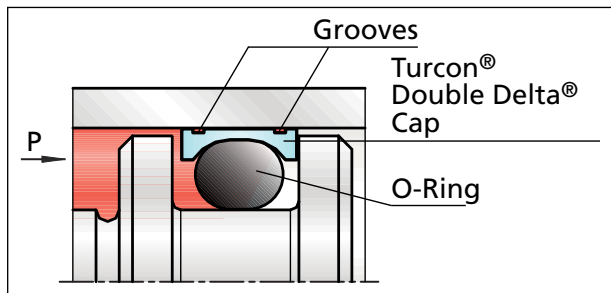


Figure 2 Grooved Turcon® Double Delta® II

By choosing the grooved version, a further decrease in the film thickness can be achieved. The grooves increase the number of pressure peaks that the oil film must pass under. Another advantage of the grooved seal is that the grooves serve as an oil reservoir when the seal is static. When the seal starts to move dynamically, the oil film is quickly re-established under the sliding surface to lubricate the seal and maintain

seal friction at a minimum. This is especially important in applications where the stroke is shorter than the seal width and it provides a general improvement in wear-life. See Figure 2.

The zero back-up width of the seal is generally preferred, even if a wider groove is available in smaller diameters. The extra space in a wider groove is used more efficiently when filled with Back-up Rings. This increases the seal life without notably affecting the friction.

Where Turcon® Double Delta® II is subjected bi-directional pressure, pressure from both sides alternately, it should always be equipped with sidewall notches. See Figure 3. These allow the pressure to properly activate the elastomer. See Figure 4. For piston use Turcon® Double Delta® II is equipped with notches as standard. The rod version must be specified with notches if they are deemed necessary.

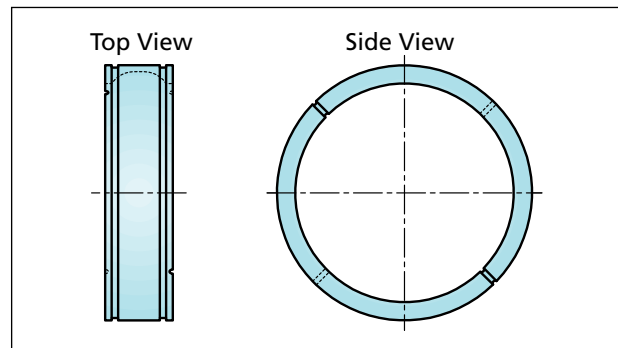


Figure 3 Turcon® Double Delta® II Notches

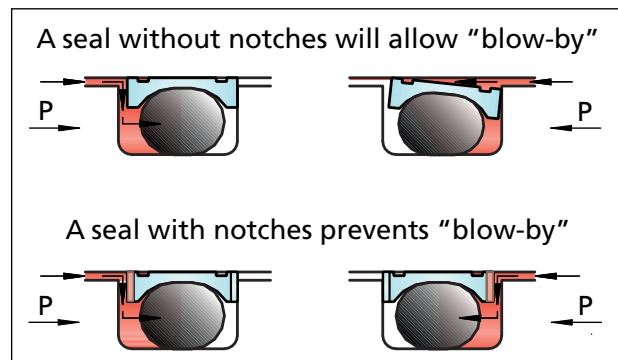


Figure 4 Turcon® Double Delta® II with notches, function

Using a seal without notches may allow blow-by, where the pressure shoots over the top of the Turcon® Double Delta® II cap and forces the seal down into the groove. See SAE International document AIR 1243 for more information on this topic.

Turcon® Double Delta® II

Technical Data

Operation pressure: 5,000 psi/ 35 MPa

Speed: Up to 49.2 ft/s/ 15.0 m/s

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer material

Clearance: As per AS4716 recommendations
Larger clearance possible with Stakbak®

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Series

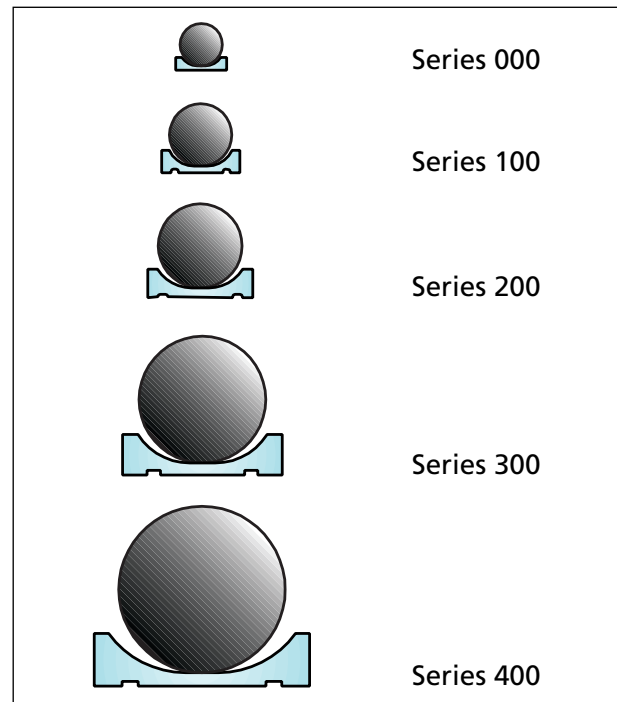
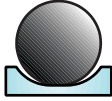


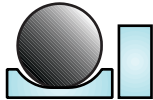
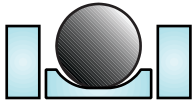





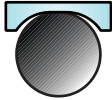


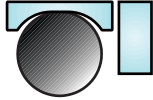
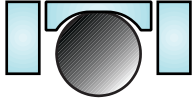
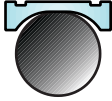


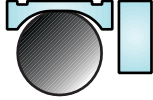
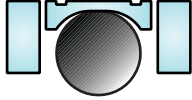


Figure 5 Relationship between Turcon® Double Delta® cross section

Seals/Back-up
Rings for AS4716

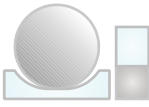

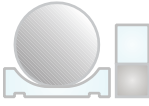

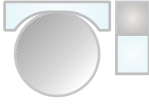

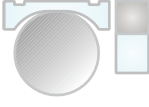

Turcon® Double Delta® II

Table I Turcon® Double Delta® II Types

Seal	Turcon® Double Delta® II		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
Rod	 RDB0_G	 RDB1_G	 RDB2_G
Rod with BUR	N/A	 RDB1AG	 RDB2AG
Grooved Rod	 RDA0_G	 RDA1_G	 RDA2_G
Grooved Rod with BUR	N/A	 RDA1AG	 RDA2AG
Piston	 PDB0_G	 PDB1_G	 PDB2_G
Piston with BUR	N/A	 PDB1AG	 PDB2AG
Grooved Piston	 PDA0_G	 PDA1_G	 PDA2_G
Grooved Piston with BUR	N/A	 PDA1AG	 PDA2AG

Turcon® Double Delta® II

Table II Turcon® Double Delta® II Types with Stakbak®

Seal	Turcon® Double Delta® II		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
Rod with Stakbak®	N/A	 RDB18G	 RDB28G
Grooved Rod with Stakbak®	N/A	 RDA18G	 RDA28G
Piston with Stakbak®	N/A	 PDB18G	 PDB28G
Grooved Piston with Stakbak®	N/A	 PDA18G	 PDA28G

- G denotes groove width; zero, one or two back-up width
- BUR - Back-up Ring

Piston seals are always delivered as standard with notch. Rod seals are always delivered without a notch.

Not every Turcon® Double Delta® is available with circumferential grooves and radial notches as the cross section and available materials limit the possibilities. This is particularly true in -000 and -100 series cross sections. Please refer to the print for groove and notch availability by seal cross section.

Turcon® Double Delta® II follows the series as laid out in AS4716. We recommend that the guidelines for static and dynamic sizes are followed to ensure a good service life for the seal.

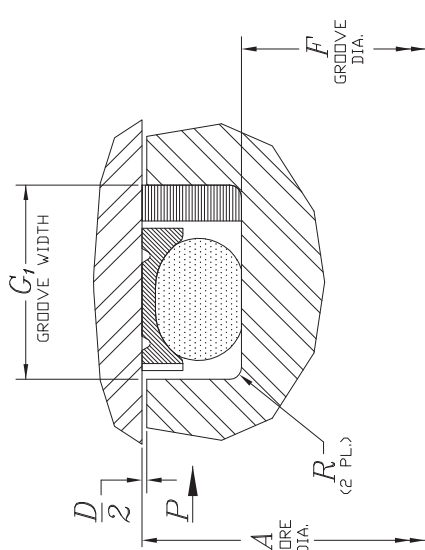
Turcon® Double Delta® II is also available for British Standard B.S.4518 and any other O-Ring grooves.

Profiles in color are recommended configurations.

Seals/Back-up Rings for AS4716

Turcon® Double Delta® II

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	G ₁ BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	1.90	0.76	210	1.99	0.81	210	435	6.224	5.747	435	020-028	.150/160	.005/015	.005
005	2.21	1.15	211	1.053	0.812	211	436	6.349	5.872	436	110-126		.005	.005
006	2.52	1.54	212	1.172	1.031	212	437	6.474	5.997	437	150-152		.005	.005
007	2.83	1.93	213	1.291	1.210	213	438	6.599	6.122	438	190-192	.183/193	.005/015	.005
008	2.97	1.89	214	1.241	1.199	214	439	6.724	6.247	439	132-140		.005	.005
009	3.29	2.20	215	1.360	1.310	215	440	6.849	6.372	440	141-149		.005	.005
010	3.60	2.50	216	1.479	1.429	216	441	6.974	6.497	441	210-222		.005	.005
011	4.22	3.12	217	1.620	1.570	217	442	7.124	6.647	442	222-224		.005	.005
012	4.85	3.75	218	1.761	1.711	218	443	7.274	6.797	443	223-227		.005	.005
013	5.50	4.41	219	1.902	1.852	219	444	7.424	6.947	444	228-229	.235/245	.010/025	.008
014	6.13	5.04	220	2.043	1.993	220	445	7.574	7.097	445	230-243		.008	.008
015	6.75	5.66	221	2.184	2.134	221	446	7.724	7.247	446	246-247		.006	.006
016	7.38	6.29	222	2.325	2.275	222	447	7.874	7.397	447	328-329	.334/344	.020/035	.006
017	8.00	6.91	223	2.466	2.416	223	448	8.024	7.547	448	330-345		.007	.007
018	8.63	7.53	224	2.607	2.557	224	449	8.174	7.697	449	346-349		.008	.008
019	9.25	8.15	225	2.748	2.698	225	450	8.324	7.847	450	423-438		.009	.009
020	9.91	8.81	226	2.889	2.839	226	451	8.474	7.997	451	439-445	.475/485	.020/035	.010
021	10.53	9.43	227	3.030	2.980	227	452	8.624	8.147	452	447-449		.011	.011
022	11.16	10.06	228	3.171	3.121	228	453	8.774	8.297	453				
023	11.78	10.68	229	3.312	3.262	229	454	8.924	8.447	454				
024	12.41	11.31	230	3.453	3.403	230	455	9.074	8.597	455				
025	13.03	11.93	231	3.594	3.544	231	456	9.224	8.747	456				
026	13.66	12.56	232	3.735	3.685	232	457	9.374	8.897	457				
027	14.28	13.18	233	3.876	3.826	233	458	9.524	9.047	458				
028	14.91	13.81	234	4.017	3.967	234	459	9.674	9.197	459				
029	15.53	14.43	235	4.158	4.108	235	460	9.824	9.347	460				
030	16.16	15.06	236	4.299	4.249	236		9.974	9.497					
031	16.78	15.68	237	4.440	4.390	237		10.124	9.647					
032	17.41	16.31	238	4.581	4.531	238		10.274	9.797					
033	18.03	16.93	239	4.722	4.672	239		10.424	9.947					
034	18.66	17.56	240	4.863	4.813	240		10.574	10.097					
035	19.28	18.18	241	5.004	4.954	241		10.724	10.247					
036	19.91	18.81	242	5.145	5.095	242		10.874	10.397					
037	20.53	19.43	243	5.286	5.236	243		11.024	10.547					
038	21.16	20.06	244	5.427	5.377	244		11.174	10.697					
039	21.78	20.68	245	5.568	5.518	245		11.324	10.847					
040	22.41	21.31	246	5.709	5.659	246		11.474	10.997					
041	23.03	21.93	247	5.850	5.800	247		11.624	11.147					
042	23.66	22.56	248	5.991	5.941	248		11.774	11.297					
043	24.28	23.18	249	6.132	6.082	249		11.924	11.447					
044	24.91	23.81	250	6.273	6.223	250		12.074	11.597					
045	25.53	24.43	251	6.414	6.364	251		12.224	11.747					
046	26.16	25.06	252	6.555	6.505	252		12.374	11.897					
047	26.78	25.68	253	6.696	6.646	253		12.524	12.047					
048	27.41	26.31	254	6.837	6.787	254		12.674	12.197					
049	28.03	26.93	255	6.978	6.928	255		12.824	12.347					



FOR ONE BACKUP WIDTH INSTALLATION PER AS4716 REVISION A

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR DOUBLE DELTA® II IN AS4716 REVISION A PISTON GLANDS.
- ORDERING EXAMPLE: PD A 1 A 9 214 A 105 NG
- FOR SIZES -004 THROUGH -149, SEAL RINGS WILL BE SUPPLIED WITH NOTCHES. FOR ALL OTHER SIZES, SEAL RINGS ARE SUPPLIED WITH NOTCHES.

DESIGN CODES FOR BACKUP RING CONFIGURATION.

BACKUP RING TYPE	MATERIAL
DELTA	TURCON® 129
A	ALUMINUM
B	STEEL
C	BRASS
D	STAINLESS STEEL
E	TITANIUM
F	INCONEL
G	COBALT ALLOY
H	COPPER ALLOY
I	PHOSPHOR BRONZE
J	SILICON BRONZE
K	NICKEL ALLOY
L	MONEL
M	AGNIUM
N	MONEL
O	TITANIUM
P	BRASS
Q	ALUMINUM
R	INCONEL
S	COBALT ALLOY
T	PHOSPHOR BRONZE
U	SILICON BRONZE
V	NICKEL ALLOY
W	MONEL
X	AGNIUM
Y	MONEL
Z	TITANIUM

DESIGNATOR: G = AS4716
 QUALITY AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON® DOUBLE DELTA® II MAT'L. CODE
 TURELCO® O-RING MAT'L. CODE

3. FOR SIZES -004 THROUGH -149, SEAL RINGS WILL BE SUPPLIED WITH NOTCHES. FOR ALL OTHER SIZES, SEAL RINGS ARE SUPPLIED WITH NOTCHES.

STABAK® PATENTS:
 U.S.A. 4,576,386
 U.K. 2,165,670
 GERMANY 2,576,078
 FRANCE 2,576,078
 SWEDEN 458,469

SCARF CUT BACKUP RINGS ARE AVAILABLE ONLY IN DASH SIZES, -004 THROUGH -028, -104 THROUGH -135, -210 THROUGH -227, -325 THROUGH -335 & -425 THROUGH -431
 STABAK® BACKUP RINGS ARE AVAILABLE ONLY IN DASH SIZES, -020 THROUGH -028, -118 THROUGH -149, -211 THROUGH -247, -325 THROUGH -349 & -425 THROUGH -449

Turcon® Double Delta® II

Turcon® Wedgpak® II

Features and benefits

- Good static and dynamic sealing effect
- Excellent stability of the elastomer element in severe working conditions
- Unidirectional version for applications where there is pressure from one side only
- Low-friction, high efficiency
- Leak-tight reliable sealing performance
- Easy installation
- Extrusion protection version operates in higher pressures and larger clearances
- Unidirectional Wedgpak® II gives effective fluid-film control and gas sealing in low and high-pressure systems
- Available in flash-free version upon request
- Sizes to suit AS4716 glands

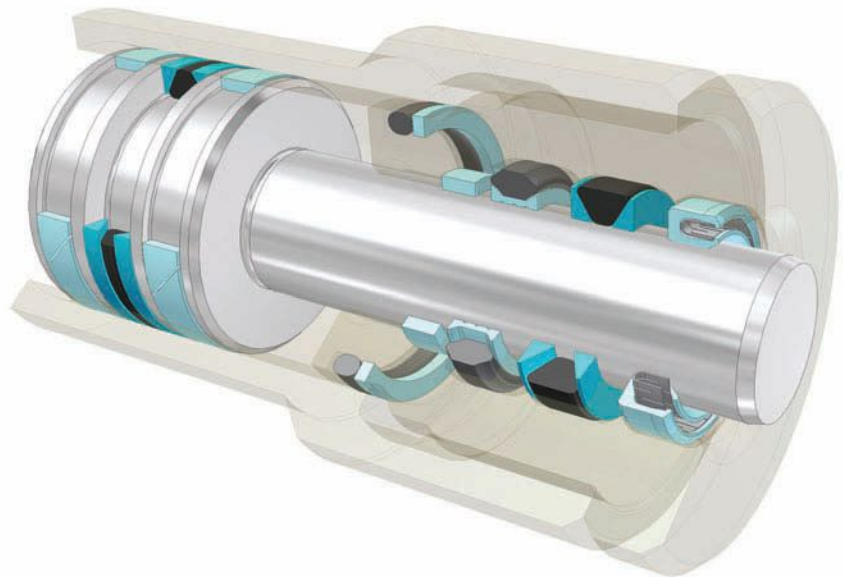


Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Wedgpak® II.

Turcon® Wedgpak® II

Description

Turcon® Wedgpak® II consists of a proprietary triangular elastomer element supported by two delta shaped Back-up Rings. The delta-shaped Back-up Rings of Turcon® Wedgpak® II prevent the elastomer element from spiraling or rolling under severe working conditions.

Turcon® Wedgpak® II EP is a version that provides superior extrusion protection at pressures above 5,000 psi/ 35 MPa and hardware clearances larger than specified in AS4716.

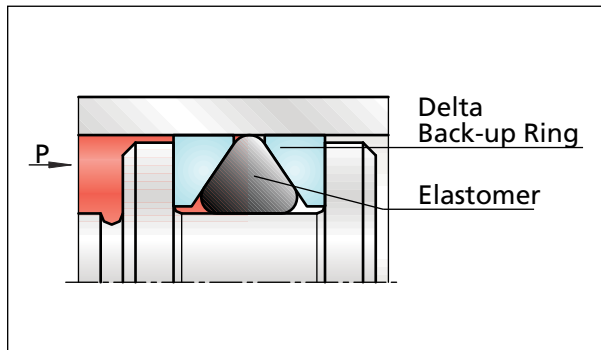


Figure 1 Turcon® Wedgpak® II

Turcon® Unidirectional Wedgpak® II consists of a delta shaped elastomer and a single delta shaped Back-up Ring. This design is used in applications with unidirectional pressure, pressure from one direction only, and provides leak-tight performance in both static and dynamic applications.

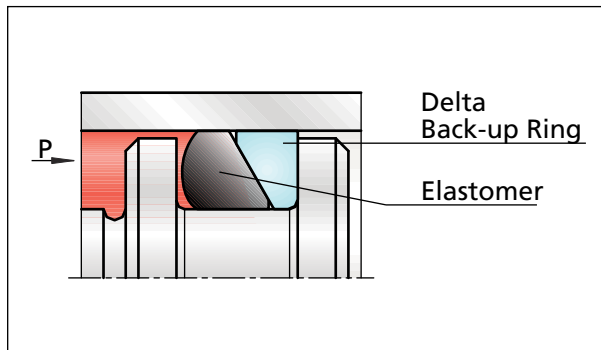


Figure 2 Turcon® Unidirectional Wedgpak® II

Method of Operation

The optimized elastomer contact area of Turcon® Wedgpak® II design results in a slipper seal-like performance with low static and dynamic friction. At the same time, the elastomer wipes the surface efficiently, providing excellent leakage control.

An outstanding load profile is the result of seal squeeze combined with the angles of the elastomer and Back-up Ring in the Unidirectional Wedgpak® II. This gives effective fluid-film control and gas sealing in low and high-pressure systems.

Though originally designed as static seals, Turcon® Wedgpak® II and Turcon® Unidirectional Wedgpak® II are proven in dynamic applications such as aircraft utility actuators and landing gear shock struts. They are also used in gas and oil separators, both at high and low pressures as well as in various hydraulic and fuelhydraulic applications.

Technical Data

Operation pressure: 5,000 psi/ 35 MPa Turcon® Wedgpak® EP can operate at higher pressures.

Speed: Up to 9.8 ft/s/ 3.0 m/s
Capable of higher speeds in non-continuous or intermittent use

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer material

Clearance: As per AS4716
Larger clearances for Turcon® Wedgpak® EP

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on elastomer material selected

Avoid combining extreme limits.

Turcon® Wedgpak® II

Series

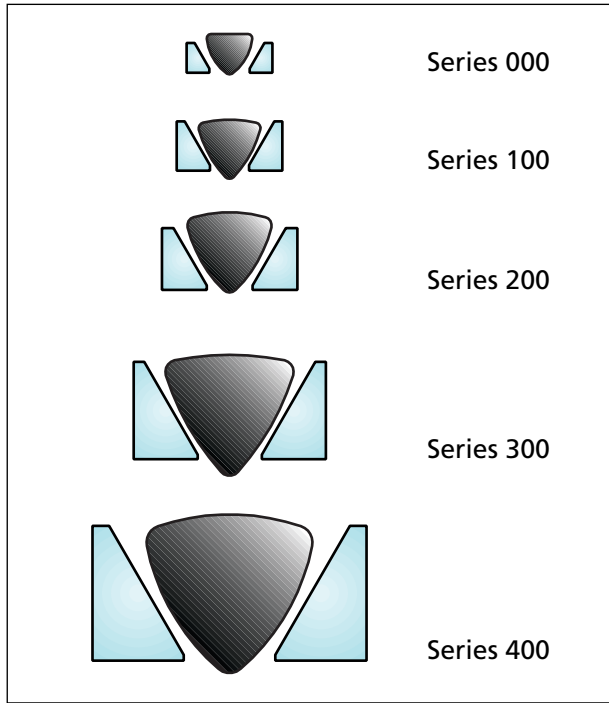












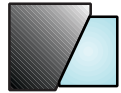





Figure 3 Relationship between Turcon® Wedgpak® II cross sections

Turcon® Wedgpak® II

Table I Turcon® Wedgpak® II Types

Seal	Turcon® Wedgpak® II		
	Width		
Type	0 BUR (G ₀)	1 BUR (G ₁)	2 BUR (G ₂)
Rod	 RAA0_G	 RAA1_G	 RAA2_G
Piston	 PAA0_G	 PAA1_G	 PAA2_G
EP Rod	N/A	 RAB1_G	 RAB2_G
EP Piston	N/A	 PAB1_G	 PAB2_G
Unidirectional Rod	 RAU0_G	 RAU1_G	 RAU2_G
Unidirectional Piston	 PAU0_G	 PAU1_G	 PAU2_G

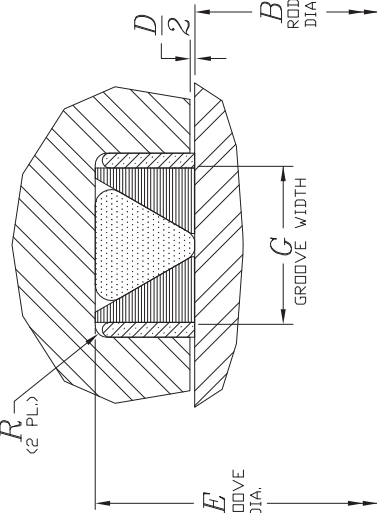
- G denotes groove width; zero, one or two Back-up width
- BUR - Back-up Ring

The elongation limits of some elastomer materials in combination with the diameter of the seal I.D. prevent the installation of Turcon® Wedgpak® II into closed piston (O.D.) grooves by circumferential stretching. Check the correct installation method with your Trelleborg Sealing Solutions marketing company before using Turcon® Wedgpak® II part numbers beginning with PA in dash sizes -004 to -009 and -104 to -109.

Profiles in color are recommended configurations.

Turcon® Wedgpak® II

DASH NO.	B DIA.	E DIA.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRICAL CLEARANCE MAX.
	+0.001 -0.001	+0.001 -0.001	+0.002 -0.002	+0.002 -0.002		+0.001 -0.001	+0.002 -0.002		+0.001 -0.001	+0.001 -0.001				
004	076	190	210	748	999	435	5747	6224	004-009	.154/.164	.210/.220	.005/.015	.004	
005	078	191	211	750	1000	436	5749	6225	005-009	.154/.164	.210/.220	.005/.015	.004	
006	081	194	212	753	1003	437	5752	6228	013-036	.150/.160	.207/.217	.005/.015	.004	
007	084	197	213	756	1006	438	5755	6231	104-109			.005/.015	.004	
008	085	198	214	757	1007	439	5756	6232	110-126			.005/.015	.006	
009	099	217	215	1060	1302	440	5774	6250	130-132		.245/.255	.005/.015	.006	
010	099	217	215	1060	1302	441	5775	6251	133-140			.007	.007	
011	099	217	215	1060	1302	442	5776	6252	141-146			.007	.007	
012	099	217	215	1060	1302	443	5777	6253	147-152			.007	.006	
013	099	217	215	1060	1302	444	5778	6254	223-224			.007	.007	
014	099	217	215	1060	1302	445	5779	6255	225-227		.304/.314	.010/.025	.007	
015	099	217	215	1060	1302	446	5780	6256	228-243			.007	.007	
016	099	217	215	1060	1302	447	5781	6257	244-245			.008	.008	
017	099	217	215	1060	1302	448	5782	6258	246-247			.009	.009	
018	099	217	215	1060	1302	449	5783	6259	328-329			.009	.009	
019	099	217	215	1060	1302	450	5784	6260	330-345		.424/.434	.020/.035	.007	
020	099	217	215	1060	1302	451	5785	6261	346-349			.007	.007	
021	099	217	215	1060	1302	452	5786	6262	425-438			.009	.009	
022	099	217	215	1060	1302	453	5787	6263	439-445			.010	.010	
023	099	217	215	1060	1302	454	5788	6264	446			.010	.010	
024	1123	1233	231	2623	2665	455	13457	13474	447-460			.020/.035	.010	
025	1185	1295	232	2748	2990	456	13457	13474						
026	1248	1358	233	2873	3115	457	13997	14474						
027	1310	1420	234	2997	3239	458	14497	14974						
028	1373	1483	235	3122	3364	459	14997	15474						
029	1373	1483	235	3122	3364	460	14997	15474						
104	183	205	237	3172	3619	457	13997	14474						
105	183	205	237	3172	3619	458	14497	14974						
106	185	207	238	3197	3644	459	14997	15474						
107	185	207	238	3197	3644	460	14997	15474						
108	248	248	248	3747	3989	457	13997	14474						
109	248	248	248	3747	3989	458	14497	14974						
110	310	310	241	3872	4114	459	14997	15474						
111	310	310	241	3872	4114	460	14997	15474						
112	310	310	241	3872	4114	457	13997	14474						
113	310	310	241	3872	4114	458	14497	14974						
114	310	310	241	3872	4114	459	14997	15474						
115	310	310	241	3872	4114	460	14997	15474						
116	310	310	241	3872	4114	457	13997	14474						
117	310	310	241	3872	4114	458	14497	14974						
118	310	310	241	3872	4114	459	14997	15474						
119	310	310	241	3872	4114	460	14997	15474						
120	310	310	241	3872	4114	457	13997	14474						
121	310	310	241	3872	4114	458	14497	14974						
122	310	310	241	3872	4114	459	14997	15474						
123	310	310	241	3872	4114	460	14997	15474						
124	310	310	241	3872	4114	457	13997	14474						
125	310	310	241	3872	4114	458	14497	14974						
126	310	310	241	3872	4114	459	14997	15474						
127	310	310	241	3872	4114	460	14997	15474						
128	310	310	241	3872	4114	457	13997	14474						
129	310	310	241	3872	4114	458	14497	14974						
130	310	310	241	3872	4114	459	14997	15474						
131	310	310	241	3872	4114	460	14997	15474						
132	310	310	241	3872	4114	457	13997	14474						
133	310	310	241	3872	4114	458	14497	14974						
134	310	310	241	3872	4114	459	14997	15474						
135	310	310	241	3872	4114	460	14997	15474						
136	310	310	241	3872	4114	457	13997	14474						
137	310	310	241	3872	4114	458	14497	14974						
138	310	310	241	3872	4114	459	14997	15474						
139	310	310	241	3872	4114	460	14997	15474						
140	310	310	241	3872	4114	457	13997	14474						
141	310	310	241	3872	4114	458	14497	14974						
142	310	310	241	3872	4114	459	14997	15474						
143	310	310	241	3872	4114	460	14997	15474						
144	310	310	241	3872	4114	457	13997	14474						
145	310	310	241	3872	4114	458	14497	14974						
146	310	310	241	3872	4114	459	14997	15474						
147	310	310	241	3872	4114	460	14997	15474						
148	310	310	241	3872	4114	457	13997	14474						
149	310	310	241	3872	4114	458	14497	14974						



ROD SEAL INSTALLATION
FOR ONE & TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

NOTES:
 1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR WEDGPAK® EP
 IN AS4716 REVISION A ROD GLANDS.
 2. ORDERING EXAMPLE:
 WEDGPAK® EP, ROD DESIGNATOR
 BACKUP WIDTH
 1 = ONE BACKUP WIDTH
 2 = TWO BACKUP WIDTH
 DELTA BACKUP RING DESIGN
 SEE BELOW
 GLAND DESIGNATOR
 G = AS4716
 SIZE DESIGNATOR
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX CERTIFICATE OF CONFORMANCE
 TURCON® DELTA BACKUP RING MAT'L CODE
 TUREL® ELASTOMER MAT'L CODE
 CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE
 DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

**△ CUT DELTA BACKUP RINGS ARE ONLY AVAILABLE IN
 1. BACKUP WIDTH SIZES: -004 THROUGH -020, -104 THROUGH -132, -210 THROUGH -230 &
 -325 THROUGH -342
 2. BACKUP WIDTH SIZES: -004 THROUGH -020, -104 THROUGH -132, -210 THROUGH -230 &
 -325 THROUGH -342**

SOLID DELTA RING		SCARF-CUT DELTA RING	
TYPE	MATERIAL	TYPE	MATERIAL
DELTA RING	ZURCON® Z40	SCARF-CUT	ZURCON® Z40
BACKUP RING	ZURCON® Z60	SCARF-CUT	ZURCON® Z60
SOLID	ZURCON® Z43	SCARF-CUT	ZURCON® Z43
DELTA RING	ZURCON® Z40	SCARF-CUT	ZURCON® Z40
BACKUP RING	ZURCON® Z60	SCARF-CUT	ZURCON® Z60
SOLID	ZURCON® Z43	SCARF-CUT	ZURCON® Z43

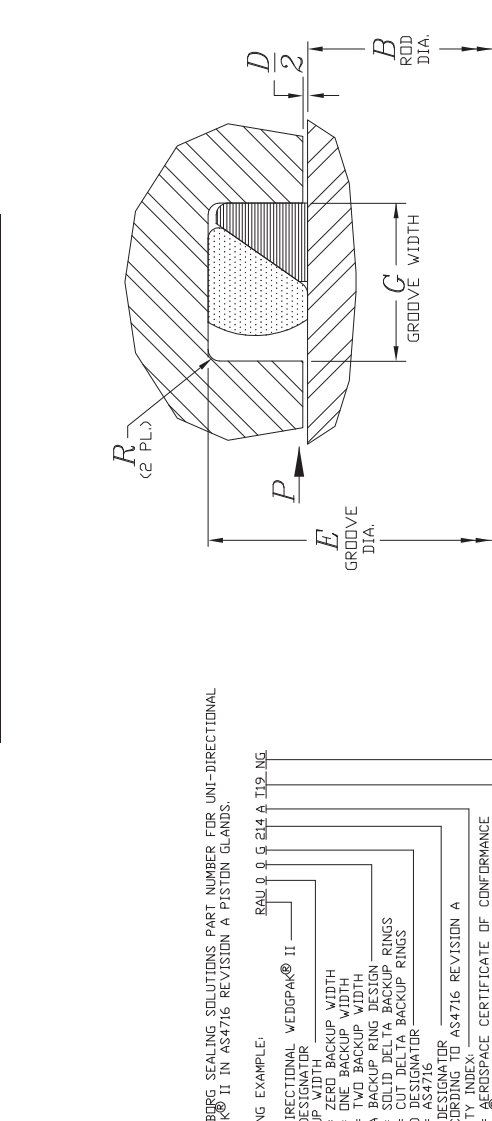
4. SOME ELASTOMER MATERIALS ELONGATION LIMITS IN COMBINATION WITH THE SCARF-CUT DESIGN OF THE TURCON WEDGPAK INT CLOSED GROOVES BY CIRCUMFERENTIAL STRETCHING BEFORE USING -004 TO -104 AND -104 TO -317 CONSULT YOUR TSS SALES ENGINEER.

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TRELLEBERG SEALING SOLUTIONS
WEDGPAK® EP
 DRAWING NO. **RAB10G000**
 INCH
 2009_1

Turcon® Wedgpak® II

DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₀ ZERO BACKUP WIDTH	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	076	190	210	078	192	435	080	194	.0987/103	.152/164	.210/220	.005/.015	.004
005	085	198	211	087	199	436	089	201	.099/104	.157/166	.211/221	.005/.015	.004
006	094	206	212	096	207	437	098	209	.100/105	.158/167	.212/222	.005/.015	.004
007	103	214	213	105	215	438	107	217	.101/106	.159/168	.213/223	.005/.015	.004
008	112	222	214	114	224				.102/107	.160/169	.214/224	.005/.015	.004
009	121	230	215	123	232	439	122	231	.103/108	.161/170	.215/225	.005/.015	.006
010	130	238	216	132	240	440	131	239	.104/109	.162/171	.216/226	.005/.015	.006
011	139	246	217	141	248	441	140	247	.105/110	.163/172	.217/227	.005/.015	.007
012	148	254	218	150	256	442	149	255	.106/111	.164/173	.218/228	.005/.015	.007
	157	262	219	159	264	443	158	263	.107/112	.165/174	.219/229	.005/.015	.007
	166	270		168	272	444	167	271	.108/113	.166/175	.220/230	.005/.015	.006
	175	278		177	280	445	176	279	.109/114	.167/176	.221/231	.010/.025	.007
	184	286		186	288	446	185	287	.110/115	.168/177	.222/232	.007	.007
013	193	294	220	195	296	445	194	295	.111/116	.169/178	.223/233	.007	.007
014	202	302	221	204	304	446	203	305	.112/117	.170/179	.224/234	.008	.007
015	211	310	222	213	312	445	212	311	.113/118	.171/180	.225/235	.008	.008
016	220	318	223	222	320	446	221	319	.114/119	.172/181	.226/236	.008	.008
017	229	326	224	231	328	447	230	327	.115/120	.173/182	.227/237	.008	.008
018	238	334	225	240	336	448	239	335	.116/121	.174/183	.228/238	.008	.008
019	247	342	226	249	344	449	248	343	.117/122	.175/184	.229/239	.008	.008
020	256	350	227	258	352	450	257	351	.118/123	.176/185	.230/240	.009	.009
021	265	358	228	267	360	451	266	361	.119/124	.177/186	.231/241	.010/.035	.010
022	274	366	229	276	368	452	275	369	.120/125	.178/187	.232/242	.010	.010
023	283	374	230	285	376	453	284	377	.121/126	.179/188	.233/243	.010	.010
024	292	382	231	294	384	454	293	383	.122/127	.180/189	.234/244	.010	.010
025	301	390	232	303	392	455	302	391	.123/128	.181/190	.235/245	.010	.010
026	310	398	233	312	400	456	311	399	.124/129	.182/191	.236/246	.010	.010
027	319	406	234	321	408	457	320	407	.125/130	.183/192	.237/247	.010	.010
028	328	414	235	330	416	458	329	415	.126/131	.184/193	.238/248	.010	.010
	337	422	236	339	424	459	338	423	.127/132	.185/194	.239/249	.010	.010
	346	430	237	348	432	460	347	431	.128/133	.186/195	.240/250	.010	.010
	355	438	238	357	440				.129/134	.187/196		.010	.010
	364	446	239	366	448				.130/135	.188/197		.010	.010
	373	454	240	375	456				.131/136	.189/198		.010	.010
	382	462	241	384	464				.132/137	.190/199		.010	.010
	391	470	242	393	472				.133/138	.191/200		.010	.010
	400	478	243	402	480				.134/139	.192/201		.010	.010
	409	486	244	411	488				.135/140	.193/202		.010	.010
104	418	494	245	420	496				.136/141	.194/203		.010	.010
105	427	502	246	429	504				.137/142	.195/204		.010	.010
106	436	510	247	438	512				.138/143	.196/205		.010	.010
107	445	518	248	447	520				.139/144	.197/206		.010	.010
108	454	526	249	456	528				.140/145	.198/207		.010	.010
109	463	534	250	465	536				.141/146	.199/208		.010	.010
110	472	542	251	474	544				.142/147	.200/209		.010	.010
111	481	550	252	483	552				.143/148	.201/210		.010	.010
112	490	558	253	492	560				.144/149	.202/211		.010	.010
113	499	566	254	501	568				.145/150	.203/212		.010	.010
114	508	574	255	510	576				.146/151	.204/213		.010	.010
115	517	582	256	519	584				.147/152	.205/214		.010	.010
116	526	590	257	528	592				.148/153	.206/215		.010	.010
117	535	598	258	537	600				.149/154	.207/216		.010	.010
118	544	606	259	546	608				.150/155	.208/217		.010	.010
119	553	614	260	555	616				.151/156	.209/218		.010	.010
120	562	622	261	564	624				.152/157	.210/219		.010	.010
121	571	630	262	573	632				.153/158	.211/220		.010	.010
122	580	638	263	582	640				.154/159	.212/221		.010	.010
123	589	646	264	591	648				.155/160	.213/222		.010	.010
124	598	654	265	600	656				.156/161	.214/223		.010	.010
125	607	662	266	609	664				.157/162	.215/224		.010	.010
126	616	670	267	618	672				.158/163	.216/225		.010	.010
127	625	678	268	627	680				.159/164	.217/226		.010	.010
128	634	686	269	636	688				.160/165	.218/227		.010	.010
129	643	694	270	645	696				.161/166	.219/228		.010	.010
130	652	702	271	654	704				.162/167	.220/229		.010	.010
131	661	710	272	663	712				.163/168	.221/230		.010	.010
132	670	718	273	672	720				.164/169	.222/231		.010	.010
133	679	726	274	681	728				.165/170	.223/232		.010	.010
134	688	734	275	690	736				.166/171	.224/233		.010	.010
135	697	742	276	699	744				.167/172	.225/234		.010	.010
136	706	750	277	708	752				.168/173	.226/235		.010	.010
137	715	758	278	717	760				.169/174	.227/236		.010	.010
138	724	766	279	726	768				.170/175	.228/237		.010	.010
139	733	774	280	735	776				.171/176	.229/238		.010	.010
140	742	782	281	744	784				.172/177	.230/239		.010	.010
141	751	790	282	753	792				.173/178	.231/240		.010	.010
142	760	798	283	762	800				.174/179	.232/241		.010	.010
143	769	806	284	771	808				.175/180	.233/242		.010	.010
144	778	814	285	780	816				.176/181	.234/243		.010	.010
145	787	822	286	789	824				.177/182	.235/244		.010	.010
146	796	830	287	798	832				.178/183	.236/245		.010	.010
147	805	838	288	807	840				.179/184	.237/246		.010	.010
148	814	846	289	816	848				.180/185	.238/247		.010	.010
149	823	854	290	825	856				.181/186	.239/248		.010	.010



ROD SEAL INSTALLATION PER AS4716 REVISION A

FOR ZERO, ONE & TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

- NOTES:
- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR UNI-DIRECTIONAL WEDGPAK® II IN AS4716 REVISION A PISTON GLANDS.
 - ORDERING EXAMPLE:
UNI-DIRECTIONAL WEDGPAK® II
ROD DESIGNATOR RAU 0.0 G 214 A II 9 NG
BACKUP WIDTH
0 = ZERO BACKUP WIDTH
1 = ONE BACKUP WIDTH
2 = TWO BACKUP WIDTH
DELTA BACKUP RING DESIGN
0 = SOLID DELTA BACKUP RINGS
C = CUT DELTA BACKUP RINGS
GLAND DESIGNATOR
SIZE DESIGNATOR
DESIGNATOR TO AS4716 REVISION A
TURCON® DELTA BACKUP RING MAT'L. CODE
A = AEROSPACE CERTIFICATE OF CONFORMANCE
T = TUREL® ELASTOMER MAT'L. CODE
QUALITY INDEX:
CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

- SCARB CUT DELTA BACKUP RINGS ARE ONLY AVAILABLE IN ZERO BACKUP WIDTH SIZES: -004 THROUGH -020, -104 THROUGH -132, -210 -230 & -325 THROUGH -342 ONE BACKUP WIDTH SIZES: -004 THROUGH -028, -104 THROUGH -142, -210 -236, -325 THROUGH -349 & -425 THROUGH -440 TWO BACKUP WIDTH SIZES: -004 THROUGH -028, -104 THROUGH -149, -210 -244, -325 THROUGH -349 & -425 THROUGH -447
- SOME ELASTOMER MATERIALS ELONGATION LIMITS IN COMBINATION WITH THE DIAMETER OF THE SEAL I.D. PRECLUDE THE INSTALLATION OF THE TURCON WEDGPAK INTO CLOSED GROOVES BY CIRCUMFERENTIAL STRETCHING, BEFORE USING -004 TO -014 AND -104 TO -117 CONSULT YOUR TSS SALES ENGINEER.

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INCH	2009_1
TITLE	UNI-DIRECTIONAL WEDGPAK II, ROD
DRAWING NO.	RAU00G00
TRELLEBERG SEALING SOLUTIONS	

Seals/Back-up
Rings for AS4716

Turcon[®] Wedgpak[®] II

DASH NO.	A DIA.	F DIA.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	G ₀ ZERO BACKUP WIDTH	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	1.90	0.76	210	3.91	435	6.284	5.747	.004-.009	.054/164	.210/220	.005/.015	.004
005	2.21	1.03	211	6.349	436	6.349	5.872	.010-.016	.150/160	.207/.217	.005/015	.005
006	2.63	1.48	212	8.794	437	6.417	6.000	.016-.022	.150/160	.207/.217	.005/015	.005
007	2.63	1.48	213	1.178	438	6.724	6.247	.014-.019	.150/160	.207/.217	.005/015	.004
008	2.97	1.89	214	1.241	439	6.974	6.497	.010-.016	.183/193	.245/255	.005/015	.005
009	3.29	2.20	215	1.303	440	7.224	6.747	.012-.017	.183/193	.245/255	.005/015	.006
010	3.60	2.50	216	1.366	441	7.474	6.997	.013-.018	.183/193	.245/255	.005/015	.006
011	4.22	3.12	217	1.428	442	7.724	7.247	.015-.020	.235/245	.304/314	.010/025	.007
012	4.22	3.12	218	1.488	443	7.974	7.497	.011-.016	.235/245	.304/314	.010/025	.006
013	4.85	3.75	219	1.551	444	8.224	7.747	.017-.022	.235/245	.304/314	.010/025	.007
014	5.50	4.41	220	1.616	445	8.474	7.997	.018-.023	.235/245	.304/314	.010/025	.007
015	6.13	5.04	221	1.678	446	8.724	8.247	.024-.029	.281/291	.424/434	.020/035	.008
016	6.75	5.66	222	1.741	447	8.974	8.497	.020-.025	.281/291	.424/434	.020/035	.008
017	7.38	6.29	223	1.804	448	9.224	8.747	.026-.031	.334/344	.475/485	.020/035	.009
018	7.38	6.29	224	1.863	449	9.474	8.997	.022-.027	.334/344	.475/485	.020/035	.009
019	7.38	6.29	225	1.922	450	9.724	9.247	.028-.033	.375/385	.579/589	.020/035	.010
020	7.38	6.29	226	1.981	451	9.974	9.497	.024-.029	.375/385	.579/589	.020/035	.010
021	8.00	6.91	227	2.043	452	10.224	9.747	.030-.035	.447/460			.010
022	8.00	6.91	228	2.102	453	10.474	9.997	.026-.031	.447/460			.010
023	8.00	6.91	229	2.161	454	10.724	10.247	.032-.037				.010
024	8.00	6.91	230	2.220	455	10.974	10.497	.028-.033				.010
025	8.63	7.54	231	2.281	456	11.224	10.747	.034-.039				.010
026	9.25	8.15	232	2.343	457	11.474	10.997	.030-.035				.010
027	9.91	8.81	233	2.406	458	11.724	11.247	.036-.041				.010
028	10.53	9.43	234	2.468	459	11.974	11.497	.032-.037				.010
029	11.16	10.06	235	2.531	460	12.224	11.747	.038-.043				.010
030	11.78	10.68	236	2.594	461	12.474	11.997	.034-.039				.010
031	12.41	11.31	237	2.656	462	12.724	12.247	.040-.045				.010
032	13.03	11.93	238	2.719	463	12.974	12.497	.036-.041				.010
033	13.66	12.56	239	2.782	464	13.224	12.747	.042-.047				.010
034	14.28	13.18	240	2.845	465	13.474	12.997	.038-.043				.010
035	14.91	13.81	241	2.908	466	13.724	13.247	.044-.049				.010
036	15.53	14.43	242	2.971	467	13.974	13.497	.040-.045				.010
037	16.16	15.06	243	3.034	468	14.224	13.747	.046-.051				.010
038	16.78	15.68	244	3.097	469	14.474	13.997	.042-.047				.010
039	17.41	16.31	245	3.160	470	14.724	14.247	.048-.053				.010
040	18.03	16.93	246	3.223	471	14.974	14.497	.044-.049				.010
041	18.66	17.56	247	3.286	472	15.224	14.747	.050-.055				.010
042	19.28	18.18	248	3.349	473	15.474	14.997	.046-.051				.010
043	19.91	18.81	249	3.412	474	15.724	15.247	.052-.057				.010
044	20.53	19.43	250	3.475	475	15.974	15.497	.048-.053				.010
045	21.16	20.06	251	3.538	476	16.224	15.747	.054-.059				.010
046	21.78	20.68	252	3.601	477	16.474	15.997	.050-.055				.010
047	22.41	21.31	253	3.664	478	16.724	16.247	.056-.061				.010
048	23.03	21.93	254	3.727	479	16.974	16.497	.052-.057				.010
049	23.66	22.56	255	3.790	480	17.224	16.747	.058-.063				.010
050	24.28	23.18	256	3.853	481	17.474	16.997	.054-.059				.010
051	24.91	23.81	257	3.916	482	17.724	17.247	.060-.065				.010
052	25.53	24.43	258	3.979	483	17.974	17.497	.056-.061				.010
053	26.16	25.06	259	4.042	484	18.224	17.747	.062-.067				.010
054	26.78	25.68	260	4.105	485	18.474	17.997	.058-.063				.010
055	27.41	26.31	261	4.168	486	18.724	18.247	.064-.069				.010
056	28.03	26.93	262	4.231	487	18.974	18.497	.060-.065				.010
057	28.66	27.56	263	4.294	488	19.224	18.747	.066-.071				.010
058	29.28	28.18	264	4.357	489	19.474	18.997	.062-.067				.010
059	29.91	28.81	265	4.420	490	19.724	19.247	.068-.073				.010
060	30.53	29.43	266	4.483	491	19.974	19.497	.064-.069				.010
061	31.16	30.06	267	4.546	492	20.224	19.747	.070-.075				.010
062	31.78	30.68	268	4.609	493	20.474	19.997	.066-.071				.010
063	32.41	31.31	269	4.672	494	20.724	20.247	.072-.077				.010
064	33.03	31.93	270	4.735	495	20.974	20.497	.068-.073				.010
065	33.66	32.56	271	4.798	496	21.224	20.747	.074-.079				.010
066	34.28	33.18	272	4.861	497	21.474	20.997	.070-.075				.010
067	34.91	33.81	273	4.924	498	21.724	21.247	.076-.081				.010
068	35.53	34.43	274	4.987	499	21.974	21.497	.072-.077				.010
069	36.16	35.06	275	5.050	500	22.224	21.747	.078-.083				.010
070	36.78	35.68	276	5.113	501	22.474	21.997	.074-.079				.010
071	37.41	36.31	277	5.176	502	22.724	22.247	.080-.085				.010
072	38.03	36.93	278	5.239	503	22.974	22.497	.076-.081				.010
073	38.66	37.56	279	5.302	504	23.224	22.747	.082-.087				.010
074	39.28	38.18	280	5.365	505	23.474	22.997	.078-.083				.010
075	39.91	38.81	281	5.428	506	23.724	23.247	.084-.089				.010
076	40.53	39.43	282	5.491	507	23.974	23.497	.080-.085				.010
077	41.16	40.06	283	5.554	508	24.224	23.747	.086-.091				.010
078	41.78	40.68	284	5.617	509	24.474	23.997	.082-.087				.010
079	42.41	41.31	285	5.680	510	24.724	24.247	.088-.093				.010
080	43.03	41.93	286	5.743	511	24.974	24.497	.084-.089				.010
081	43.66	42.56	287	5.806	512	25.224	24.747	.090-.095				.010
082	44.28	43.18	288	5.869	513	25.474	24.997	.086-.091				.010
083	44.91	43.81	289	5.932	514	25.724	25.247	.092-.097				.010
084	45.53	44.43	290	5.995	515	25.974	25.497	.088-.093				.010
085	46.16	45.06	291	6.058	516	26.224	25.747	.094-.099				.010
086	46.78	45.68	292	6.121	517	26.474	25.997	.090-.095				.010
087	47.41	46.31	293	6.184	518	26.724	26.247	.096-.101				.010
088	48.03	46.93	294	6.247	519	26.974	26.497	.092-.097				.010
089	48.66	47.56	295	6.310	520	27.224	26.747	.098-.103				.010
090	49.28	48.18	296	6.373	521	27.474	26.997	.094-.099				.010
091	49.91	48.81	297	6.436	522	27.724	27.247	.100-.105				.010
092	50.53	49.43	298	6.499	523	27.974	27.497	.096-.101				.010
093	51.16	50.06	299	6.562	524	28.224	27.747	.102-.107				.010
094	51.78	50.68	300	6.625	525	28.474	27.997	.098-.103				.010
095	52.41	51.31	301	6.688	526	28.724	28.247	.104-.109				.010
096	53.03	51.93	302	6.751	527	28.974	28.497	.100-.105				.010
097	53.66	52.56	303	6.814	528	29.224	28.747	.106-.111				.010
098	54.28	53.18	304	6.877	529	29.474	28.997	.102-.107				.010
099	54.91	53.81	305	6.940	530	29.724	29.247	.108-.113				.010
100	55.53	54.43	306	7.003	531	29.974	29.497	.104-.109				.010
101	56.16	55.06	307	7.066	532	30.224	29.747	.110-.115				.010
102	56.78	55.68	308	7.129	533	30.474	29.997	.106-.111				.010
103	57.41	56.31	309	7.192	534	30.724	30.247	.112-.117				.010
104	58.03	56.93	310	7.255	535	30.974	30.497	.108-.113				.010
105	58.66	57.56	311	7.318	536	31.224	30.747	.114-.119				.010
106	59.28	58.18	312	7.381	537	31.474	30.997	.110-.115				.010
107												

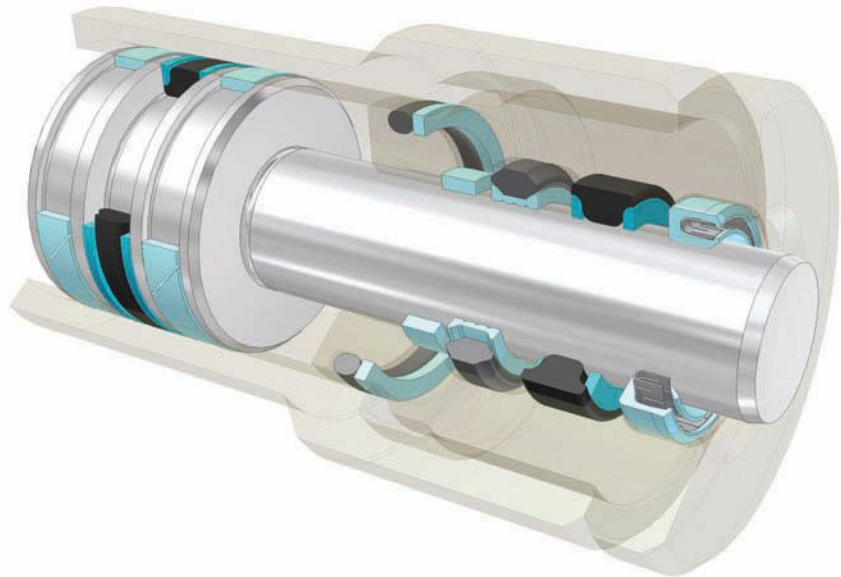
Turcon® Wedgpak® II

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	G ₀ ZERO BACKUP WIDTH	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
	+0.001 -0.001	+0.001 -0.001		+0.003 -0.003	+0.003 -0.003		+0.003 -0.003	+0.003 -0.003		+0.003 -0.003	+0.003 -0.003					
004	.190	.076	210	1.100	0.436	435	6.224	5.747	004	.004	.004	.098/.103	.154/.164	.210/.220	.005/.015	.004
005	.205	.088	211	1.116	.452	436	6.312	5.834	005	.004	.004	.102/.106	.158/.168	.214/.224	.005	.004
006	.220	.100	212	1.132	.468	437	6.400	5.920	006	.004	.004	.106/.110	.162/.172	.218/.228	.005	.004
007	.235	.112	213	1.148	.484	438	6.488	6.006	007	.004	.004	.110/.114	.166/.176	.222/.232	.005	.004
008	.250	.124	214	1.164	.500		6.576	6.092	008	.005	.005	.114/.118	.170/.180	.226/.236	.006	.005
009	.265	.136	215	1.180	.516	439	6.664	6.178	009	.005	.005	.118/.122	.174/.184	.230/.240	.006	.006
010	.280	.148	216	1.196	.532	440	6.752	6.264	010	.006	.006	.122/.126	.178/.188	.234/.244	.006	.006
011	.295	.160	217	1.212	.548	441	6.840	6.350	011	.006	.006	.126/.130	.182/.192	.238/.248	.006	.006
012	.310	.172	218	1.228	.564	442	6.928	6.436	012	.007	.007	.130/.134	.186/.196	.242/.252	.007	.007
013	.325	.184	219	1.244	.580	443	7.016	6.522	013	.007	.007	.134/.138	.190/.200	.246/.256	.007	.007
014	.340	.196	220	1.260	.596	444	7.104	6.608	014	.008	.008	.138/.142	.194/.204	.250/.260	.008	.008
015	.355	.208	221	1.276	.612	445	7.192	6.694	015	.008	.008	.142/.146	.198/.208	.254/.264	.008	.008
016	.370	.220	222	1.292	.628	446	7.280	6.780	016	.009	.009	.146/.150	.202/.212	.258/.268	.009	.009
017	.385	.232	223	1.308	.644		7.368	6.866	017	.009	.009	.150/.154	.206/.216	.262/.272	.009	.009
018	.400	.244	224	1.324	.660	447	7.456	6.952	018	.010	.010	.154/.158	.210/.220	.266/.276	.010	.010
019	.415	.256	225	1.340	.676	448	7.544	7.038	019	.010	.010	.158/.162	.214/.224	.270/.280	.010	.010
020	.430	.268	226	1.356	.692	449	7.632	7.124	020	.011	.011	.162/.166	.218/.228	.274/.284	.011	.011
021	.445	.280	227	1.372	.708	450	7.720	7.210	021	.011	.011	.166/.170	.222/.232	.278/.288	.011	.011
022	.460	.292	228	1.388	.724	451	7.808	7.296	022	.012	.012	.170/.174	.226/.236	.282/.292	.012	.012
023	.475	.304	229	1.404	.740	452	7.896	7.382	023	.012	.012	.174/.178	.230/.240	.286/.296	.012	.012
024	.490	.316	230	1.420	.756	453	7.984	7.468	024	.013	.013	.178/.182	.234/.244	.290/.300	.013	.013
025	.505	.328	231	1.436	.772	454	8.072	7.554	025	.013	.013	.182/.186	.238/.248	.294/.304	.013	.013
026	.520	.340	232	1.452	.788	455	8.160	7.640	026	.014	.014	.186/.190	.242/.252	.298/.308	.014	.014
027	.535	.352	233	1.468	.804	456	8.248	7.726	027	.014	.014	.190/.194	.246/.256	.302/.312	.014	.014
028	.550	.364	234	1.484	.820	457	8.336	7.812	028	.015	.015	.194/.198	.250/.260	.306/.316	.015	.015
029	.565	.376	235	1.500	.836	458	8.424	7.898	029	.015	.015	.198/.202	.254/.264	.310/.320	.015	.015
030	.580	.388	236	1.516	.852	459	8.512	7.984	030	.016	.016	.202/.206	.258/.268	.314/.324	.016	.016
031	.595	.400	237	1.532	.868	460	8.600	8.070	031	.016	.016	.206/.210	.262/.272	.318/.328	.016	.016
032	.610	.412	238	1.548	.884		8.688	8.156	032	.017	.017	.210/.214	.266/.276	.322/.332	.017	.017
033	.625	.424	239	1.564	.900		8.776	8.242	033	.017	.017	.214/.218	.270/.280	.326/.336	.017	.017
034	.640	.436	240	1.580	.916		8.864	8.328	034	.018	.018	.218/.222	.274/.284	.330/.340	.018	.018
035	.655	.448	241	1.596	.932	325	8.952	8.414	035	.018	.018	.222/.226	.278/.288	.334/.344	.018	.018
036	.670	.460	242	1.612	.948	326	9.040	8.500	036	.019	.019	.226/.230	.282/.292	.338/.348	.019	.019
037	.685	.472	243	1.628	.964	327	9.128	8.586	037	.019	.019	.230/.234	.286/.296	.342/.352	.019	.019
038	.700	.484	244	1.644	.980	328	9.216	8.672	038	.020	.020	.234/.238	.290/.300	.346/.356	.020	.020
039	.715	.496	245	1.660	.996	329	9.304	8.758	039	.020	.020	.238/.242	.294/.304	.350/.360	.020	.020
040	.730	.508	246	1.676	.1012	330	9.392	8.844	040	.021	.021	.242/.246	.298/.308	.354/.364	.021	.021
041	.745	.520	247	1.692	.1024	331	9.480	8.930	041	.021	.021	.246/.250	.302/.312	.358/.368	.021	.021
042	.760	.532	248	1.708	.1036	332	9.568	9.016	042	.022	.022	.250/.254	.306/.316	.362/.372	.022	.022
043	.775	.544	249	1.724	.1048	333	9.656	9.102	043	.022	.022	.254/.258	.310/.320	.366/.376	.022	.022
044	.790	.556	250	1.740	.1060	334	9.744	9.188	044	.023	.023	.258/.262	.314/.324	.370/.380	.023	.023
045	.805	.568	251	1.756	.1072	335	9.832	9.274	045	.023	.023	.262/.266	.318/.328	.374/.384	.023	.023
046	.820	.580	252	1.772	.1084	336	9.920	9.360	046	.024	.024	.266/.270	.322/.332	.378/.388	.024	.024
047	.835	.592	253	1.788	.1096	337	10.008	9.446	047	.024	.024	.270/.274	.326/.336	.382/.392	.024	.024
048	.850	.604	254	1.804	.1108	338	10.096	9.532	048	.025	.025	.274/.278	.330/.340	.386/.396	.025	.025
049	.865	.616	255	1.820	.1120	339	10.184	9.618	049	.025	.025	.278/.282	.334/.344	.390/.400	.025	.025
050	.880	.628	256	1.836	.1132	340	10.272	9.704	050	.026	.026	.282/.286	.338/.348	.394/.404	.026	.026
051	.895	.640	257	1.852	.1144	341	10.360	9.790	051	.026	.026	.286/.290	.342/.352	.398/.408	.026	.026
052	.910	.652	258	1.868	.1156	342	10.448	9.876	052	.027	.027	.290/.294	.346/.356	.402/.412	.027	.027
053	.925	.664	259	1.884	.1168	343	10.536	9.962	053	.027	.027	.294/.298	.350/.360	.406/.416	.027	.027
054	.940	.676	260	1.900	.1180	344	10.624	10.048	054	.028	.028	.298/.302	.354/.364	.410/.420	.028	.028
055	.955	.688	261	1.916	.1192	345	10.712	10.134	055	.028	.028	.302/.306	.358/.368	.414/.424	.028	.028
056	.970	.700	262	1.932	.1204	346	10.800	10.220	056	.029	.029	.306/.310	.362/.372	.418/.428	.029	.029
057	.985	.712	263	1.948	.1216	347	10.888	10.306	057	.029	.029	.310/.314	.366/.376	.422/.432	.029	.029
058	.1000	.724	264	1.964	.1228	348	10.976	10.392	058	.030	.030	.314/.318	.370/.380	.426/.436	.030	.030
059	.1015	.736	265	1.980	.1240	349	11.064	10.478	059	.030	.030	.318/.322	.374/.384	.430/.440	.030	.030
060	.1030	.748	266	1.996	.1252	350	11.152	10.564	060	.031	.031	.322/.326	.378/.388	.434/.444	.031	.031
061	.1045	.760	267	2.012	.1264	351	11.240	10.650	061	.031	.031	.326/.330	.382/.392	.438/.448	.031	.031
062	.1060	.772	268	2.028	.1276	352	11.328	10.736	062	.032	.032	.330/.334	.386/.396	.442/.452	.032	.032
063	.1075	.784	269	2.044	.1288	353	11.416	10.822	063	.032	.032	.334/.338	.390/.400	.446/.456	.032	.032
064	.1090	.796	270	2.060	.1300	354	11.504	10.908	064	.033	.033	.338/.342	.394/.404	.450/.460	.033	.033
065	.1105	.808	271	2.076	.1312	355	11.592	10.994	065	.033	.033	.342/.346	.398/.408	.454/.464	.033	.033
066	.1120	.820	272	2.092	.1324	356	11.680	11.080	066	.034	.034	.346/.350	.402/.412	.458/.468	.034	.034
067	.1135	.832	273	2.108	.1336	357	11.768	11.166	067	.034	.034	.350/.354	.406/.416	.462/.472	.034	.034
068	.1150	.844	274	2.124	.1348	358	11.856	11.252	068	.035	.035	.354/.358	.410/.420	.466/.476	.035	.035
069	.1165	.856	275	2.140	.1360	359	11.944	11.338	069	.035	.035	.358/.362	.414/.424	.470/.480	.035	.035
070	.1180	.868	276	2.156	.1372	360	12.032	11.424	070	.036	.036	.362/.366	.418/.428	.474/.484	.036	.036
071	.1195	.880	277	2.172	.1384	361	12.120	11.510	071	.036	.036	.366/.370	.422/.432	.478/.488	.036	.036
072	.1210	.892	278	2.188	.1396	362	12.208	11.596	072	.037	.037	.370/.374	.426/.436	.482/.492	.037	.037
073	.1225	.904	279	2.204	.1408	363	12.296	11.682	073	.037	.037	.374/.378	.430/.440	.486/.496	.037	.037
074	.1240	.916	280	2.220	.1420	364	12.384	11.768	074	.038	.038	.378/.382	.434/.444	.490/.500	.038	.038
075	.1255	.928	281	2.236	.1432	365	12.472	11.854	075	.038	.038	.382/.386	.438/.448	.494/.504	.038	.038
076	.1270	.940	282	2.252	.1444	366	12.560	11.940	076	.039	.039	.386/.390	.442/.452	.498/.508	.039	.039
077	.1285	.952	283	2.268	.1456	367	12.648	12.026	077	.039	.039	.390/.394	.446/.456	.502/.512	.039	.039
078	.1300	.964	284	2.284	.1468	368										

Turcon® T-Seal

Features and benefits

- Good static and light-duty dynamic sealing effect
- Excellent resistance to rolling within the gland
- Excellent extrusion resistance
- Provides bidirectional sealing
- Preferred option for media separation, such as fluid/gas or fluid/fluid
- Tandem version maximizes extrusion resistance at system pressures above 5,000 psi/ 35 MPa
- Available in flash-free version
- Sizes to suit all O-Ring glands including MIL-G-5514F and AS4716
- Approved for a large number of National Stock Numbers (NSN)



Seals/Back-up
Rings for AS4716

Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® T-Seal.

Turcon® T-Seal

Description

Turcon® T-Seal consists of a T-shaped elastomer sealing element supported by Turcon® Back-up Rings on both sides. This combination results in a stable seal, the semi-circular lip configuration ensuring positive sealing. The side flanges, which form the seal's base offer excellent resistance to rolling and act as an effective platform to position and energize the anti-extrusion rings.

Turcon® T-Seal is ideal for light applications, both as a rod or piston seal, where they provide long-life, maximized leakage control and excellent extrusion protection.

A full range of sizes is offered to suit all MIL-G-5514F and AS4716 glands.

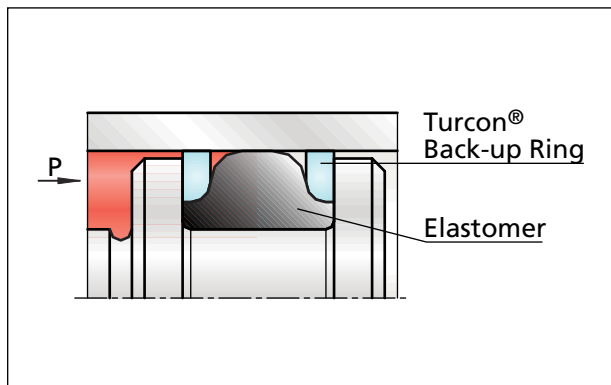


Figure 1 Turcon® T-Seal

Method of Operation

Due to its large elastomer footprint Turcon® T-Seal is a good static seal with high reliability. Providing bidirectional sealing, it is the preferred option for media separation, such as fluid/gas or fluid/fluid.

The one or two Back-up Ring widths offer especially good protection against extrusion. This is due to the additional material volume of the Back-up Rings compared to zero Back-up Ring widths.

An alternative is Tandem Turcon® T-Seal. This utilizes a co-modulus Back-up Ring design to prevent abrasion of the elastomer component. It maximizes extrusion resistance of the sealing assembly at system pressures above 5,000 psi/ 35 MPa. This is even the case in application conditions where optimum seal performance is difficult, such as large hardware clearances. The inner anti-abrasion ring is usually made from softer Turcon® T01 or virgin PTFE, while the outer anti-extrusion ring is made from a high modulus material like polyimide or PEEK™.

Technical Data

Operation pressure:	5,000 psi/ 35 MPa static 3,000 psi/ 21 MPa dynamic
Speed:	9.8 ft/s/ 3.0 m/s or higher for non-continuous or intermittent use
Temperature range:	-65°F to +390°F/ -54°C to +200°C depending on elastomer
Clearance:	As per AS4716 Larger with tandem Back-up Ring configuration
Media:	Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Series

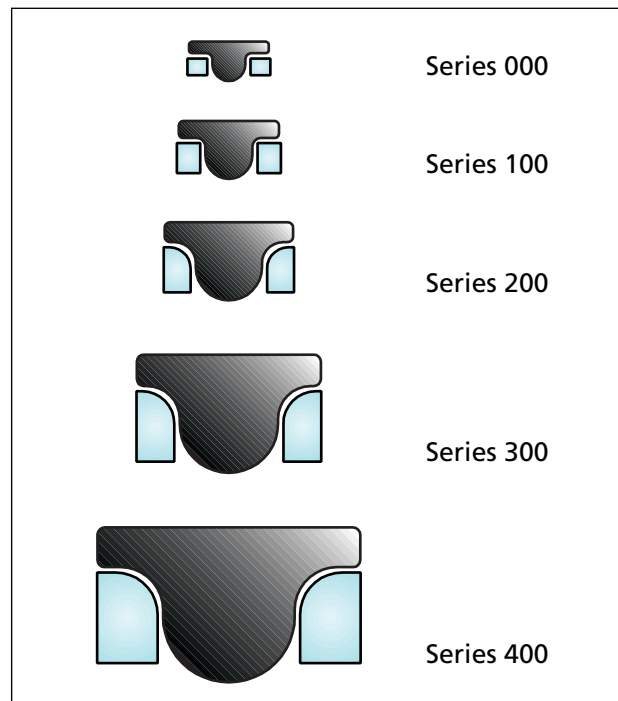
















Figure 2 Relative Size of Turcon® T-Seal cross section

Turcon® T-Seal

Table I Turcon® T-Seal Types

Seal	Turcon® T-Seal		
	Width		
Type	0 BUR (G0)	1 BUR (G1)	2 BUR (G2)
Rod with BUR AS4716 Rev. A	 RBA0_G	 RBA1_G	 RBA2_G
Piston with BUR AS4716 Rev. A	 PBA0_G	 PBA1_G	 PBA2_G
Rod with BUR MIL-G-5514 F	 RB10_M (old p/n S38410)	 RB11_M (old p/n S38411)	 RB12_M (old p/n S38412)
Piston with BUR MIL-G-5514 F	 PB20_M (old p/n S38420)	 PB21_M (old p/n S38421)	 PB22_M (old p/n S38422)
Tandem (Staged) Rod	N/A	N/A	 RBB2_G
Tandem (Staged) Piston	N/A	N/A	 PBB2_G

- G denotes groove width; zero, one or two back-up width
- BUR - Back-up Ring

The elongation limits of some elastomer materials in combination with the diameter of the seal I.D. prevent the installation of Turcon® T-Seal into closed piston (O.D.) grooves by circumferential stretching. Check the correct installation method with your Trelleborg Sealing Solutions marketing company before using Turcon® T-Seal part numbers beginning with PB in dash sizes -004 to -009 and -104 to -109.

Profiles in color are recommended configurations.

Seals/Back-up
Rings for AS4716

Turcon® T-Seal

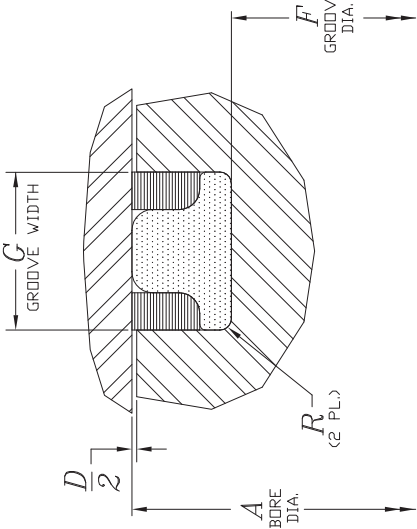
DASH NO.	B DIA. +.000/-0.001	E DIA. +.001/-0.001	DASH NO.	B DIA. +.000/-0.001	E DIA. +.000/-0.001	DASH NO.	B DIA. +.003/-0.003	E DIA. +.003/-0.003
004	.076	.190	210	.748	.989	435	5.747	6.624
005	.081	.213	211	.773	1.016	436	5.824	6.724
006	.086	.236	212	.797	1.040	437	5.925	6.825
007	.091	.259	213	.822	1.064	438	6.026	6.926
008	.096	.283	214	.846	1.088	439	6.127	7.027
009	.101	.307	215	.871	1.112	440	6.228	7.128
010	.106	.330	216	.895	1.136	441	6.329	7.229
011	.111	.354	217	.920	1.160	442	6.430	7.330
012	.116	.378	218	.944	1.184	443	6.531	7.431
013	.121	.402	219	.969	1.208	444	6.632	7.532
014	.126	.426	220	.993	1.232	445	6.733	7.633
015	.131	.450	221	1.017	1.256	446	6.834	7.734
016	.136	.474	222	1.041	1.280	447	6.935	7.835
017	.141	.498	223	1.065	1.304	448	7.036	7.936
018	.146	.522	224	1.089	1.328	449	7.137	8.037
019	.151	.546	225	1.113	1.352	450	7.238	8.138
020	.156	.570	226	1.137	1.376	451	7.339	8.239
021	.161	.594	227	1.161	1.400	452	7.440	8.340
022	.166	.618	228	1.185	1.424	453	7.541	8.441
023	.171	.642	229	1.209	1.448	454	7.642	8.542
024	.176	.666	230	1.233	1.472	455	7.743	8.643
025	.181	.690	231	1.257	1.496	456	7.844	8.744
026	.186	.714	232	1.281	1.520	457	7.945	8.845
027	.191	.738	233	1.305	1.544	458	8.046	8.946
028	.196	.762	234	1.329	1.568	459	8.147	9.047
029	.201	.786	235	1.353	1.592	460	8.248	9.148
030	.206	.810	236	1.377	1.616			
031	.211	.834	237	1.401	1.640			
032	.216	.858	238	1.425	1.664			
033	.221	.882	239	1.449	1.688			
034	.226	.906	240	1.473	1.712			
035	.231	.930	241	1.497	1.736			
036	.236	.954	242	1.521	1.760			
037	.241	.978	243	1.545	1.784			
038	.246	.1002	244	1.569	1.808			
039	.251	.1026	245	1.593	1.832			
040	.256	.1050	246	1.617	1.856			
041	.261	.1074	247	1.641	1.880			
042	.266	.1098	248	1.665	1.904			
043	.271	.1122	249	1.689	1.928			
044	.276	.1146	250	1.713	1.952			
045	.281	.1170	251	1.737	1.976			
046	.286	.1194	252	1.761	2.000			
047	.291	.1218	253	1.785	2.024			
048	.296	.1242	254	1.809	2.048			
049	.301	.1266	255	1.833	2.072			
050	.306	.1290	256	1.857	2.096			
051	.311	.1314	257	1.881	2.120			
052	.316	.1338	258	1.905	2.144			
053	.321	.1362	259	1.929	2.168			
054	.326	.1386	260	1.953	2.192			
055	.331	.1410	261	1.977	2.216			
056	.336	.1434	262	2.001	2.240			
057	.341	.1458	263	2.025	2.264			
058	.346	.1482	264	2.049	2.288			
059	.351	.1506	265	2.073	2.312			
060	.356	.1530	266	2.097	2.336			
061	.361	.1554	267	2.121	2.360			
062	.366	.1578	268	2.145	2.384			
063	.371	.1602	269	2.169	2.408			
064	.376	.1626	270	2.193	2.432			
065	.381	.1650	271	2.217	2.456			
066	.386	.1674	272	2.241	2.480			
067	.391	.1698	273	2.265	2.504			
068	.396	.1722	274	2.289	2.528			
069	.401	.1746	275	2.313	2.552			
070	.406	.1770	276	2.337	2.576			
071	.411	.1794	277	2.361	2.600			
072	.416	.1818	278	2.385	2.624			
073	.421	.1842	279	2.409	2.648			
074	.426	.1866	280	2.433	2.672			
075	.431	.1890	281	2.457	2.696			
076	.436	.1914	282	2.481	2.720			
077	.441	.1938	283	2.505	2.744			
078	.446	.1962	284	2.529	2.768			
079	.451	.1986	285	2.553	2.792			
080	.456	.2010	286	2.577	2.816			
081	.461	.2034	287	2.601	2.840			
082	.466	.2058	288	2.625	2.864			
083	.471	.2082	289	2.649	2.888			
084	.476	.2106	290	2.673	2.912			
085	.481	.2130	291	2.697	2.936			
086	.486	.2154	292	2.721	2.960			
087	.491	.2178	293	2.745	2.984			
088	.496	.2202	294	2.769	3.008			
089	.501	.2226	295	2.793	3.032			
090	.506	.2250	296	2.817	3.056			
091	.511	.2274	297	2.841	3.080			
092	.516	.2298	298	2.865	3.104			
093	.521	.2322	299	2.889	3.128			
094	.526	.2346	300	2.913	3.152			
095	.531	.2370	301	2.937	3.176			
096	.536	.2394	302	2.961	3.200			
097	.541	.2418	303	2.985	3.224			
098	.546	.2442	304	3.009	3.248			
099	.551	.2466	305	3.033	3.272			
100	.556	.2490	306	3.057	3.296			
101	.561	.2514	307	3.081	3.320			
102	.566	.2538	308	3.105	3.344			
103	.571	.2562	309	3.129	3.368			
104	.576	.2586	310	3.153	3.392			
105	.581	.2610	311	3.177	3.416			
106	.586	.2634	312	3.201	3.440			
107	.591	.2658	313	3.225	3.464			
108	.596	.2682	314	3.249	3.488			
109	.601	.2706	315	3.273	3.512			
110	.606	.2730	316	3.297	3.536			
111	.611	.2754	317	3.321	3.560			
112	.616	.2778	318	3.345	3.584			
113	.621	.2802	319	3.369	3.608			
114	.626	.2826	320	3.393	3.632			
115	.631	.2850	321	3.417	3.656			
116	.636	.2874	322	3.441	3.680			
117	.641	.2898	323	3.465	3.704			
118	.646	.2922	324	3.489	3.728			
119	.651	.2946	325	3.513	3.752			
120	.656	.2970	326	3.537	3.776			
121	.661	.2994	327	3.561	3.800			
122	.666	.3018	328	3.585	3.824			
123	.671	.3042	329	3.609	3.848			
124	.676	.3066	330	3.633	3.872			
125	.681	.3090	331	3.657	3.896			
126	.686	.3114	332	3.681	3.920			
127	.691	.3138	333	3.705	3.944			
128	.696	.3162	334	3.729	3.968			
129	.701	.3186	335	3.753	3.992			
130	.706	.3210	336	3.777	4.016			
131	.711	.3234	337	3.801	4.040			
132	.716	.3258	338	3.825	4.064			
133	.721	.3282	339	3.849	4.088			
134	.726	.3306	340	3.873	4.112			
135	.731	.3330	341	3.897	4.136			
136	.736	.3354	342	3.921	4.160			
137	.741	.3378	343	3.945	4.184			
138	.746	.3402	344	3.969	4.208			
139	.751	.3426	345	3.993	4.232			
140	.756	.3450	346	4.017	4.256			
141	.761	.3474	347	4.041	4.280			
142	.766	.3498	348	4.065	4.304			
143	.771	.3522	349	4.089	4.328			
144	.776	.3546	350	4.113	4.352			
145	.781	.3570	351	4.137	4.376			
146	.786	.3594	352	4.161	4.400			
147	.791	.3618	353	4.185	4.424			
148	.796	.3642	354	4.209	4.448			
149	.801	.3666	355	4.233	4.472			
150	.806	.3690	356	4.257	4.496			
151	.811	.3714	357	4.281	4.520			
152	.816	.3738	358	4.305	4.544			
153	.821	.3762	359	4.329	4.568			
154	.826	.3786	360	4.353	4.592			
155	.831	.3810	361	4.377	4.616			
156	.836	.3834	362	4.401	4.640			
157	.841	.3858	363	4.425	4.664			
158	.846	.3882	364	4.449	4.688			
159	.851	.3906	365	4.473	4.712			
160	.856	.3930	366	4.497	4.736			
161	.861	.3954	367	4.521	4.760			
162	.866	.3978	368	4.545	4.784			
163	.871	.4002	369	4.569	4.808			
164	.876	.4026	370	4.593	4.832			
165	.881	.4050	371	4.617	4.856			
166	.886	.4074	372	4.641	4.880			
167	.891	.4098	373	4.665	4.904			
168	.896	.4122	374	4.689	4.928			
169	.901	.4146	375	4.713	4.952			
170	.906	.4170	376	4.737	4.976			
171	.911	.4194	377	4.761	5.000			
172								

Turcon® T-Seal

DASH NO.		B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	DASH NO.	B DIA.	E DIA.	G ₂ BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	076	+0.001	+0.002	210	078	+0.002	435	078	+0.003	435	078	+0.003	435	078	+0.003	435	078	+0.003	.210/.220	.005/.015	.004
005	106	+0.001	+0.002	211	106	+0.002	436	106	+0.003	436	106	+0.003	436	106	+0.003	436	106	+0.003	.207/.217	.005/.015	.004
006	136	+0.001	+0.002	212	136	+0.002	437	136	+0.003	437	136	+0.003	437	136	+0.003	437	136	+0.003			
007	166	+0.001	+0.002	213	166	+0.002	438	166	+0.003	438	166	+0.003	438	166	+0.003	438	166	+0.003			
008	185	+0.001	+0.002	214	185	+0.002	439	185	+0.003	439	185	+0.003	439	185	+0.003	439	185	+0.003			
009	217	+0.001	+0.002	215	217	+0.002	440	217	+0.003	440	217	+0.003	440	217	+0.003	440	217	+0.003	.245/.255	.005/.015	.006
010	248	+0.001	+0.002	216	248	+0.002	441	248	+0.003	441	248	+0.003	441	248	+0.003	441	248	+0.003			
011	310	+0.001	+0.002	217	310	+0.002	442	310	+0.003	442	310	+0.003	442	310	+0.003	442	310	+0.003			
012	385	+0.001	+0.002	218	385	+0.002	443	385	+0.003	443	385	+0.003	443	385	+0.003	443	385	+0.003			
013	435	+0.001	+0.002	219	435	+0.002	444	435	+0.003	444	435	+0.003	444	435	+0.003	444	435	+0.003			
014	498	+0.001	+0.002	220	498	+0.002	445	498	+0.003	445	498	+0.003	445	498	+0.003	445	498	+0.003	.304/.314	.010/.025	.007
015	560	+0.001	+0.002	221	560	+0.002	446	560	+0.003	446	560	+0.003	446	560	+0.003	446	560	+0.003			
016	623	+0.001	+0.002	222	623	+0.002	447	623	+0.003	447	623	+0.003	447	623	+0.003	447	623	+0.003			
017	685	+0.001	+0.002	223	685	+0.002	448	685	+0.003	448	685	+0.003	448	685	+0.003	448	685	+0.003			
018	748	+0.001	+0.002	224	748	+0.002	449	748	+0.003	449	748	+0.003	449	748	+0.003	449	748	+0.003			
019	810	+0.001	+0.002	225	810	+0.002	450	810	+0.003	450	810	+0.003	450	810	+0.003	450	810	+0.003	.424/.434	.020/.035	.007
020	873	+0.001	+0.002	226	873	+0.002	451	873	+0.003	451	873	+0.003	451	873	+0.003	451	873	+0.003			
021	935	+0.001	+0.002	227	935	+0.002	452	935	+0.003	452	935	+0.003	452	935	+0.003	452	935	+0.003			
022	998	+0.001	+0.002	228	998	+0.002	453	998	+0.003	453	998	+0.003	453	998	+0.003	453	998	+0.003			
023	1060	+0.001	+0.002	229	1060	+0.002	454	1060	+0.003	454	1060	+0.003	454	1060	+0.003	454	1060	+0.003			
024	1123	+0.001	+0.002	230	1123	+0.002	455	1123	+0.003	455	1123	+0.003	455	1123	+0.003	455	1123	+0.003			
025	1185	+0.001	+0.002	231	1185	+0.002	456	1185	+0.003	456	1185	+0.003	456	1185	+0.003	456	1185	+0.003			
026	1248	+0.001	+0.002	232	1248	+0.002	457	1248	+0.003	457	1248	+0.003	457	1248	+0.003	457	1248	+0.003			
027	1310	+0.001	+0.002	233	1310	+0.002	458	1310	+0.003	458	1310	+0.003	458	1310	+0.003	458	1310	+0.003			
028	1373	+0.001	+0.002	234	1373	+0.002	459	1373	+0.003	459	1373	+0.003	459	1373	+0.003	459	1373	+0.003	.579/.589	.020/.035	.010
029	1435	+0.001	+0.002	235	1435	+0.002	460	1435	+0.003	460	1435	+0.003	460	1435	+0.003	460	1435	+0.003			.010
030	1498	+0.001	+0.002	236	1498	+0.002	461	1498	+0.003	461	1498	+0.003	461	1498	+0.003	461	1498	+0.003			
031	1560	+0.001	+0.002	237	1560	+0.002	462	1560	+0.003	462	1560	+0.003	462	1560	+0.003	462	1560	+0.003			
032	1623	+0.001	+0.002	238	1623	+0.002	463	1623	+0.003	463	1623	+0.003	463	1623	+0.003	463	1623	+0.003			
033	1685	+0.001	+0.002	239	1685	+0.002	464	1685	+0.003	464	1685	+0.003	464	1685	+0.003	464	1685	+0.003			
034	1748	+0.001	+0.002	240	1748	+0.002	465	1748	+0.003	465	1748	+0.003	465	1748	+0.003	465	1748	+0.003			
035	1810	+0.001	+0.002	241	1810	+0.002	466	1810	+0.003	466	1810	+0.003	466	1810	+0.003	466	1810	+0.003			
036	1873	+0.001	+0.002	242	1873	+0.002	467	1873	+0.003	467	1873	+0.003	467	1873	+0.003	467	1873	+0.003			
037	1935	+0.001	+0.002	243	1935	+0.002	468	1935	+0.003	468	1935	+0.003	468	1935	+0.003	468	1935	+0.003			
038	1998	+0.001	+0.002	244	1998	+0.002	469	1998	+0.003	469	1998	+0.003	469	1998	+0.003	469	1998	+0.003			
039	2060	+0.001	+0.002	245	2060	+0.002	470	2060	+0.003	470	2060	+0.003	470	2060	+0.003	470	2060	+0.003			
040	2123	+0.001	+0.002	246	2123	+0.002	471	2123	+0.003	471	2123	+0.003	471	2123	+0.003	471	2123	+0.003			
041	2185	+0.001	+0.002	247	2185	+0.002	472	2185	+0.003	472	2185	+0.003	472	2185	+0.003	472	2185	+0.003			
042	2248	+0.001	+0.002	248	2248	+0.002	473	2248	+0.003	473	2248	+0.003	473	2248	+0.003	473	2248	+0.003			
043	2310	+0.001	+0.002	249	2310	+0.002	474	2310	+0.003	474	2310	+0.003	474	2310	+0.003	474	2310	+0.003			
044	2373	+0.001	+0.002	250	2373	+0.002	475	2373	+0.003	475	2373	+0.003	475	2373	+0.003	475	2373	+0.003			
045	2435	+0.001	+0.002	251	2435	+0.002	476	2435	+0.003	476	2435	+0.003	476	2435	+0.003	476	2435	+0.003			
046	2498	+0.001	+0.002	252	2498	+0.002	477	2498	+0.003	477	2498	+0.003	477	2498	+0.003	477	2498	+0.003			
047	2560	+0.001	+0.002	253	2560	+0.002	478	2560	+0.003	478	2560	+0.003	478	2560	+0.003	478	2560	+0.003			
048	2623	+0.001	+0.002	254	2623	+0.002	479	2623	+0.003	479	2623	+0.003	479	2623	+0.003	479	2623	+0.003			
049	2685	+0.001	+0.002	255	2685	+0.002	480	2685	+0.003	480	2685	+0.003	480	2685	+0.003	480	2685	+0.003			
050	2748	+0.001	+0.002	256	2748	+0.002	481	2748	+0.003	481	2748	+0.003	481	2748	+0.003	481	2748	+0.003			
051	2810	+0.001	+0.002	257	2810	+0.002	482	2810	+0.003	482	2810	+0.003	482	2810	+0.003	482	2810	+0.003			
052	2873	+0.001	+0.002	258	2873	+0.002	483	2873	+0.003	483	2873	+0.003	483	2873	+0.003	483	2873	+0.003			
053	2935	+0.001	+0.002	259	2935	+0.002	484	2935	+0.003	484	2935	+0.003	484	2935	+0.003	484	2935	+0.003			
054	2998	+0.001	+0.002	260	2998	+0.002	485	2998	+0.003	485	2998	+0.003	485	2998	+0.003	485	2998	+0.003			
055	3060	+0.001	+0.002	261	3060	+0.002	486	3060	+0.003	486	3060	+0.003	486	3060	+0.003	486	3060	+0.003			
056	3123	+0.001	+0.002	262	3123	+0.002	487	3123	+0.003	487	3123	+0.003	487	3123	+0.003	487	3123	+0.003			
057	3185	+0.001	+0.002	263	3185	+0.002	488	3185	+0.003	488	3185	+0.003	488	3185	+0.003	488	3185	+0.003			
058	3248	+0.001	+0.002	264	3248	+0.002	489	3248	+0.003	489	3248	+0.003	489	3248	+0.003	489	3248	+0.003			
059	3310	+0.001	+0.002	265	3310	+0.002	490	3310	+0.003	490	3310	+0.003	490	3310	+0.003	490	3310	+0.003			
060	3373	+0.001	+0.002	266	3373	+0.002	491	3373	+0.003	491	3373	+0.003	491	3373	+0.003	491	3373	+0.003			
061	3435	+0.001	+0.002	267	3435	+0.002	492	3435	+0.003	492	3435	+0.003	492	3435	+0.003	492	3435	+0.003			
062	3498	+0.001	+0.002	268	3498	+0.002	493	3498	+0.003	493	3498	+0.003	493	3498	+0.003	493	3498	+0.003			
063	3560	+0.001	+0.002	269	3560	+0.002	494	3560	+0.003	494	3560	+0.003	494	3560	+0.003	494	3560	+0.003			
064	3623	+0.001	+0.002	270	3623	+0.002	495	3623	+0.003	495	3623	+0.003	495	3623	+0.003	495	3623	+0.003			
065	3685	+0.001	+0.002	271	3685	+0.002	496	3685	+0.003	496	3685	+0.003	496	3685	+0.003	496	3685	+0.003			
066	3748	+0.001	+0.002	272	3748	+0.002	497	3748	+0.003	497	3748	+0.003	497	3748	+0.003	497	3748	+0.003			
067	3810	+0.001	+0.002	273	3810	+0.002	498	3810	+0.003	498	3810	+0.003	498	3810	+0.003	498	3810	+0.003			

Turcon® T-Seal

DASH NO.	G ₀ ZERO BACKUP WIDTH	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004-109	.098/.103	.154/.164	.210/.220	.005/.015	.004
010-108	.104/.108	.150/.160	.207/.217	.005/.015	.004
014-109	.104/.109	.150/.160	.207/.217	.005/.015	.004
110-126	.141/.151	.183/.193	.245/.255	.005/.015	.006
130-132	.188/.198	.235/.245	.304/.314	.010/.025	.006
133-140	.188/.198	.235/.245	.304/.314	.010/.025	.006
141-149	.223-.227	.281/.291	.334/.344	.020/.035	.007
151-158	.223-.227	.281/.291	.334/.344	.020/.035	.007
220-224	.188/.198	.235/.245	.304/.314	.010/.025	.006
228-243	.188/.198	.235/.245	.304/.314	.010/.025	.006
244-245	.188/.198	.235/.245	.304/.314	.010/.025	.006
246-247	.188/.198	.235/.245	.304/.314	.010/.025	.006
323-329	.281/.291	.334/.344	.424/.434	.020/.035	.006
330-345	.281/.291	.334/.344	.424/.434	.020/.035	.006
346-349	.375/.385	.475/.485	.579/.589	.020/.035	.009
425-438	.375/.385	.475/.485	.579/.589	.020/.035	.010
439-445	.375/.385	.475/.485	.579/.589	.020/.035	.010
446	.375/.385	.475/.485	.579/.589	.020/.035	.010
447-460	.375/.385	.475/.485	.579/.589	.020/.035	.011



Piston Seal Installation
FOR ZERO, ONE & TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

- NOTES:
1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR T-SEAL IN AS4716 REVISION A PISTON GLANDS.
- ORDERING EXAMPLE:
PBA 0 0 0 214A I19 NG
T-SEAL: PISTON DESIGNATOR
BACKUP WIDTH
A = BORE DIA.
G₀ = ZERO BACKUP WIDTH
G₁ = ONE BACKUP WIDTH
G₂ = TWO BACKUP WIDTH
BACKUP RING DESIGN WIDTH
0 = SOLID BACKUP RINGS
C = CUT BACKUP RINGS
GLAND DESIGNATOR
G = AS4716
SIZE DESIGNATOR TO AS4716 REVISION A
QUALITY INDEX
TURCON® BACKUP RING MAT'L. CODE
TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- PREFERRED SEAL DESIGNS ARE EITHER ONE OR TWO BACKUP WIDTH SEALS.
- SOME ELASTOMER MATERIALS ELONGATION LIMITS IN COMBINATION WITH THE DIAMETER OF THE SEAL I.D. PRECLUDE THE INSTALLATION OF THE TURCON T-SEAL INTO CLOSED GROOVES BY CIRCUMFERENTIAL STRETCHING. BEFORE USING -004 TO -014 AND -104 TO -117 CONSULT YOUR TSS SALES ENGINEER.

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.
004	.190	.076	210	.991	.002	325	3.993	3.731
006	.233	.129	211	1.105	.002	326	4.118	3.876
007	.266	.158	212	1.178	.002	327	4.243	4.001
008	.297	.189	213	1.178	.002	328	4.368	4.126
009	.329	.220	214	1.241	.002	329	4.493	4.251
010	.360	.250	215	1.303	.002	330	4.618	4.376
011	.392	.281	216	1.366	.002	331	4.743	4.501
012	.424	.312	217	1.428	.002	332	4.868	4.626
013	.456	.343	218	1.491	.002	333	4.993	4.751
014	.488	.374	219	1.553	.002	334	5.118	4.876
015	.520	.405	220	1.616	.002	335	5.243	5.001
016	.552	.436	221	1.678	.002	336	5.368	5.126
017	.584	.467	222	1.741	.002	337	5.493	5.251
018	.616	.498	223	1.803	.002	338	5.618	5.376
019	.648	.529	224	1.866	.002	339	5.743	5.501
020	.680	.560	225	1.928	.002	340	5.868	5.626
021	.712	.591	226	2.000	.002	341	5.993	5.751
022	.744	.622	227	2.062	.002	342	6.118	5.876
023	.776	.653	228	2.124	.002	343	6.243	6.001
024	.808	.684	229	2.187	.002	344	6.368	6.126
025	.840	.715	230	2.249	.002	345	6.493	6.251
026	.872	.746	231	2.311	.002	346	6.618	6.376
027	.904	.777	232	2.374	.002	347	6.743	6.501
028	.936	.808	233	2.436	.002	348	6.868	6.626
104	3.993	3.731	234	2.499	.002	349	6.993	6.751
105	4.118	3.876	235	2.561	.002	350	7.118	6.876
106	4.243	4.001	236	2.624	.002	351	7.243	7.001
107	4.368	4.126	237	2.686	.002	352	7.368	7.126
108	4.493	4.251	238	2.749	.002	353	7.493	7.251
109	4.618	4.376	239	2.811	.002	354	7.618	7.376
110	4.743	4.501	240	2.874	.002	355	7.743	7.501
111	4.868	4.626	241	2.936	.002	356	7.868	7.626
112	4.993	4.751	242	3.000	.002	357	7.993	7.751
113	5.118	4.876	243	3.062	.002	358	8.118	7.876
114	5.243	5.001	244	3.125	.002	359	8.243	8.001
115	5.368	5.126	245	3.187	.002	360	8.368	8.126
116	5.493	5.251	246	3.250	.002	361	8.493	8.251
117	5.618	5.376	247	3.312	.002	362	8.618	8.376
118	5.743	5.501	248	3.375	.002	363	8.743	8.501
119	5.868	5.626	249	3.438	.002	364	8.868	8.626
120	5.993	5.751	250	3.500	.002	365	8.993	8.751
121	6.118	5.876	251	3.563	.002	366	9.118	8.876
122	6.243	6.001	252	3.625	.002	367	9.243	9.001
123	6.368	6.126	253	3.688	.002	368	9.368	9.126
124	6.493	6.251	254	3.750	.002	369	9.493	9.251
125	6.618	6.376	255	3.813	.002	370	9.618	9.376
126	6.743	6.501	256	3.875	.002	371	9.743	9.501
127	6.868	6.626	257	3.938	.002	372	9.868	9.626
128	6.993	6.751	258	4.000	.002	373	9.993	9.751
129	7.118	6.876	259	4.063	.002	374	10.118	9.876
130	7.243	7.001	260	4.125	.002	375	10.243	10.001
131	7.368	7.126	261	4.188	.002	376	10.368	10.126
132	7.493	7.251	262	4.250	.002	377	10.493	10.251
133	7.618	7.376	263	4.313	.002	378	10.618	10.376
134	7.743	7.501	264	4.375	.002	379	10.743	10.501
135	7.868	7.626	265	4.438	.002	380	10.868	10.626
136	7.993	7.751	266	4.500	.002	381	10.993	10.751
137	8.118	7.876	267	4.563	.002	382	11.118	10.876
138	8.243	8.001	268	4.625	.002	383	11.243	11.001
139	8.368	8.126	269	4.688	.002	384	11.368	11.126
140	8.493	8.251	270	4.750	.002	385	11.493	11.251
141	8.618	8.376	271	4.813	.002	386	11.618	11.376
142	8.743	8.501	272	4.875	.002	387	11.743	11.501
143	8.868	8.626	273	4.938	.002	388	11.868	11.626
144	8.993	8.751	274	5.000	.002	389	11.993	11.751
145	9.118	8.876	275	5.063	.002	390	12.118	11.876
146	9.243	9.001	276	5.125	.002	391	12.243	12.001
147	9.368	9.126	277	5.188	.002	392	12.368	12.126
148	9.493	9.251	278	5.250	.002	393	12.493	12.251
149	9.618	9.376	279	5.313	.002	394	12.618	12.376
150	9.743	9.501	280	5.375	.002	395	12.743	12.501
151	9.868	9.626	281	5.438	.002	396	12.868	12.626
152	9.993	9.751	282	5.500	.002	397	12.993	12.751
153	10.118	9.876	283	5.563	.002	398	13.118	12.876
154	10.243	10.001	284	5.625	.002	399	13.243	13.001
155	10.368	10.126	285	5.688	.002	400	13.368	13.126
156	10.493	10.251	286	5.750	.002	401	13.493	13.251
157	10.618	10.376	287	5.813	.002	402	13.618	13.376
158	10.743	10.501	288	5.875	.002	403	13.743	13.501
159	10.868	10.626	289	5.938	.002	404	13.868	13.626
160	10.993	10.751	290	6.000	.002	405	13.993	13.751
161	11.118	10.876	291	6.063	.002	406	14.118	13.876
162	11.243	11.001	292	6.125	.002	407	14.243	14.001
163	11.368	11.126	293	6.188	.002	408	14.368	14.126
164	11.493	11.251	294	6.250	.002	409	14.493	14.251
165	11.618	11.376	295	6.313	.002	410	14.618	14.376
166	11.743	11.501	296	6.375	.002	411	14.743	14.501
167	11.868	11.626	297	6.438	.002	412	14.868	14.626
168	11.993	11.751	298	6.500	.002	413	14.993	14.751
169	12.118	11.876	299	6.563	.002	414	15.118	14.876
170	12.243	12.001	300	6.625	.002	415	15.243	15.001
171	12.368	12.126	301	6.688	.002	416	15.368	15.126
172	12.493	12.251	302	6.750	.002	417	15.493	15.251
173	12.618	12.376	303	6.813	.002	418	15.618	15.376
174	12.743	12.501	304	6.875	.002	419	15.743	15.501
175	12.868	12.626	305	6.938	.002	420	15.868	15.626
176	12.993	12.751	306	7.000	.002	421	15.993	15.751
177	13.118	12.876	307	7.063	.002	422	16.118	15.876
178	13.243	13.001	308	7.125	.002	423	16.243	16.001
179	13.368	13.126	309	7.188	.002	424	16.368	16.126
180	13.493	13.251	310	7.250	.002	425	16.493	16.251
181	13.618	13.376	311	7.313	.002	426	16.618	16.376
182	13.743	13.501	312	7.375	.002	427	16.743	16.501
183	13.868	13.626	313	7.438	.002	428	16.868	16.626
184	13.993	13.751	314	7.500	.002	429	16.993	16.751
185	14.118	13.876	315	7.563	.002	430	17.118	16.876
186	14.243	14.001	316	7.625	.002	431	17.243	17.001
187	14.368	14.126	317	7.688	.002	432	17.368	17.126
188	14.493	14.251	318	7.750	.002	433	17.493	17.251
189	14.618	14.376	319	7.813	.002	434	17.618	17.376
190	14.743	14.501	320	7.875	.002	435	17.743	17.501
191	14.868	14.62						

Turcon® T-Seal

DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	A DIA.	F DIA.	DASH NO.	G ₂ BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.001	+0.000		+0.002	+0.000		+0.003	+0.003		+0.003	+0.003		004-009	.210/.230	.004
005	1.90	0.76	210	1.95	0.750	435	6.224	5.747		5.747	5.747		010-012	.207/.217	.005/.015
006	2.21	1.053	211	1.053	0.812	436	6.349	5.862		5.862	5.862		014-016		.004
007	2.52	1.346	212	1.346	1.076	437	6.474	6.024		6.024	6.024		10-106		.004
008	2.83	1.639	213	1.639	1.340	438	6.599	6.247		6.247	6.247		110-126		.005
	3.14	1.932	214	1.932	1.604		6.724	6.477		6.477	6.477		127-129	.245/.255	.006
009	3.45	2.225	215	2.225	1.868	439	6.849	6.647		6.647	6.647		130-132		.006
010	3.76	2.518	216	2.518	2.132	440	6.974	6.849		6.849	6.849		133-140		.006
011	4.07	2.811	217	2.811	2.396	441	7.099	6.974		6.974	6.974		141-149		.006
012	4.38	3.104	218	3.104	2.660	442	7.224	7.247		7.247	7.247		150-152		.007
	4.69	3.397	219	3.397	2.924	443	7.349	7.477		7.477	7.477		228-232		.007
	5.00	3.689	220	3.689	3.188	444	7.474	7.599		7.599	7.599		233-237	.304/.314	.006
013	5.31	3.982	221	3.982	3.452	445	7.599	7.724		7.724	7.724		248-243		.007
014	5.62	4.275	222	4.275	3.716	446	7.724	7.849		7.849	7.849		249-247		.008
015	5.93	4.568	223	4.568	3.980	447	7.849	8.000		8.000	8.000		245-247		.008
016	6.24	4.861	224	4.861	4.244	448	7.974	8.125		8.125	8.125		325-327		.006
017	6.55	5.154	225	5.154	4.508	449	8.099	8.250		8.250	8.250		328-333		.007
018	6.86	5.447	226	5.447	4.772	450	8.224	8.375		8.375	8.375		338-343	.424/.434	.007
	7.17	5.740	227	5.740	5.036	451	8.349	8.500		8.500	8.500		348-349		.008
019	7.48	6.033	228	6.033	5.300	452	8.474	8.625		8.625	8.625		425-438		.009
020	7.79	6.326	229	6.326	5.564	453	8.599	8.750		8.750	8.750		439-445	.579/.589	.010
021	8.10	6.619	230	6.619	5.828	454	8.724	8.875		8.875	8.875		446		.010
022	8.41	6.912	231	6.912	6.092	455	8.849	9.000		9.000	9.000		447-460		.011
023	8.72	7.205	232	7.205	6.356	456	8.974	9.125		9.125	9.125				
024	9.03	7.498	233	7.498	6.620	457	9.099	9.250		9.250	9.250				
025	9.34	7.791	234	7.791	6.884	458	9.224	9.375		9.375	9.375				
026	9.65	8.084	235	8.084	7.148	459	9.349	9.500		9.500	9.500				
027	9.96	8.377	236	8.377	7.412	460	9.474	9.625		9.625	9.625				
028	10.27	8.670	237	8.670	7.676		9.599	9.750		9.750	9.750				
	10.58	8.963	238	8.963	7.940		9.724	9.875		9.875	9.875				
104	10.89	9.256	239	9.256	8.204		9.849	10.000		10.000	10.000				
105	11.20	9.549	240	9.549	8.468		9.974	10.125		10.125	10.125				
106	11.51	9.842	241	9.842	8.732		10.099	10.250		10.250	10.250				
107	11.82	10.135	242	10.135	9.000		10.224	10.375		10.375	10.375				
108	12.13	10.428	243	10.428	9.264		10.349	10.500		10.500	10.500				
109	12.44	10.721	244	10.721	9.528		10.474	10.625		10.625	10.625				
	12.75	11.014	245	11.014	9.792		10.599	10.750		10.750	10.750				
110	13.06	11.307	246	11.307	10.060		10.724	10.875		10.875	10.875				
111	13.37	11.600	247	11.600	10.324		10.849	11.000		11.000	11.000				
112	13.68	11.893	248	11.893	10.588		10.974	11.125		11.125	11.125				
113	13.99	12.186	249	12.186	10.852		11.099	11.250		11.250	11.250				
114	14.30	12.479	250	12.479	11.116		11.224	11.375		11.375	11.375				
	14.61	12.772	251	12.772	11.380		11.349	11.500		11.500	11.500				
115	14.92	13.065	252	13.065	11.644		11.474	11.625		11.625	11.625				
116	15.23	13.358	253	13.358	11.908		11.599	11.750		11.750	11.750				
117	15.54	13.651	254	13.651	12.172		11.724	11.875		11.875	11.875				
118	15.85	13.944	255	13.944	12.436		11.849	12.000		12.000	12.000				
119	16.16	14.237	256	14.237	12.700		11.974	12.125		12.125	12.125				
120	16.47	14.530	257	14.530	12.964		12.099	12.250		12.250	12.250				
121	16.78	14.823	258	14.823	13.228		12.224	12.375		12.375	12.375				
122	17.09	15.116	259	15.116	13.492		12.349	12.500		12.500	12.500				
123	17.40	15.409	260	15.409	13.756		12.474	12.625		12.625	12.625				
124	17.71	15.702	261	15.702	14.020		12.599	12.750		12.750	12.750				
	18.02	15.995	262	15.995	14.284		12.724	12.875		12.875	12.875				
125	18.33	16.288	263	16.288	14.548		12.849	13.000		13.000	13.000				
126	18.64	16.581	264	16.581	14.812		12.974	13.125		13.125	13.125				
127	18.95	16.874	265	16.874	15.076		13.099	13.250		13.250	13.250				
128	19.26	17.167	266	17.167	15.340		13.224	13.375		13.375	13.375				
129	19.57	17.460	267	17.460	15.604		13.349	13.500		13.500	13.500				
	19.88	17.753	268	17.753	15.868		13.474	13.625		13.625	13.625				
130	20.19	18.046	269	18.046	16.132		13.599	13.750		13.750	13.750				
131	20.50	18.339	270	18.339	16.396		13.724	13.875		13.875	13.875				
132	20.81	18.632	271	18.632	16.660		13.849	14.000		14.000	14.000				
133	21.12	18.925	272	18.925	16.924		13.974	14.125		14.125	14.125				
134	21.43	19.218	273	19.218	17.188		14.099	14.250		14.250	14.250				
	21.74	19.511	274	19.511	17.452		14.224	14.375		14.375	14.375				
135	22.05	19.804	275	19.804	17.716		14.349	14.500		14.500	14.500				
136	22.36	20.097	276	20.097	17.980		14.474	14.625		14.625	14.625				
137	22.67	20.390	277	20.390	18.244		14.599	14.750		14.750	14.750				
138	22.98	20.683	278	20.683	18.508		14.724	14.875		14.875	14.875				
139	23.29	20.976	279	20.976	18.772		14.849	15.000		15.000	15.000				
	23.60	21.269	280	21.269	19.036		14.974	15.125		15.125	15.125				
140	23.91	21.562	281	21.562	19.300		15.099	15.250		15.250	15.250				
141	24.22	21.855	282	21.855	19.564		15.224	15.375		15.375	15.375				
142	24.53	22.148	283	22.148	19.828		15.349	15.500		15.500	15.500				
143	24.84	22.441	284	22.441	20.092		15.474	15.625		15.625	15.625				
144	25.15	22.734	285	22.734	20.356		15.599	15.750		15.750	15.750				
145	25.46	23.027	286	23.027	20.620		15.724	15.875		15.875	15.875				
146	25.77	23.320	287	23.320	20.884		15.849	16.000		16.000	16.000				
147	26.08	23.613	288	23.613	21.148		15.974	16.125		16.125	16.125				
148	26.39	23.906	289	23.906	21.412		16.099	16.250		16.250	16.250				
149	26.70	24.199	290	24.199	21.676		16.224	16.375		16.375	16.375				
	27.01	24.492	291	24.492	21.940		16.349	16.500		16.500	16.500				
149	27.32	24.785	292	24.785	22.204		16.474	16.625		16.625	16.625				

PISTON SEAL INSTALLATION
FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR TANDEM T-SEAL IN AS4716 REVISION A PISTON GLANDS.
- ORDERING EXAMPLE:
TANDEM T-SEAL, PISTON DESIGNATOR
2 = TWO BACKUP WIDTH
BACKUP RING DESIGN
GLAND DESIGNATOR
G = AS4716
SIZE DESIGNATOR
QUALITY INDEX
A: AIRCRAFT
F: FERROUS MATERIALS
T: TUREL® ELASTOMER MATERIALS
E: ELASTOMER MATERIALS
CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

3. ALL TURCON ANTI-ABRASION RINGS ARE SOLID, EXCEPT THE FOLLOWING DASH SIZES:
-004 THROUGH -020, -104 THROUGH -132, -210 THROUGH -342

△ DESIGN CODES FOR BACKUP RING CONFIGURATION

BACKUP RING TYPE	MATERIAL
CUT BACKUP RING	ZURCON® Z40
BACKUP RING	ZURCON® Z60
BACKUP RING	ZURCON® Z43

DESIGN CODE

R					
S					
T					

PBB 2 0 G 214 A I19 MG

FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

PISTON SEAL INSTALLATION
FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

5. SOME ELASTOMER MATERIALS ELONGATION LIMITS IN COMBINATION WITH THE DIAMETER OF THE SEAL ID. PRECLUDE THE INSTALLATION OF THE TANDEM T-SEAL INTO CLOSED GROOVES BY CIRCUMFERENTIAL FINCHING. FINCHING RANGES ARE ID -014 AND -104 TO -117. CONSULT YOUR TSS SALES ENGINEER.

THIS DOCUMENT CONTAINS TRELLE

Features and benefits

- Combines the benefits of a low-friction Turcon® slipper seal with the high sealing characteristics of an elastomer seal
- High sealing effect in applications requiring media separation, fluid/fluid or fluid/gas
- Optimized leakage rate
- Low gas permeation rate
- Capable of operating successfully at higher pressures and sliding speeds than Turcon® T-Seal
- Outstanding sliding properties, no stick-slip effect
- Designed for zero Back-up Ring width groove per AS4716

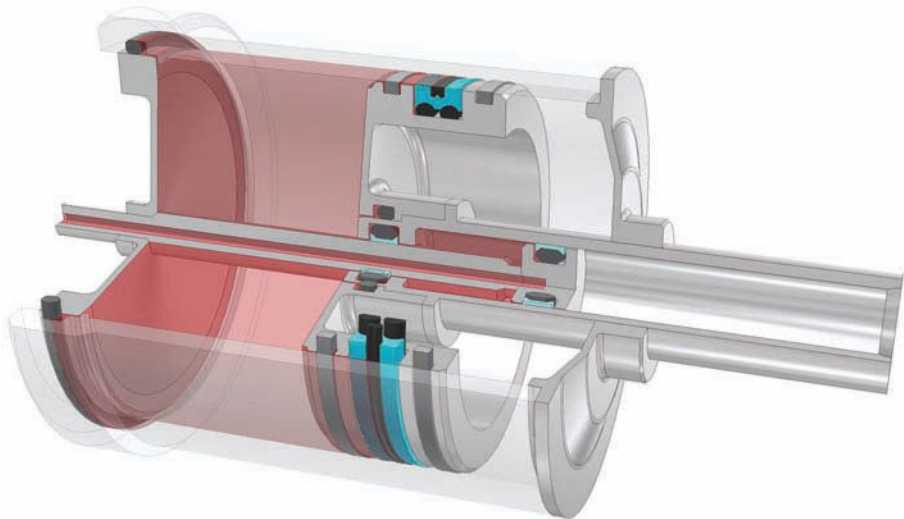


Illustration shows typical hydro-pneumatic accumulator with a sealing configuration incorporating Turcon® AQ-Seal® 5.

Turcon® AQ-Seal® 5

Description

Turcon® AQ-Seal® 5 is a double-acting piston seal designed for reciprocating or helical movements. It consists of a dynamic Turcon® sealing element into which an elastomer Turel® X-Ring, with a limited footprint, is inset centrally. The assembly is energized by two elastomer O-Rings. Turcon® AQ Seal® 5 is highly recommended for applications requiring media separation in extremely dynamic situations, such as in shock absorbers.

A range of sizes in the 300 and 400 series are offered to suit MIL-G-5514F and AS4716 bores. Custom designs are also available.

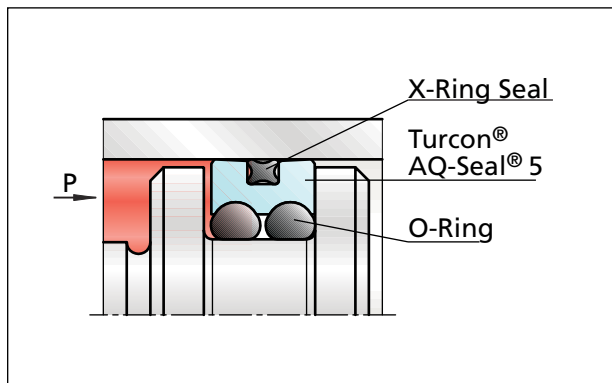


Figure 1 Turcon® AQ-Seal® 5

Method of Operation

Turcon® AQ-Seal® 5 combines the benefits of a low-friction Turcon® slipper seal with the high sealing characteristics of an elastomer seal. It does this by incorporating a limited footprint Turel® X-Ring in the dynamic sealing face, optimizing leakage control, while minimizing friction.

The unique characteristics of Turcon® AQ-Seal® 5 are its special seal profile with a defined seal edge and the use of two elastomer O-Rings as energizing elements to optimize its pressure profile.

Technical Data

Operation pressure: 5,000 psi/ 35 MPa

Speed: 9.8 ft/s/ 3.0 m/s
Capable of higher speeds with non-continuous or intermittent use

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer

Clearance: As per AS4716
Larger using custom corner-reinforced configuration

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Series

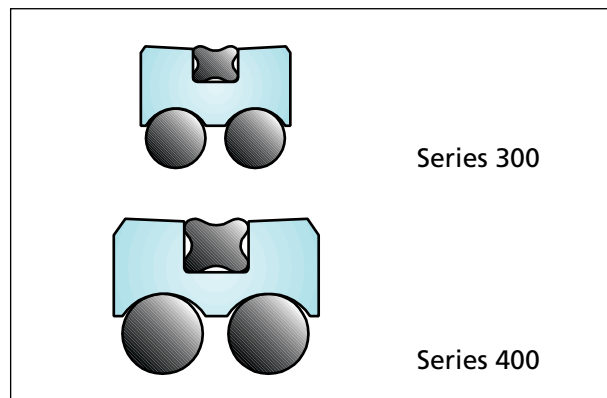
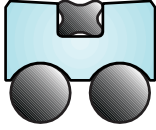
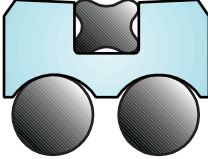


Figure 2 Relative size of Turcon® AQ-Seal® 5 cross section

Turcon® AQ-Seal® 5

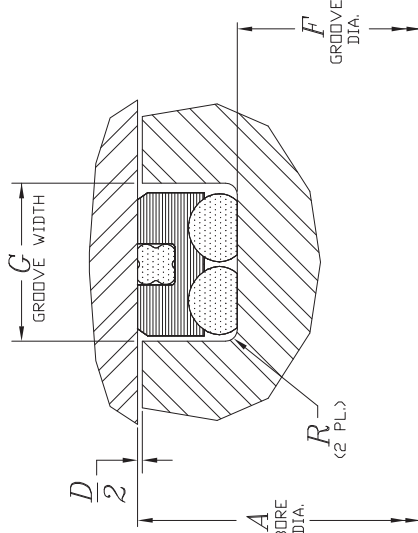
Table I Turcon® AQ-Seal® 5 Types

Cross Section	Description	Part Number	Gland Standard
	Turcon® AQ-Seal® 5	PQA00G3__	AS4716 300 Series Glands
	Turcon® AQ-Seal® 5	PQA00G4__	AS4716 400 Series Glands

Profiles in color are recommended configurations.

Turcon® AQ-Seal® 5

DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
325-329	.281/.291	.020/.035	.006
330-345			.007
346-445			.008
446			.009
447-460			.010
			.011



PISTON SEAL INSTALLATION
FOR ZERO BACK-UP WIDTH AS4716 REVISION A GROOVES

DASH NO.	A DIA.	F DIA.
325	1.867	1.495
326	1.992	1.620
327	2.118	1.746
328	2.243	1.871
329	2.368	1.996
330	2.493	2.121
331	2.618	2.246
332	2.743	2.371
333	2.868	2.496
334	2.993	2.621
335	3.118	2.746
336	3.243	2.871
337	3.368	2.996
338	3.493	3.121
339	3.618	3.246
340	3.743	3.371
341	3.868	3.496
342	3.993	3.621
343	4.118	3.746
344	4.243	3.871
345	4.368	3.996
346	4.493	4.121
347	4.618	4.246
348	4.743	4.371
349	4.868	4.496
425	4.574	4.497
426	4.722	4.645
427	4.870	4.793
428	5.018	4.941
429	5.166	5.089
430	5.314	5.237
431	5.462	5.385
432	5.610	5.533
433	5.758	5.681
434	5.906	5.829
435	6.054	5.977
436	6.202	6.125
437	6.350	6.273
438	6.498	6.421
439	6.646	6.569
440	6.794	6.717
441	6.942	6.865
442	7.090	7.013
443	7.238	7.161
444	7.386	7.309
445	7.534	7.457
446	7.682	7.605
447	7.830	7.753
448	7.978	7.901
449	8.126	8.049
450	8.274	8.197
451	8.422	8.345
452	8.570	8.493
453	8.718	8.641
454	8.866	8.789
455	9.014	8.937
456	9.162	9.085
457	9.310	9.233
458	9.458	9.381
459	9.606	9.529
460	9.754	9.677

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR AQ SEAL® 5 IN AS4716 REVISION A PISTON GLANDS.
ORDERING EXAMPLE: PQA00G3334A105NP
- AQ SEAL® 5, PISTON DESIGNATOR
BACKUP WIDTH
DESIGN CODE
GLAND DESIGNATOR
SIZE DESIGNATOR
ZERO BACKUP WIDTH -325 THRU -460 ONLY
TUBE® X-RING & O-RING MAT'L CODE
QUALITY INDEX - CERTIFICATE OF PERFORMANCE
TURCON® X-RING & O-RING MAT'L CODE
CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- GLAND DIMENSIONS PER AS4716 REV A -300 & -400 SERIES ONLY.

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TRELLEBERG
SEALING SOLUTIONS

TITLE
AQ SEAL® 5

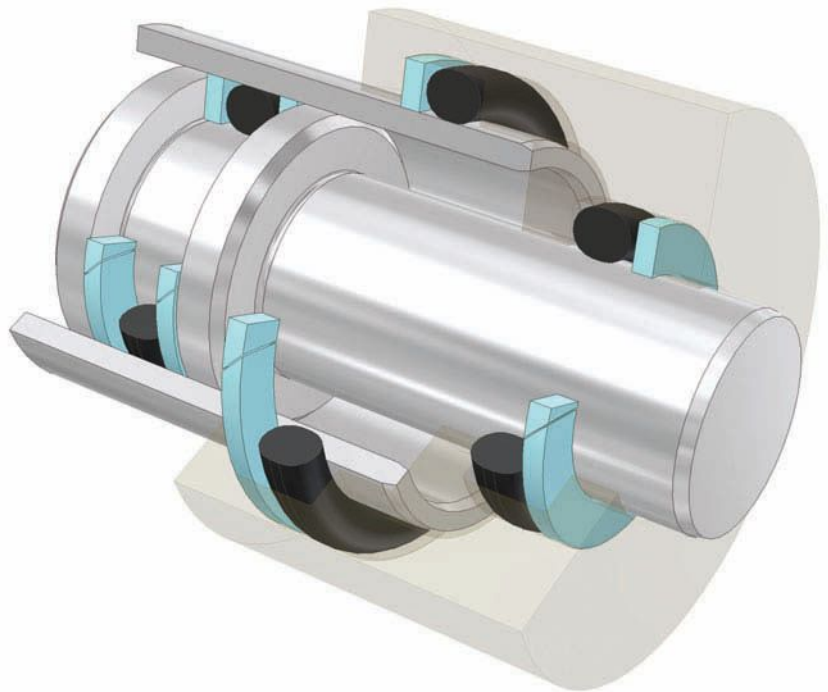
DRAWING NO.
PQA00G000

- AQ SEAL® PATENTS:**
- U.S.A. 4,179,131
 - GERMANY 2,710,745
 - BRAZIL 77,077,45
 - AUSTRIA 398 342
 - FRANCE 2,710,745
 - U.K. 1 563 970
 - SPAIN 2,039,870
 - SWITZERLAND 599,487
 - INDONESIA 2,039,870
 - SPAIN 2,039,870
 - HOLLAND 771E219
 - SWEDEN 771197/24
 - GERMANY 1 088 636
 - ITALY 1 088 636
 - DENMARK 146,050
 - * JAPAN PATENT PENDING

Back-up Ring and Stakbak®

Features and benefits

- Prevents O-Ring extrusion
- Prolongs O-Ring service life
- Allows O-Rings to be utilized in higher pressure applications, against softer mating surfaces and where there are reciprocating or rotating movements
- Compatible with virtually all media and gases
- Easy Installation
- Wide range of geometries to meet the needs of all applications
- Sizes to meet all standards
- Non-standard sizes also available



Seals/Back-up
Rings for AS4716

Illustration shows typical hydraulic cylinder with Back-up Rings and O-Rings.

Back-up Ring and Stakbak®

Description

During the 1950s Trelleborg Sealing Solutions developed the Back-up Ring as an improvement on leather packing rings.

Back-up Rings are protective and supporting elements with no sealing function. Made from extrusion-resistant materials such as Turcon®, they usually have a rectangular cross section and are installed in a groove with an elastomer O-Ring. Due to their tight fit in the housing, Back-up Rings prevent extrusion of the pressurized elastomer sealing element into the sealing gap.

Using Back-up Rings allows O-Rings to be utilized in higher pressure applications, against softer mating surfaces and where there are reciprocating or rotating movements. They also compensate for radial sealing gaps and large temperature fluctuations.

The wide range of Back-up Rings offered meets all aerospace industry standards.

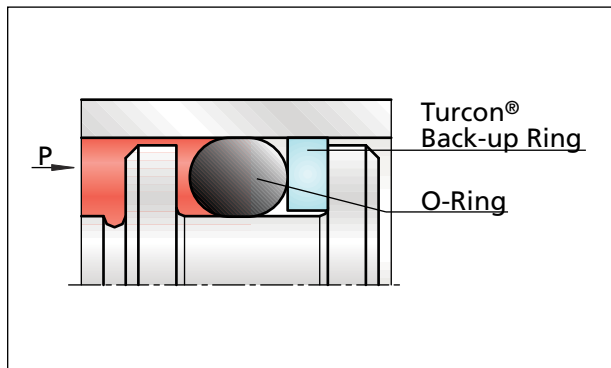


Figure 1 Turcon® Back-up Ring

Stakbak® is a dual modulus bonded stacked Back-up Ring. It consists of one ring made of Turcon®, which protects the O-Ring, and a second ring in HiMod® / Zurcon® to prevent extrusion. Easy to install, the Stakbak® is capable of operating at higher pressures than a standard Back-up Ring.

Method of Operation

The Back-up Ring is installed between the O-Ring and the groove wall, separating the O-Ring from the clearance gap.

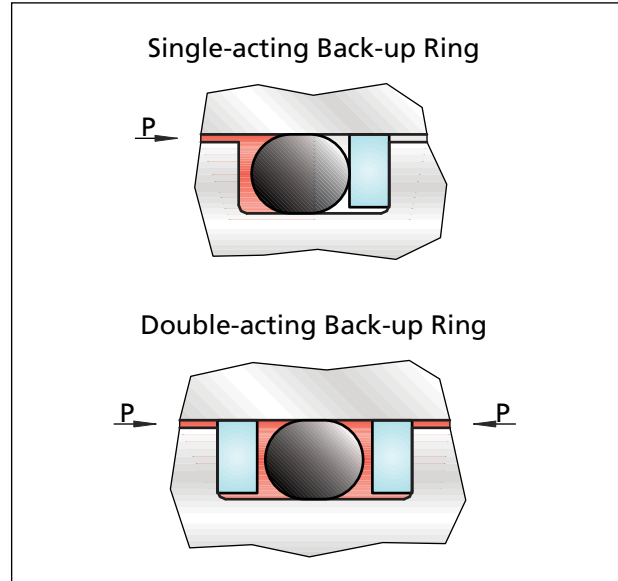


Figure 2 Single-acting and double-acting sealing configurations with Back-up Rings

Back-up Ring and Stakbak®

Technical Data

Operating pressure:

- 3,000 psi/ 21 MPa for standard design in Turcon® T01 or Turcon T28 per AMS8791
- 5,000 psi/ 35 MPa for standard design in Turcon® with fillers, Turcon® T11 carbon and graphite-filled PTFE
- 8,000 psi/ 55 Mpa for special versions such as Stakbak®

Speed: 49.2 ft/s/ 15 m/s

Temperature range: -94°F to +390°F/ -70°C to +200°C

Clearance: As per Mil-G-5514, AS4716 or AS5857

Media: Compatible with virtually all media and gases

Materials

Standard material for Back-up Rings is Turcon® T01, Virgin PTFE. Stronger materials are available for specific applications.

Series

Back-up Rings follow the series according to aerospace seal gland standard AS4716 Revision A and static seal gland standard AS5857. These guidelines should be followed to ensure good service life. Part numbers for Trelleborg Sealing Solutions Back-up Rings correlate to aerospace gland standards as indicated by the sixth digit.

Part No 6 th Digit	Description
M	Mil-P-5514 and Mil-G-5514F-Aerospace Hydraulic Packing Gland Standard, Static and Dynamic. Mil-G-5514F Back-up Rings can be used in the AS4716 Rev. A glands in -300 and 400 series glands only.
G	AS4716 Revision A, Aerospace Hydraulic Packing Gland Standard, Static and Dynamic
E	AS5857, Aerospace Static Gland Standard

Back-up Rings can also be supplied in non-standard diameter sizes.

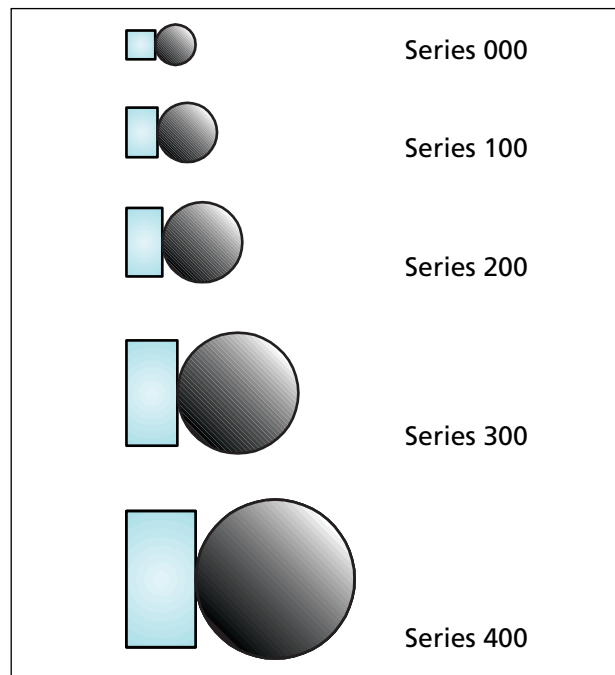


Figure 3 Relative Size of Back-up Ring cross section

Ordering

O-Ring must be ordered separately from Back-up Ring.

Guidelines for Gap, Pressure and Size

Back-up Rings must be used if the pressures given in the tables below are exceeded.

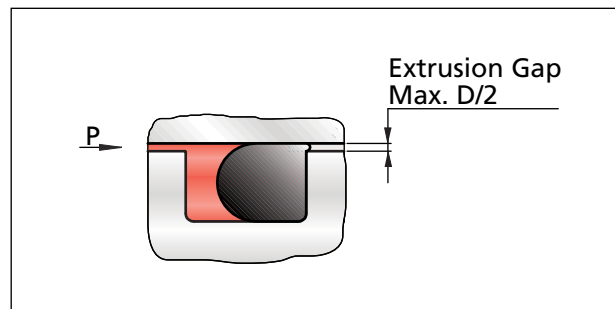


Figure 4 Extrusion Gap

Back-up Ring and Stakbak®

Table I Extrusion Gap Size D for 70 Shore Hardness









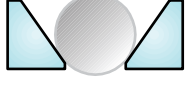


Series	O-Ring Cross Section inch mm	Extrusion Gap D inch mm		
		500 psi 3.5 Mpa	1,000 psi 7 Mpa	1,500 psi 10.5 Mpa
000	0.070 1.78	0.006 0.15	0.004 0.10	0.002 0.05
100	0.103 2.62	0.007 0.18	0.005 0.13	0.003 0.08
200	0.139 3.53	0.008 0.20	0.006 0.15	0.004 0.10
300	0.210 5.33	0.010 0.25	0.007 0.18	0.005 0.13
400	0.276 7.00	0.012 0.30	0.008 0.20	0.006 0.15

Table II Extrusion Gap Size D for 80 Shore Hardness

Series	O-Ring Cross Section inch mm	Extrusion Gap D inch mm				
		500 psi 3.5 Mpa	1,000 psi 7 Mpa	1,500 psi 10.5 Mpa	2,000 psi 14 Mpa	2,500 psi 17.5 Mpa
000	0.070 1.78	0.008 0.20	0.006 0.15	0.004 0.10	0.002 0.05	0.001 0.03
100	0.103 2.62	0.010 0.25	0.007 0.18	0.005 0.13	0.003 0.08	0.002 0.04
200	0.139 3.53	0.012 0.30	0.008 0.20	0.006 0.15	0.004 0.10	0.002 0.05
300	0.210 5.33	0.014 0.35	0.010 0.25	0.007 0.18	0.005 0.13	0.002 0.06
400	0.276 7.00	0.016 0.40	0.012 0.30	0.008 0.20	0.006 0.15	0.003 0.07

Back-up Ring and Stakbak®

Table III Back-up Ring Types: Industry Standards Mil-P-5514 and Mil-G-5514

Cross section	Description	Part Number (Old part number)	Aerospace, military or Boeing part number	Gland standard
	Heavy duty Spiral Rod or piston seal (see Note 1)	BM820S (S38030)	MS28782	Mil-P-5514 Revisions A, B, C, D, E one or two BUR widths
	Heavy duty Solid Rod or piston seal	BUS00M* (S13050)		Mil-P-5514 Revisions C, D, E one or two BUR widths
	Heavy duty single turn Rod or piston seal (see Note 1)	BM740M (S38029)	MS28774	Mil-P-5514 thru Mil-G-5514 All revisions one or two BUR widths
	Heavy-duty single turn Scarf-cut Rod or piston seal	BGS20M* (S13122)		Mil-P-5514 thru Mil-G-5514 All revisions one or two BUR widths
	Heavy-duty spiral turn Scarf-cut Rod or piston seal	BP170M* (S12517)		Mil- P-5514 Revisions C, D, E fractional one or two BUR widths
	Heavy-duty single turn Rod or piston seal	BU870M* (S12587)		Mil-P-5514 Revisions A, B, C, D, E one or two BUR widths
	Heavy-duty single turn Scarf-cut Rod or piston seal	BG660M* (S12766)		Mil-P-5514 Revisions D, E one or two BUR widths
	Delta Solid Piston seal	--- (S11243)* (S33824 is recommended)	LS4652	Mil-P-5514 Revisions C, D, E one or two BUR widths
	Delta Solid Rod seal	--- (S11242)* (S33823 is recommended)	LS4652	Mil-P-5514 Revisions C, D, E one or two BUR widths
	Delta Solid Piston seal	--- (S33278)*		Mil-P-5514 Revisions C, D, E one or two BUR widths
	Delta Solid Rod seal	--- (S33277)*		Mil-P-5514 Revisions C, D, E one or two BUR widths

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;

BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type














BUR – Back-up Ring

* The part number is for one ring only. Two rings should be ordered to form a set.

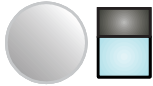
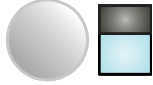

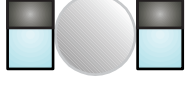



Back-up Ring Material Notes:

¹⁾ Mil-spec and BAC Back-up Rings available in only AMS-R-8791 material, TSS Turcon T28 only

Back-up Ring and Stakbak®

Cross section	Description	Part Number (Old part number)	Aerospace, military or Boeing part number	Gland standard
	Delta Solid Piston seal	BU440M* (S33824)		Mil-G-5514 Revision F one or two BUR widths
	Delta Solid Rod seal	BU230M* (S33823)		Mil-G-5514 Revision F one or two BUR widths
	Heavy-duty single turn Solid or scarf-cut Rod or piston seal	BUS70M* Uncut BGS70M* Cut (S33157)		Mil-G-5514 Revision F
	Heavy-duty single turn Solid or scarf-cut Rod or piston seal	BUS10M Uncut BGS10M Cut (S33861)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Rod Seal	BG990M (S36991)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Rod Seal	BG920M (S36992)		Mil-G-5514 Revision F Two BUR Width
	Stakbak® bonded Scarf-cut Piston Seal	BG010M (S37001)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Piston Seal	BG420M (S37242)		Mil-G-5514 Revision F Two BUR Width
	Stakbak® bonded Scarf-cut Rod Seal	BG110M (S37011)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Piston Seal	BG210M (S37021)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Rod Seal	BG550M (S37055)		Mil-G-5514 Revision F Two BUR Width
	Stakbak® bonded Scarf-cut Piston Seal	BG660M (S37060)		Mil-G-5514 Revision F One BUR Width
	Stakbak® bonded Scarf-cut Rod Seal	BG760M (S37076)		Mil-G-5514 Revision F One BUR Width

Back-up Ring and Stakbak®

	Stakbak® bonded Scarf-cut Piston Seal	BG830M (S37083)		Mil-G-5514 Revision F One BUR Width
	Stakbak® un-bonded Scarf-cut Piston Seal	BG410M (S37241)		Mil-G-5514 Revision F One BUR Width
	Stakbak® un-bonded Scarf-cut Piston Seal	BG610M (S37261)		Mil-G-5514 Revision F Two BUR Width
	Stakbak® un-bonded Scarf-cut Piston Seal	BG420M (S37242)		Mil-G-5514 Revision F Two BUR Width
	Stakbak® un-bonded Scarf-cut Rod Seal	BG510M (S37251)		Mil-G-5514 Revision F One BUR Width
	Stakbak® un-bonded Scarf-cut Rod Seal	BG710M (S37271)		Mil-G-5514 Revision F One BUR Width
	Stakbak® un-bonded Scarf-cut Rod Seal	BG520M (S37252)		Mil-G-5514 Revision F One BUR Width

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;

BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type





BUR – Back-up Ring

* The part number is for one ring only. Two rings should be ordered to form a set.






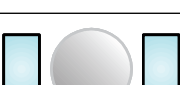
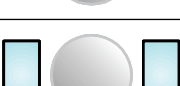
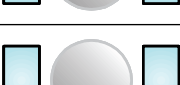
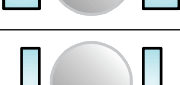
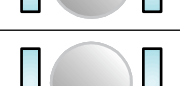
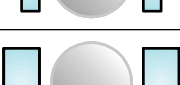
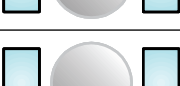
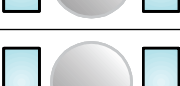
Back-up Ring Material Notes:

¹⁾ Mil-spec and BAC Back-up Rings available in only AMS-R-8791 material, TSS Turcon T28 only

Table IV Back-up Ring Types: Other industry Standards including AS4716 and AS5857




Cross Section	Description	Part Number (Old ref. P/N)	Aerospace, Military or Boeing Part Number	Gland Standard
	Heavy-duty single turn Scarf-cut Rod or piston seal	BG440G* (S38544)		AS4716
	Heavy-duty single turn Scarf-cut Rod or piston seal	BG450G* (S38545)		AS4716
	Heavy-duty single turn Solid Rod or piston seal	BU190G* (S38619)		AS4716
	Heavy-duty single turn Solid Rod or piston seal	BU180G* (S38618)		AS4716

Back-up Ring and Stakbak®

Cross Section	Description	Part Number (Old ref. P/N)	Aerospace, Military or Boeing Part Number	Gland Standard
	Heavy-duty single turn Scarf-cut Rod seal (see Note 2)	BG470G**	AS5781R10-XXX	AS4716 Revision A
	Heavy-duty single turn Scarf-cut Piston seal (see Note 2)	BH470G**	AS5781P10-XXX	AS4716 Revision A
	Heavy-duty single turn Solid Rod seal (see Note 2)	BU470G**	AS5782R10-XXX	AS4716 Revision A
	Heavy-duty single turn Solid Piston seal (see Note 2)	BV470G**	AS5782P10-XXX	AS4716 Revision A
	Heavy-duty single turn Scarf-cut Rod seal	BG47LG*	TSS Standard	AS4716 Revision A
	Heavy-duty single turn Scarf-cut Piston seal	BH47LG*	TSS Standard	AS4716 Revision A
	Heavy-duty single turn Solid Rod seal	BU47LG*	TSS Standard	AS4716 Revision A
	Heavy-duty single turn Solid Piston seal	BV47LG*	TSS Standard	AS4716 Revision A
	Two Back-up Rings in one Back-up Gland Width Cut, Rod seal	BG870G (S38587)		AS4716 Revision A
	Two Back-up Rings in one Back-up Gland Width Cut, Piston seal	BG880G (S38588)		AS4716 Revision A
	Heavy-duty single turn Scarf-cut Rod seal (see Note 3)	BG580E*	AS5861R10-XXX	AS5857
	Heavy-duty single turn Scarf-cut Piston seal (see Note 3)	BH580E*	AS5861P10-XXX	AS5857
	Heavy-duty single turn Solid Piston seal (see Note 3)	BV580E*	AS5860P10-XXX	AS5857

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;
BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type

Back-up Ring and Stakbak®

	Heavy-duty single turn Solid Rod seal (see Note 3)	BU580E*	AS5860R10-XXX	AS5857
	Heavy-duty single turn Scarf-cut Rod seal	BG58LE*	TSS Standard	AS5857
	Heavy-duty single turn Scarf-cut Piston seal	BH58LE*	TSS Standard	AS5857
	Heavy-duty single turn Solid Piston seal	BV58LE*	TSS Standard	AS5857
	Heavy-duty single turn Solid Rod seal	BU58VE*	TSS Standard	AS5857
	Heavy-duty single turn Rod or piston seal	BU890M* (S30989)		AS568 One or Two BUR Width
	Heavy-duty single turn Scarf-cut Rod or piston seal (see Note 1)	BG940M* (S30294)	BACR12BM	Boeing Standard
	Heavy-duty single turn Rod or piston seal (see Note 1)	BG660M* (S30310)	BACR12BP	Boeing Standard

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;
BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type

BUR – Back-up Ring

* The part number is for one ring only. Two rings should be ordered to form a set.

For gland standard AS4716 note ID and OD differences, AMS3678/X color for rod and AMS3678/X for piston

New gland standard AS5857 for static seals only. Note dimensional differences to other Aerospace gland standards. Standard BUR AS5860 and AS5861 only available in AMS3678/10 material, carbon fiber-filled PTFE (Turcon T29)

BUR labeled TSS Standard are per Trelleborg Sealing Solutions recommended tolerances. These differ from the specification tolerances but parts are designed to same fit, form and function as the standards. TSS Standard BUR designs can be ordered in any Turcon material grade.

** Can be ordered with any AMS 3678 material code

Back-up Ring Material Notes:

¹⁾ Mil-spec and BAC Backup Rings available in only AMS-R-8791 material, TSS Turcon T28 only

²⁾ AS4716 Backup Rings available in Turcon T01, T09, T13, T44, T05, T04, T10, T40 & T29, PT00 which coincide with AMS3678/ materials (see Table I)

³⁾ AS5857 Backup Rings available is AMS3678/10 material only, TSS Turcon T29 only

Back-up Ring and Stakbak®

Table V AMS3678 Material to Turcon Cross-reference

AMS3678 Material Code	Filler Types	Turcon Code
AMS3678/1A	Virgin PTFE Grades A and B	T01
AMS3678/1B	Virgin PTFE Grades A and B	T28
AMS3678/2	PTFE filled with graphite	T09
AMS3678/3	PTFE filled with glass fiber and molybdenum disulfide	T13
AMS3678/4	PTFE filled with glass fiber	T44
AMS3678/5	PTFE filled with inorganic pigment	T05
AMS3678/6	PTFE filled with bronze powder	T04
AMS3678/7	PTFE filled with carbon and graphite*	T10
AMS3678/8	PTFE filled with carbon fiber	T40
AMS3678/9	PTFE filled with inorganic pigment (AS4716)	---
AMS3678/10	PTFE filled with carbon fiber	T29

* Turcon T11 does not meet AMS3678/7

Back-up Ring and Stakbak®

Table VI Cross-reference Guide for Back-up Rings

Boeing standards	Military standards	Part Numbers				Description
		Aero-space standards	Other standards	TSS Part Number		
				Old TSS P/N	New TSS P/N	
BACR12AJ	MS28783			---	---	Spiral turn Back-up Ring
BACR12BM			A22549	S30294	BG940M	Single turn Back-up Ring Heavy-duty, scarf-cut
BACR12BM			LS10862	S30294	BG940M	Single turn Back-up Ring Heavy-duty, scarf-cut
BACR12BP			LS11060	S30310	BU100M	Back-up Ring Heavy-duty, solid
	M8791/1	AS8791		S38049	BG910M	Single turn Back-up Ring, scarf-cut
	MS27595			S38027	BU950M	Back-up Ring Solid
	MS28773			S38028	BM730S	Single turn Back-up Ring, Boss connection, scarf-cut
	MS28774			S38029	BM740M	Single turn Back-up Ring, scarf-cut
	MS28782			S38030	BM820S	Spiral turn Back-up Ring
	MS9058			---	---	Single turn Back-up Ring, Boss connection, scarf-cut
		AS5781			BG470G BH470G	Single turn Back-up Ring, AS4716 glands, scarf-cut
		AS5782			BU470G BV470G	Single turn Back-up Ring, AS4716 glands
		AS5860			BG580E BH580E	Single turn Back-up Ring, AS5857 glands*, scarf-cut
		AS5861			BU580E BV580E	Single turn Back-up Ring, AS5857 glands*, solid

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;
BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type; BM*** = Mil-Spec Back-up Ring

* New gland standard AS5857 Back-up Rings for static seals only. Note dimensional gland differences to other Aerospace gland standards; AS4716 and Mil-G-5514. Only available in AMS3678/10 material, carbon fiber-filled PTFE or Turcon T29, ordering example AS5861P10-XXX.

Back-up Ring and Stakbak®

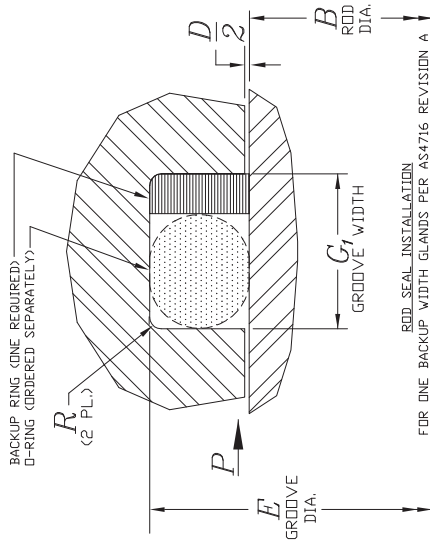
Table VII Conversions from new to old part numbers

New P/N	Old P/N
BP090A	S11109
BG480M	S11248
BP170M	S12517
BU870M	S12587
BG660M	S12766
BU500M	S13050
BG690M	S13069
BGS20M	S13122
BG940M	S30294
BU100M	S30310
BU890M	S30989
BU570M	S33157
BU230M	S33823
BU440M	S33824
BGS10M	S33861
BG990M	S36991
BG920M	S36992
BG010M	S37001
BG020M	S37002

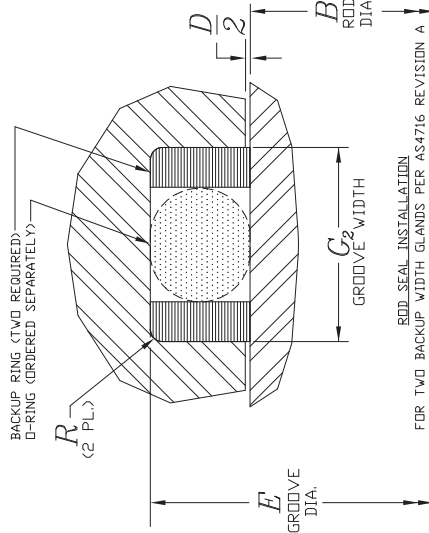
New P/N	Old P/N
BG110M	S37011
BG210M	S37021
BG550M	S37055
BG600M	S37060
BG760M	S37076
BG830M	S37083
BG410M	S37241
BG420M	S37242
BG510M	S37251
BG520M	S37252
BG610M	S37261
BG710M	S37271
BG440G	S38544
BG450G	S38545
BG870G	S38587
BG880G	S38588
BU180G	S38618
BU190G	S38619

BU*** = Back-up Ring Uncut (Solid); BV*** = Back-up Ring Uncut (Solid); BG*** = Back-up Ring Scarf Cut;
 BH*** = Back-up Ring Scarf Cut; BP*** = Back-up Ring Spiral type

Back-up Ring and Stakbak®



FOR ONE BACKUP INSTALLATION
ROD SEAL WIDTH GLANDS PER AS4716 REVISION A



FOR TWO BACKUP INSTALLATION
ROD SEAL WIDTH GLANDS PER AS4716 REVISION A

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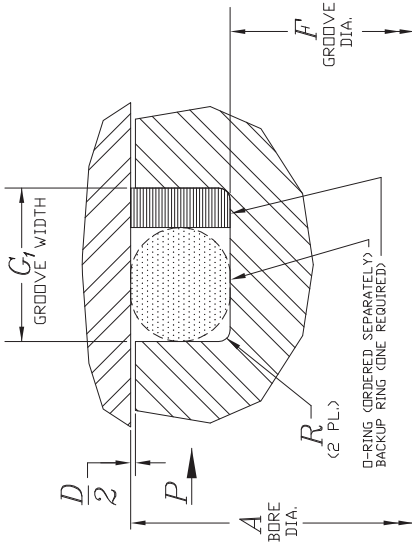
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DRAWING NO.	BG470G000
TRELLEBORG SEALING SOLUTIONS	

DASH NO.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084-009	.154/.164	.210/.220	.207/.217	.005/.015	.004
010-012	.150/.160	.207/.217		.005	.004
013-028				.005	.004
104-109				.005	.004
110-126		.245/.255		.005/.015	.005
127-129				.006	.006
130-132				.007	.007
133-133				.007	.007
141-141				.006	.006
223-224	.235/.245	.304/.314		.010/.025	.006
225-227				.007	.007
228-230				.007	.007
325-327				.006	.006
328-329	.334/.344	.424/.434		.020/.035	.007
330-331				.007	.007
332-343				.007	.007
425-437	.475/.485	.579/.589		.020/.035	.009

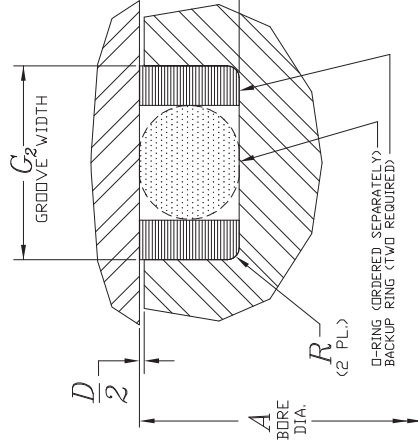
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212	873	1.115	.212	212	006
213	935	1.177	.213	213	008
214	998	1.240	.214	214	008
215	1.060	1.302	.215	215	009
216	1.123	1.365	.216	216	000
217	1.185	1.427	.217	217	010
218	1.248	1.490	.218	218	012
219	1.310	1.552	.219	219	012
220	1.373	1.615	.220	220	013
221	1.435	1.677	.221	221	015
222	1.498	1.740	.222	222	015
223	1.563	1.805	.223	223	015
224	1.748	1.990	.224	224	018
225	1.873	2.115	.225	225	018
226	1.998	2.240	.226	226	019
227	2.123	2.365	.227	227	020
228	2.248	2.490	.228	228	021
229	2.373	2.615	.229	229	022
230	2.498	2.740	.230	230	023
325	1.498	1.870	.325	325	024
326	1.543	1.930	.326	326	024
327	1.588	2.000	.327	327	024
328	1.673	2.045	.328	328	024
329	1.748	2.115	.329	329	024
330	1.823	2.185	.330	330	024
331	1.908	2.255	.331	331	024
332	1.993	2.325	.332	332	024
333	2.078	2.395	.333	333	024
334	2.163	2.465	.334	334	024
335	2.248	2.535	.335	335	024
336	2.333	2.605	.336	336	024
337	2.418	2.675	.337	337	024
338	2.503	2.745	.338	338	024
339	2.588	2.815	.339	339	024
340	2.673	2.885	.340	340	024
341	2.758	2.955	.341	341	024
342	2.843	3.025	.342	342	024
343	2.928	3.095	.343	343	024
344	3.013	3.165	.344	344	024
345	3.098	3.235	.345	345	024
346	3.183	3.305	.346	346	024
347	3.268	3.375	.347	347	024
348	3.353	3.445	.348	348	024
349	3.438	3.515	.349	349	024
425	4.497	5.759	.425	425	000
426	4.582	5.829	.426	426	000
427	4.667	5.899	.427	427	000
428	4.752	5.969	.428	428	000
429	4.837	6.039	.429	429	000
430	4.922	6.109	.430	430	000
431	5.007	6.179	.431	431	000
432	5.092	6.249	.432	432	000
433	5.177	6.319	.433	433	000
434	5.262	6.389	.434	434	000
435	5.347	6.459	.435	435	000
436	5.432	6.529	.436	436	000
437	5.517	6.599	.437	437	000
438	5.602	6.669	.438	438	000
439	5.687	6.739	.439	439	000
440	5.772	6.809	.440	440	000
441	5.857	6.879	.441	441	000
442	5.942	6.949	.442	442	000
443	6.027	7.019	.443	443	000
444	6.112	7.089	.444	444	000
445	6.197	7.159	.445	445	000
446	6.282	7.229	.446	446	000
447	6.367	7.299	.447	447	000
448	6.452	7.369	.448	448	000
449	6.537	7.439	.449	449	000
450	6.622	7.509	.450	450	000
451	6.707	7.579	.451	451	000
452	6.792	7.649	.452	452	000
453	6.877	7.719	.453	453	000
454	6.962	7.789	.454	454	000
455	7.047	7.859	.455	455	000
456	7.132	7.929	.456	456	000
457	7.217	8.000	.457	457	000
458	7.302	8.070	.458	458	000
459	7.387	8.140	.459	459	000
460	7.472	8.210	.460	460	000
461	7.557	8.280	.461	461	000
462	7.642	8.350	.462	462	000
463	7.727	8.420	.463	463	000
464	7.812	8.490	.464	464	000
465	7.897	8.560	.465	465	000
466	7.982	8.630	.466	466	000
467	8.067	8.700	.467	467	000
468	8.152	8.770	.468	468	000
469	8.237	8.840	.469	469	000
470	8.322	8.910	.470	470	000
471	8.407	8.980	.471	471	000
472	8.492	9.050	.472	472	000
473	8.577	9.120	.473	473	000
474	8.662	9.190	.474	474	000
475	8.747	9.260	.475	475	000
476	8.832	9.330	.476	476	000
477	8.917	9.400	.477	477	000
478	9.002	9.470	.478	478	000
479	9.087	9.540	.479	479	000
480	9.172	9.610	.480	480	000
481	9.257	9.680	.481	481	000
482	9.342	9.750	.482	482	000
483	9.427	9.820	.483	483	000
484	9.512	9.890	.484	484	000
485	9.597	9.960	.485	485	000
486	9.682	10.030	.486	486	000
487	9.767	10.100	.487	487	000
488	9.852	10.170	.488	488	000
489	9.937	10.240	.489	489	000
490	10.022	10.310	.490	490	000
491	10.107	10.380	.491	491	000
492	10.192	10.450	.492	492	000
493	10.277	10.520	.493	493	000
494	10.362	10.590	.494	494	000
495	10.447	10.660	.495	495	000
496	10.532	10.730	.496	496	000
497	10.617	10.800	.497	497	000
498	10.702	10.870	.498	498	000
499	10.787	10.940	.499	499	000
500	10.872	11.010	.500	500	000

- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, INTERNAL BACKUP RINGS IN AS4716 REVISION A ROD GLANDS.
 - ORDERING EXAMPLE: BG47.0 G 214 A 129
 BACKUP RING, SCARF-CUT, INTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 0 = PER SPECIFICATION
 GLAND DESIGNATOR
 SIZE DESIGNATOR
 ACTUATING TO AS4716 REVISION A
 G = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON® BACKUP RING MAT'L. CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - FOR SOLID, INTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BG470G000.
 - ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE

Back-up Ring and Stakbak®



BACKUP RING INSTALLATION
FOR ONE BACKUP WIDTH GLANDS PER AS4716 REVISION A



BACKUP RING INSTALLATION
FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

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INCH

TRELLERBORG SEALING SOLUTIONS

TITLE
BACKUP RING, SCARF-CUT, EXTERNAL

DRAWING NO.
BH470G000

2011_9

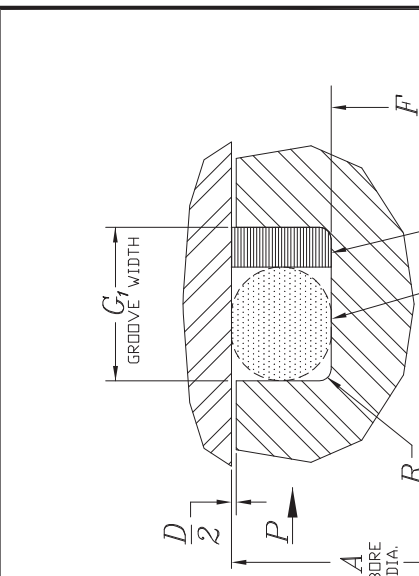
DASH NO.	G1 ONE BACKUP WIDTH	G2 TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084-009	.154/.164	.210/.220	.005/.015	.004
010-012	.150/.160	.207/.217	.005/.015	.004
013-028				.004
104-109				.004
110-126	.183/.193	.245/.255	.005/.015	.005
127-129				.005
130-132				.006
133-135				.006
136-139				.006
140-144				.006
223-224				.006
225-227	.235/.245	.304/.314	.010/.025	.006
228-230				.007
325-327				.006
328-329				.006
330-331	.334/.344	.424/.434	.020/.035	.006
332-333				.006
334-335				.008
425-437	.475/.485	.579/.589	.020/.035	.009

DASH NO.	A DIA.	F DIA.	D-RING NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	G1	G2	R	D
004	+0.000	+0.001	004	+0.002	+0.002	210	210	.154/.164	.210/.220	.005/.015	.004
005	.190	.076	005	1.053	.812	211	211	.150/.160	.207/.217	.005/.015	.004
006	.235	.115	006	1.116	.874	212	212				
007	.266	.129	007	1.178	.936	213	213				
008	.297	.189	008	1.241	.999	214	214				
009	.329	.220	009	1.303	1.061	215	215	.183/.193	.245/.255	.005/.015	.005
010	.425	.330	010	1.366	1.164	216	216				
011	.455	.375	011	1.429	1.267	217	217				
012	+0.002	+0.002	012	1.491	1.249	218	218	.235/.245	.304/.314	.010/.025	.006
013			013	1.553	1.311	219	219				
014	.550	.441	014	1.616	1.374	220	220				
015	.613	.504	015	1.678	1.436	221	221	.334/.344	.424/.434	.020/.035	.006
016	.775	.566	016	1.741	1.499	222	222				
017	.800	.651	017	1.803	1.562	223	223				
018	.863	.753	018	1.866	1.624	224	224	.475/.485	.579/.589	.020/.035	.009
019	.925	.815	019	1.929	1.687	225	225				
020	.991	.881	020	1.992	1.750	226	226				
021	1.053	.943	021	2.055	1.813	227	227				
022	1.116	1.006	022	2.118	1.876	228	228				
023	1.178	1.068	023	2.181	1.939	229	229				
024	1.241	1.131	024	2.244	2.002	230	230				
025	1.303	1.193	025	2.307	2.065						
026	1.366	1.256	026	2.370	2.128						
027	1.428	1.318	027	2.433	2.191						
028	1.491	1.381	028	2.496	2.254						
104	+0.000	+0.000	104	+0.002	+0.002	325	325				
105	.297	.158	105	1.053	.812	326	326				
106	.360	.187	106	1.116	.874	327	327				
107	.391	.215	107	1.178	.936	328	328				
108	.422	.246	108	1.241	.999	329	329				
109	.453	.275	109	1.303	1.061	330	330				
110	+0.002	+0.002	110	1.366	1.124	331	331				
111	.550	.379	111	1.429	1.187	332	332				
112	.613	.441	112	1.491	1.250	333	333				
113	.675	.502	113	1.553	1.313	334	334				
114	.738	.565	114	1.616	1.376						
115	.800	.627	115	1.678	1.439						
116	.863	.689	116	1.741	1.502						
117	.925	.751	117	1.803	1.565						
118	.991	.812	118	1.866	1.628						
119	1.053	.874	119	1.929	1.691						
120	1.116	.942	120	2.000	1.754						
121	1.178	1.003	121	2.062	1.817						
122	1.241	1.066	122	2.124	1.880						
123	1.303	1.128	123	2.187	1.943						
124	1.366	1.191	124	2.250	2.006						
125	1.428	1.253	125	2.313	2.069						
126	1.491	1.316	126	2.376	2.132						
127	1.553	1.378	127	2.439	2.195						
128	1.616	1.503	128	2.502	2.258						
129	1.678	1.566	129	2.565	2.321						
130	1.805	1.631	130	2.628	2.384						
131	1.867	1.693	131	2.691	2.447						
132	1.930	1.756	132	2.754	2.510						
133	1.992	1.818	133	2.817	2.573						
134	2.055	1.881	134	2.880	2.636						
135	2.118	1.944	135	2.943	2.699						
136	2.180	2.006	136	3.006	2.762						
137	2.243	2.069	137	3.069	2.825						
138	2.306	2.131	138	3.132	2.888						
139	2.368	2.194	139	3.195	2.951						

NOTES:

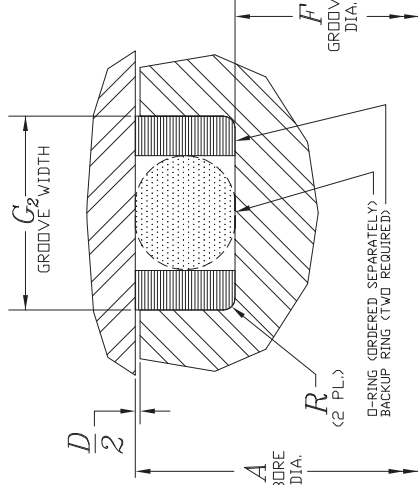
- TRELLERBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, EXTERNAL BACKUP RINGS IN AS4716 REVISION A PISTON GLANDS.
- ORDERING EXAMPLE:
 BH4710.0.214 A 122
 BACKUP RING, SCARF-CUT, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 0 = PER SPECIFICATION
 GLAND DESIGNATOR
 G = AS4716
 SIZE DESIGNATOR
 ACCORDING TO AS4716 REVISION A
 QUALITY AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCIN BACKUP RING MATL CODE
 CONSULT THE TRELLERBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SOLID, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLERBORG SEALING SOLUTIONS PART NUMBER BV470G000.
- ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE.

Back-up Ring and Stakbak[®]



R (2 PL.)
D-RING (ORDERED SEPARATELY)
BACKUP RING (ONE REQUIRED)

FOR ONE BACKUP WIDTH GLANDS PER AS4716 REVISION A



R (2 PL.)
D-RING (ORDERED SEPARATELY)
BACKUP RING (TWO REQUIRED)

FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

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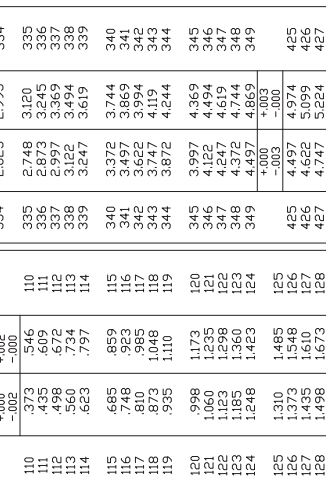
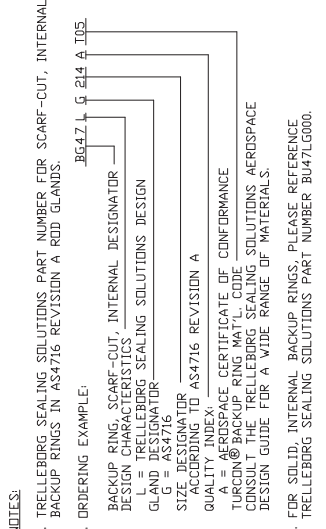
INCH
2009_1
TRELLEBORG SEALING SOLUTIONS
DRAWING NO.
BACKUP RING, SOLID, EXTERNAL
BV470G000

DASH NO.	DASH NO.	D-RING NO.	DASH NO.	G_1 ONE BACKUP WIDTH	G_2 TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	004	435	210	.1847/164	.2107/220	.005/.015	.004
005	210	436	211	.1847/164	.2107/220	.005/.015	.004
006	211	437	212	.1507/160	.207/217	.005/.015	.005
007	212	438	213	.1507/160	.207/217	.005/.015	.005
008	213	439	214	.101-126	.245/.255	.005/.015	.005
009	214	440	215	.127-129	.245/.255	.005/.015	.005
010	215	441	216	.130-132	.245/.255	.005/.015	.005
011	216	442	217	.133-140	.245/.255	.005/.015	.005
012	217	443	218	.203-207	.304/.314	.010/.025	.006
013	218	444	219	.203-207	.304/.314	.010/.025	.006
014	219	445	220	.228-243	.304/.314	.010/.025	.007
015	220	446	221	.244-245	.304/.314	.010/.025	.008
016	221	447	222	.246-247	.304/.314	.010/.025	.008
017	222	448	223	.328-329	.424/.434	.020/.035	.006
018	223	449	224	.330-345	.424/.434	.020/.035	.007
019	224	450	225	.346-349	.424/.434	.020/.035	.008
020	225	451	226	.425-438	.579/.589	.020/.035	.009
021	226	452	227	.439-445	.579/.589	.020/.035	.009
022	227	453	228	.446	.579/.589	.020/.035	.010
023	228	454	229	.447-460	.579/.589	.020/.035	.011
024	229	455	230				

DASH NO.	DASH NO.	D-RING NO.	DASH NO.	A DIA.	F DIA.
210	210	435	210	6.284	5.747
211	211	436	211	6.549	5.872
212	212	437	212	6.474	5.997
213	213	438	213	6.724	6.247
214	214	439	214	6.974	6.497
215	215	440	215	7.224	6.747
216	216	441	216	7.474	6.997
217	217	442	217	7.724	7.247
218	218	443	218	7.974	7.497
219	219	444	219	8.224	7.747
220	220	445	220	8.474	7.997
221	221	446	221	8.724	8.247
222	222	447	222	8.974	8.497
223	223	448	223	9.224	8.747
224	224	449	224	9.474	8.997
225	225	450	225	9.724	9.247
226	226	451	226	9.974	9.497
227	227	452	227	10.224	9.747
228	228	453	228	10.474	9.997
229	229	454	229	10.724	10.247
230	230	455	230	10.974	10.497
231	231	456	231	11.224	10.747
232	232	457	232	11.474	10.997
233	233	458	233	11.724	11.247
234	234	459	234	11.974	11.497
235	235	460	235	12.224	11.747
236	236		236	12.474	11.997
237	237		237	12.724	12.247
238	238		238	12.974	12.497
239	239		239	13.224	12.747
240	240		240	13.474	12.997
241	241		241	13.724	13.247
242	242		242	13.974	13.497
243	243		243	14.224	13.747
244	244		244	14.474	13.997
245	245		245	14.724	14.247
246	246		246	14.974	14.497
247	247		247	15.224	14.747
248	248		248	15.474	14.997
249	249		249	15.724	15.247
250	250		250	15.974	15.497
251	251		251	16.224	15.747
252	252		252	16.474	15.997
253	253		253	16.724	16.247
254	254		254	16.974	16.497
255	255		255	17.224	16.747
256	256		256	17.474	16.997
257	257		257	17.724	17.247
258	258		258	17.974	17.497
259	259		259	18.224	17.747
260	260		260	18.474	17.997
261	261		261	18.724	18.247
262	262		262	18.974	18.497
263	263		263	19.224	18.747
264	264		264	19.474	18.997
265	265		265	19.724	19.247
266	266		266	19.974	19.497
267	267		267	20.224	19.747
268	268		268	20.474	19.997
269	269		269	20.724	20.247
270	270		270	20.974	20.497
271	271		271	21.224	20.747
272	272		272	21.474	20.997
273	273		273	21.724	21.247
274	274		274	21.974	21.497
275	275		275	22.224	21.747
276	276		276	22.474	21.997
277	277		277	22.724	22.247
278	278		278	22.974	22.497
279	279		279	23.224	22.747
280	280		280	23.474	22.997
281	281		281	23.724	23.247
282	282		282	23.974	23.497
283	283		283	24.224	23.747
284	284		284	24.474	23.997
285	285		285	24.724	24.247
286	286		286	24.974	24.497
287	287		287	25.224	24.747
288	288		288	25.474	24.997
289	289		289	25.724	25.247
290	290		290	25.974	25.497
291	291		291	26.224	25.747
292	292		292	26.474	25.997
293	293		293	26.724	26.247
294	294		294	26.974	26.497
295	295		295	27.224	26.747
296	296		296	27.474	26.997
297	297		297	27.724	27.247
298	298		298	27.974	27.497
299	299		299	28.224	27.747
300	300		300	28.474	27.997
301	301		301	28.724	28.247
302	302		302	28.974	28.497
303	303		303	29.224	28.747
304	304		304	29.474	28.997
305	305		305	29.724	29.247
306	306		306	29.974	29.497
307	307		307	30.224	29.747
308	308		308	30.474	29.997
309	309		309	30.724	30.247
310	310		310	30.974	30.497
311	311		311	31.224	30.747
312	312		312	31.474	30.997
313	313		313	31.724	31.247
314	314		314	31.974	31.497
315	315		315	32.224	31.747
316	316		316	32.474	31.997
317	317		317	32.724	32.247
318	318		318	32.974	32.497
319	319		319	33.224	32.747
320	320		320	33.474	32.997
321	321		321	33.724	33.247
322	322		322	33.974	33.497
323	323		323	34.224	33.747
324	324		324	34.474	33.997
325	325		325	34.724	34.247
326	326		326	34.974	34.497
327	327		327	35.224	34.747
328	328		328	35.474	34.997
329	329		329	35.724	35.247
330	330		330	35.974	35.497
331	331		331	36.224	35.747
332	332		332	36.474	35.997
333	333		333	36.724	36.247
334	334		334	36.974	36.497
335	335		335	37.224	36.747
336	336		336	37.474	36.997
337	337		337	37.724	37.247
338	338		338	37.974	37.497
339	339		339	38.224	37.747
340	340		340	38.474	37.997
341	341		341	38.724	38.247
342	342		342	38.974	38.497
343	343		343	39.224	38.747
344	344		344	39.474	38.997
345	345		345	39.724	39.247
346	346		346	39.974	39.497
347	347		347	40.224	39.747
348	348		348	40.474	39.997
349	349		349	40.724	40.247
350	350		350	40.974	40.497
351	351		351	41.224	40.747
352	352		352	41.474	40.997
353	353		353	41.724	41.247
354	354		354	41.974	41.497
355	355		355	42.224	41.747
356	356		356	42.474	41.997
357	357		357	42.724	42.247
358	358		358	42.974	42.497
359	359		359	43.224	42.747
360	360		360	43.474	42.997
361	361		361	43.724	43

Back-up Ring and Stakbak®

DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	B DIA.	E DIA.	D-RING NO.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRICAL CLEARANCE MAX.
084	+0.00	-0.01	004	210	746	989	210	084-009	.154/.164	.210/.220	.005/.015	.004
085	+0.06	-0.01	005	211	816	1051	211	010-012	.150/.160	.207/.217	.005/.015	.004
086	+0.08	-0.02	006	212	873	1115	212	013-028				.005
087	+0.14	-0.04	007	213	935	1177	213	104-109				.004
088	+0.185	-0.04	008	214	998	1240	214	110-126				.005
089	+0.217	-0.05	009	215	1060	1302	215	127-129	.183/.193	.245/.255	.005/.015	.006
090	+0.246	-0.05	010	216	1123	1365	216	130-132				.006
091	+0.273	-0.05	011	217	1186	1427	217	133-133				.007
092	+0.300	-0.05	012	218	1248	1490	218	136-136				.007
093	+0.327	-0.05	013	219	1310	1552	219	223-224	.235/.245	.304/.314	.010/.025	.006
094	+0.354	-0.05	014	220	1373	1615	220	225-227				.007
095	+0.381	-0.05	015	221	1435	1677	221	228-230				.006
096	+0.408	-0.05	016	222	1498	1740	222	325-327	.334/.344	.424/.434	.020/.035	.007
097	+0.435	-0.05	017	223	1561	1802	223	328-329				.007
098	+0.462	-0.05	018	224	1624	1865	224	329-349				.007
099	+0.489	-0.05	019	225	1687	1928	225	425-437	.475/.485	.579/.589	.020/.035	.009
100	+0.516	-0.05	020	226	1750	1991	226					
101	+0.543	-0.05	021	227	1813	2054	227					
102	+0.570	-0.05	022	228	1876	2117	228					
103	+0.597	-0.05	023	229	1939	2180	229					
104	+0.624	-0.05	024	230	2002	2243	230					
105	+0.651	-0.05	025	231	2065	2306	231					
106	+0.678	-0.05	026	232	2128	2369	232					
107	+0.705	-0.05	027	233	2191	2432	233					
108	+0.732	-0.05	028	234	2254	2495	234					
109	+0.759	-0.05	029	235	2317	2558	235					
110	+0.786	-0.05	030	236	2380	2621	236					
111	+0.813	-0.05	031	237	2443	2684	237					
112	+0.840	-0.05	032	238	2506	2747	238					
113	+0.867	-0.05	033	239	2569	2810	239					
114	+0.894	-0.05	034	240	2632	2873	240					
115	+0.921	-0.05	035	241	2695	2936	241					
116	+0.948	-0.05	036	242	2758	2999	242					
117	+0.975	-0.05	037	243	2821	3062	243					
118	+1.002	-0.05	038	244	2884	3125	244					
119	+1.029	-0.05	039	245	2947	3188	245					
120	+1.056	-0.05	040	246	3010	3251	246					
121	+1.083	-0.05	041	247	3073	3314	247					
122	+1.110	-0.05	042	248	3136	3377	248					
123	+1.137	-0.05	043	249	3199	3440	249					
124	+1.164	-0.05	044	250	3262	3503	250					
125	+1.191	-0.05	045	251	3325	3566	251					
126	+1.218	-0.05	046	252	3388	3629	252					
127	+1.245	-0.05	047	253	3451	3692	253					
128	+1.272	-0.05	048	254	3514	3755	254					
129	+1.299	-0.05	049	255	3577	3818	255					
130	+1.326	-0.05	050	256	3640	3881	256					
131	+1.353	-0.05	051	257	3703	3944	257					
132	+1.380	-0.05	052	258	3766	4007	258					
133	+1.407	-0.05	053	259	3829	4070	259					
134	+1.434	-0.05	054	260	3892	4133	260					
135	+1.461	-0.05	055	261	3955	4196	261					
136	+1.488	-0.05	056	262	4018	4259	262					
137	+1.515	-0.05	057	263	4081	4322	263					
138	+1.542	-0.05	058	264	4144	4385	264					
139	+1.569	-0.05	059	265	4207	4448	265					



NOTE:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, INTERNAL BACKUP RINGS IN AS4716 REVISION A ROD GLANDS.
- ORDERING EXAMPLE:
 BACKUP RING, SCARF-CUT, INTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBORG SEALING SOLUTIONS DESIGN
 G = AS4716
 SIZE DESIGNATOR
 ACQUISITION TO AS4716 REVISION A
 G O A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCIN® BACKUP RING MATH CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SOLID, INTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BU47LG000.

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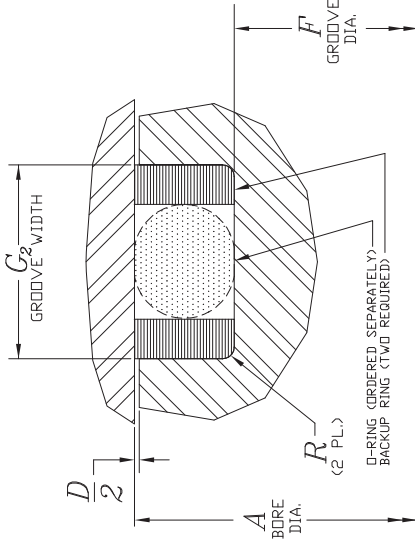
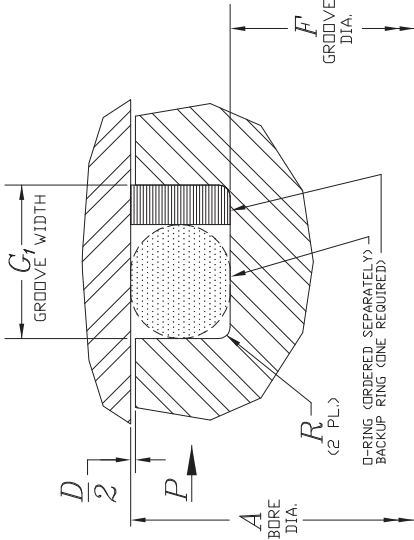
TRELLEBORG SEALING SOLUTIONS
 TITLE BACKUP RING, SCARF-CUT, INTERNAL
 DRAWING NO. BG47LG000

Back-up Ring and Stakbak®

DASH NO.	A DIA.	F DIA.	D-RING ND.	DASH NO.	A DIA.	F DIA.	D-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.001	+0.001	004	210	+0.002	+0.002	210	004-009	.154/.164	.210/.220	.005/.015	.004
005	190	076	005	211	1.053	.812	211	010-012	.150/.160	.207/.217	.005/.015	.004
006	235	129	006	212	1.116	.874	212	013-028				.004
007	265	158	007	213	1.178	.936	213	014-019				.005
008	297	189	008	214	1.241	.999	214	010-126				.005
009	329	220	009	215	1.303	1.061	215	127-129	.183/.193	.245/.255	.005/.015	.006
010	420	290	010	216	1.366	1.124	216	130-132				.006
011	452	320	011	217	1.428	1.186	217	133-139				.006
012	+0.002	+0.002	012	218	1.491	1.249	218	223-224				.006
013	-0.002	-0.002	013	219	1.553	1.311	219	225-227	.235/.245	.304/.314	.010/.025	.006
014	550	441	014	220	1.616	1.374	220	228-230				.007
015	613	504	015	221	1.678	1.436	221	323-327	.334/.344	.424/.434	.020/.035	.006
016	775	566	016	222	1.741	1.499	222	328-329				.006
017	800	621	017	223	1.803	1.562	223	330-343				.006
018	863	753	018	224	1.892	1.750	224	425-437	.475/.485	.579/.589	.020/.035	.009
019	925	815	019	225	2.118	1.876	225					
020	991	881	020	226	2.243	2.001	226					
021	1.053	943	021	227	2.368	2.126	227					
022	1.116	1.006	022	228	2.493	2.251	228					
023	1.178	1.068	023	229	2.618	2.376	229					
024	1.241	1.131	024	230	2.743	2.501	230					
025	1.303	1.193	025		+0.002	+0.002						
026	1.366	1.256	026	325	1.867	1.495	325					
027	1.428	1.318	027	326	1.992	1.620	326					
028	1.491	1.381	028	327	2.118	1.746	327					
029	+0.001	+0.001	029	328	2.243	1.871	328					
030	-0.001	-0.001	030	329	2.368	1.996	329					
104	297	158	104	330	2.493	2.121	330					
105	329	187	105	331	2.618	2.246	331					
106	360	215	106	332	2.743	2.371	332					
107	391	243	107	333	2.868	2.496	333					
108	422	271	108	334	2.993	2.621	334					
109	+0.003	+0.003	109	335	3.118	2.746	335					
110	-0.003	-0.003	110	336	3.243	2.871	336					
111	550	441	111	337	3.368	2.996	337					
112	613	504	112	338	3.493	3.121	338					
113	675	566	113	339	3.618	3.246	339					
114	738	628	114	340	3.743	3.371	340					
115	800	690	115	341	3.868	3.496	341					
116	863	751	116	342	3.993	3.621	342					
117	925	812	117	343	4.118	3.746	343					
118	991	874	118	344	4.243	3.871	344					
119	1.053	936	119	345	4.368	3.996	345					
120	1.116	998	120	346	4.493	4.121	346					
121	1.178	1.060	121	347	4.618	4.246	347					
122	1.241	1.122	122	348	4.743	4.371	348					
123	1.303	1.184	123	349	4.868	4.496	349					
124	1.366	1.246	124		+0.003	+0.003						
125	1.428	1.308	125	425	4.974	4.497	425					
126	1.491	1.370	126	426	5.099	4.622	426					
127	1.553	1.432	127	427	5.224	4.747	427					
128	1.616	1.503	128	428	5.349	4.872	428					
129	1.678	1.566	129	429	5.474	4.997	429					
130	1.805	1.631	130	430	5.599	5.122	430					
131	1.867	1.693	131	431	5.724	5.247	431					
132	1.930	1.756	132	432	5.849	5.372	432					
133	2.055	1.881	133	433	5.974	5.497	433					
134	2.055	1.881	134	434	6.099	5.622	434					
135	2.118	1.944	135	435	6.224	5.747	435					
136	2.180	2.006	136	436	6.349	5.872	436					
137	2.243	2.069	137	437	6.474	5.997	437					
138	2.305	2.131	138									
139	2.368	2.194	139									

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, EXTERNAL BACKUP RINGS IN AS4716 REVISION A PISTON GLANDS.
- ORDERING EXAMPLE: BH47LG 214 A 105
 BACKUP RING, SCARF-CUT, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBERG SEALING SOLUTIONS DESIGN
 G = AS4716
 SIZE DESIGNATOR
 ACCORDING TO AS4716 REVISION A
 QUALITY AIRSPACE CERTIFICATE OF CONFORMANCE
 TURCIN® BACKUP RING MTL CODE
 CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SOLID, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBERG SEALING SOLUTIONS PART NUMBER BV47LG000.



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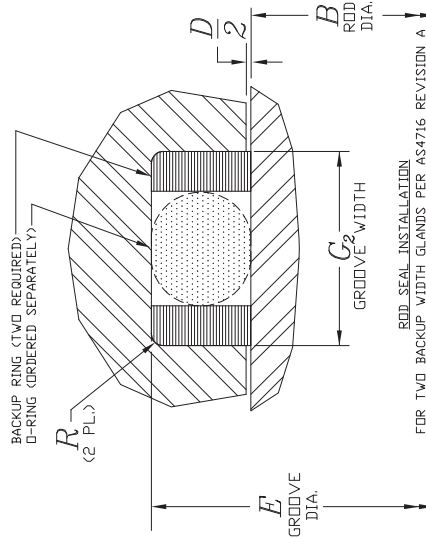
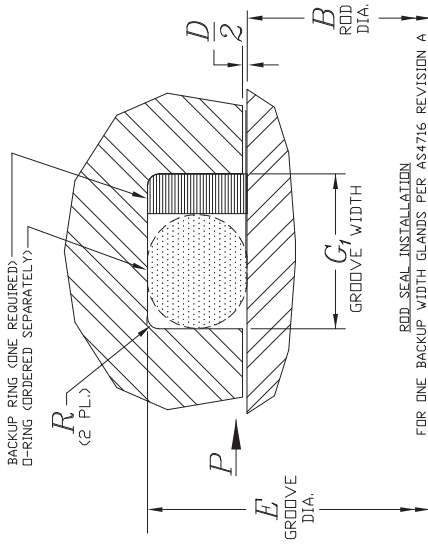
INCH 2011_8

TITLE: BACKUP RING, SCARF-CUT, EXTERNAL

DRAWING NO.: BH47LG000

TRELLEBERG SEALING SOLUTIONS

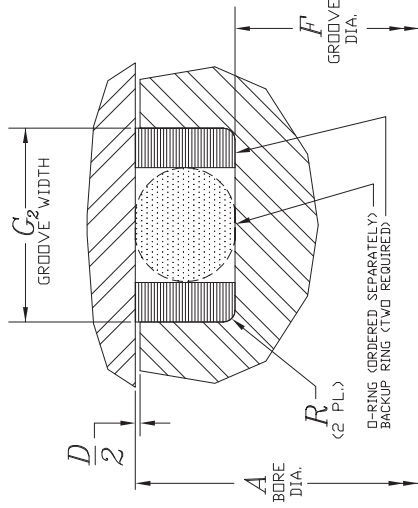
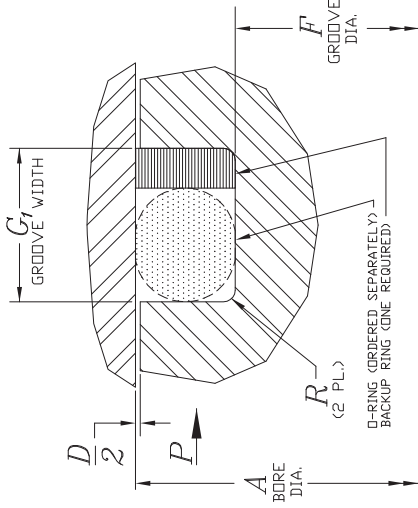
Back-up Ring and Stakbak®



DASH NO.	DASH NO.	D-RING NO.	E DIA.	B DIA.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	435	210	1.989	1.000	.1547/164	.210/220	.005/.015	.004
005	436	211	1.989	1.000	.1507/160	.207/217	.005/.015	.004
006	437	212	1.997	1.003	.103-038			.005
007	438	213	6.247	6.247	104-106			.004
008	439	214	6.497	6.497	127-129	.183/193	.245/.255	.005
009	440	215	6.747	6.747	130-132			.006
010	441	216	6.997	6.997	133-135			.006
011	442	217	7.247	7.247	136-138			.007
012	443	218	7.497	7.497	139-141			.007
013	444	219	8.224	8.224	223-224			.006
014	445	220	8.474	8.474	225-227	.235/245	.304/314	.010/.025
015	446	221	8.724	8.724	228-243			.007
016	447	222	8.974	8.974	244-245			.007
017	448	223	9.224	9.224	246-247			.008
018	449	224	9.474	9.474	328-329			.007
019	450	225	9.724	9.724	330-345	.334/344	.424/434	.020/.035
020	451	226	10.497	10.497	425-438			.007
021	452	227	10.747	10.747	439-445	.475/485	.579/589	.020/.035
022	453	228	11.474	11.474	446			.010
023	454	229	11.724	11.724	447			.010
024	455	230	11.974	11.974	452			.010
025	456	231	12.474	12.474	453			.010
026	457	232	12.974	12.974	454			.010
027	458	233	13.474	13.474	455			.010
028	459	234	13.974	13.974	456			.010
029	460	235	14.474	14.474	457			.010
030	461	236	14.974	14.974	458			.010
031	462	237	15.474	15.474	459			.010
032	463	238	15.974	15.974	460			.010

DASH NO.	DASH NO.	D-RING NO.	E DIA.	B DIA.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
033	464	239	16.474	16.474	464			.010
034	465	240	16.974	16.974	465			.010
035	466	241	17.474	17.474	466			.010
036	467	242	17.974	17.974	467			.010
037	468	243	18.474	18.474	468			.010
038	469	244	18.974	18.974	469			.010
039	470	245	19.474	19.474	470			.010
040	471	246	19.974	19.974	471			.010
041	472	247	20.474	20.474	472			.010
042	473	248	20.974	20.974	473			.010
043	474	249	21.474	21.474	474			.010
044	475	250	21.974	21.974	475			.010
045	476	251	22.474	22.474	476			.010
046	477	252	22.974	22.974	477			.010
047	478	253	23.474	23.474	478			.010
048	479	254	23.974	23.974	479			.010
049	480	255	24.474	24.474	480			.010
050	481	256	24.974	24.974	481			.010
051	482	257	25.474	25.474	482			.010
052	483	258	25.974	25.974	483			.010
053	484	259	26.474	26.474	484			.010
054	485	260	26.974	26.974	485			.010
055	486	261	27.474	27.474	486			.010
056	487	262	27.974	27.974	487			.010
057	488	263	28.474	28.474	488			.010
058	489	264	28.974	28.974	489			.010
059	490	265	29.474	29.474	490			.010
060	491	266	29.974	29.974	491			.010
061	492	267	30.474	30.474	492			.010
062	493	268	30.974	30.974	493			.010
063	494	269	31.474	31.474	494			.010
064	495	270	31.974	31.974	495			.010
065	496	271	32.474	32.474	496			.010
066	497	272	32.974	32.974	497			.010
067	498	273	33.474	33.474	498			.010
068	499	274	33.974	33.974	499			.010
069	500	275	34.474	34.474	500			.010
070	501	276	34.974	34.974	501			.010
071	502	277	35.474	35.474	502			.010
072	503	278	35.974	35.974	503			.010
073	504	279	36.474	36.474	504			.010
074	505	280	36.974	36.974	505			.010
075	506	281	37.474	37.474	506			.010
076	507	282	37.974	37.974	507			.010
077	508	283	38.474	38.474	508			.010
078	509	284	38.974	38.974	509			.010
079	510	285	39.474	39.474	510			.010
080	511	286	39.974	39.974	511			.010
081	512	287	40.474	40.474	512			.010
082	513	288	40.974	40.974	513			.010
083	514	289	41.474	41.474	514			.010
084	515	290	41.974	41.974	515			.010
085	516	291	42.474	42.474	516			.010
086	517	292	42.974	42.974	517			.010
087	518	293	43.474	43.474	518			.010
088	519	294	43.974	43.974	519			.010
089	520	295	44.474	44.474	520			.010
090	521	296	44.974	44.974	521			.010
091	522	297	45.474	45.474	522			.010
092	523	298	45.974	45.974	523			.010
093	524	299	46.474	46.474	524			.010
094	525	300	46.974	46.974	525			.010
095	526	301	47.474	47.474	526			.010
096	527	302	47.974	47.974	527			.010
097	528	303	48.474	48.474	528			.010
098	529	304	48.974	48.974	529			.010
099	530	305	49.474	49.474	530			.010
100	531	306	49.974	49.974	531			.010
101	532	307	50.474	50.474	532			.010
102	533	308	50.974	50.974	533			.010
103	534	309	51.474	51.474	534			.010
104	535	310	51.974	51.974	535			.010
105	536	311	52.474	52.474	536			.010
106	537	312	52.974	52.974	537			.010
107	538	313	53.474	53.474	538			.010
108	539	314	53.974	53.974	539			.010
109	540	315	54.474	54.474	540			.010
110	541	316	54.974	54.974	541			.010
111	542	317	55.474	55.474	542			.010
112	543	318	55.974	55.974	543			.010
113	544	319	56.474	56.474	544			.010
114	545	320	56.974	56.974	545			.010
115	546	321	57.474	57.474	546			.010
116	547	322	57.974	57.974	547			.010
117	548	323	58.474	58.474	548			.010
118	549	324	58.974	58.974	549			.010
119	550	325	59.474	59.474	550			.010
120	551	326	59.974	59.974	551			.010
121	552	327	60.474	60.474	552			.010
122	553	328	60.974	60.974	553			.010
123	554	329	61.474	61.474	554			.010
124	555	330	61.974	61.974	555			.010
125	556	331	62.474	62.474	556			.010
126	557	332	62.974	62.974	557			.010
127	558	333	63.474	63.474	558			.010
128	559	334	63.974	63.974	559			.010
129	560	335	64.474	64.474	560			.010
130	561	336	64.974	64.974	561			.010
131	562	337	65.474	65.474	562			.010
132	563	338	65.974	65.974	563			.010
133	564	339	66.474	66.474	564			.010
134	565	340	66.974	66.974	565			.010
135	566	341	67.474	67.474	566			.010
136	567	342	67.974	67.974	567			.010
137	568	343	68.474	68.474	568			.010
138	569	344	68.974	68.974	569			.010
139	570	345	69.474	69.474	570			.010
140	571	346	69.974	69.974	571			.010
141	572	347	70.474	70.474	572			.010
142	573	348	70.974	70.974	573			.010
143	574	349	71.474	71.474	574			.010
144	575	350	71.974	71.974	575			.010
145	576	351	72.474	72.474	576			.010
146	577	352	72.974	72.974	577			.010
147	578	353	73.474	73.474	578			.010
148	579	354	73.974	73.974	579			.010
149	580	355	74.474	74.474	580			.010
150	581	356	74.974	74.974	581			.010
151	582	357	75.474	75.474	582			.010
152	583	358	75.974	75.974	583			.010
153	584	359	76.474	76.474	584			.010
154	585	360	76.974	76.974	585			.010
155	586	361	77.474	77.474	586			.010
156	587	362	77.974	77.974	587			.010
157	588	363	78.474	78.474	588			.010
158	589	364	78.974	78.974	589			.010
159	590	365	79.474					

Back-up Ring and Stakbak®



FOR ONE BACKUP WIDTH GLANDS PER AS4716 REVISION A

FOR TWO BACKUP WIDTH GLANDS PER AS4716 REVISION A

DASH NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.	G1 ONE BACKUP WIDTH	G2 TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	435	6.284	5.747	435	.184/164	.210/220	.005/.015	.004
005	436	6.549	5.972	436	.150/160	.207/217	.005/.015	.004
006	437	6.474	5.997	437	.104-109		.005	.004
007	438	6.724	6.247	438	.104-109		.005	.004
008	439	6.974	6.497	439	.127-129	.245/.255	.005/.015	.005
009	440	7.224	6.747	440	.130-132		.006	.005
010	441	7.474	6.997	441	.133-134		.006	.005
011	442	7.724	7.247	442	.133-134		.006	.005
012	443	7.974	7.497	443	.210-222		.006	.005
013	444	8.224	7.747	444	.223-224		.006	.006
014	445	8.474	7.997	445	.225-227	.304/.314	.010/.025	.007
015	446	8.724	8.247	446	.228-243		.008	.008
016	447	8.974	8.497	447	.244-245		.008	.008
017	448	9.224	8.747	448	.246-247		.008	.008
018	449	9.474	8.997	449	.328-329		.006	.006
019	450	9.724	9.247	450	.330-345	.424/.434	.020/.035	.007
020	451	9.974	9.497	451	.346-349		.008	.008
021	452	10.224	9.747	452	.425-438		.009	.009
022	453	10.474	9.997	453	.439-445		.009	.009
023	454	10.724	10.247	454	.446	.579/.589	.020/.035	.010
024	455	10.974	10.497	455	.447-460		.011	.011
025	456	11.224	10.747	456				
026	457	11.474	10.997	457				
027	458	11.724	11.247	458				
028	459	11.974	11.497	459				
029	460	12.224	11.747	460				

BACKUP RING INSTALLATION PER AS4716 REVISION A

BACKUP RING INSTALLATION PER AS4716 REVISION A

- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SOLID, EXTERNAL BACKUP RINGS IN AS4716 REVISION A PISTON GLANDS.
 - ORDERING EXAMPLE: BV47LG214A105
 BACKUP RING SOLID, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBORG SEALING SOLUTIONS DESIGN
 GLAND DESIGNATOR
 G = AS4716
 SIZE DESIGNATOR
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX CERTIFICATE OF CONFORMANCE
 TURCIN® BACKUP RING MAT'L CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - TRELLEBORG SEALING SOLUTIONS PART NUMBER B447LG000.

DASH NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	G1 ONE BACKUP WIDTH	G2 TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	210	5.991	7.760	210	325	1.867	1.495	325	130	.184/164	.210/220	.005/.015	.004
005	211	6.241	8.010	211	326	1.992	1.620	326	131	.150/160	.207/217	.005/.015	.004
006	212	6.491	8.260	212	327	2.118	1.746	327	132	.104-109		.005	.004
007	213	6.741	8.510	213	328	2.243	1.871	328	133	.104-109		.005	.004
008	214	6.991	8.760	214	329	2.368	1.996	329	134	.127-129	.245/.255	.005/.015	.005
009	215	7.241	9.010	215	330	2.493	2.121	330	135	.130-132		.006	.005
010	216	7.491	9.260	216	331	2.618	2.246	331	136	.133-134		.006	.005
011	217	7.741	9.510	217	332	2.743	2.371	332	137	.210-222		.006	.005
012	218	7.991	9.760	218	333	2.868	2.496	333	138	.223-224		.006	.005
013	219	8.241	1.001	219	334	2.993	2.621	334	139	.225-227	.304/.314	.010/.025	.007
014	220	8.491	1.251	220	335	3.118	2.746	335	140	.228-243		.008	.008
015	221	8.741	1.501	221	336	3.243	2.871	336	141	.244-245		.008	.008
016	222	8.991	1.751	222	337	3.368	2.996	337	142	.246-247		.008	.008
017	223	9.241	2.001	223	338	3.493	3.121	338	143	.328-329		.006	.006
018	224	9.491	2.251	224	339	3.618	3.246	339	144	.330-345	.424/.434	.020/.035	.007
019	225	9.741	2.501	225	340	3.743	3.371	340	145	.346-349		.008	.008
020	226	9.991	2.751	226	341	3.868	3.496	341	146	.425-438		.009	.009
021	227	10.241	3.001	227	342	3.993	3.621	342	147	.439-445		.009	.009
022	228	10.491	3.251	228	343	4.118	3.746	343	148	.446	.579/.589	.020/.035	.010
023	229	10.741	3.501	229	344	4.243	3.871	344	149			.011	.011
024	230	10.991	3.751	230	345	4.368	3.996	345	150				
025	231	11.241	4.001	231	346	4.493	4.121	346	151				
026	232	11.491	4.251	232	347	4.618	4.246	347	152				
027	233	11.741	4.501	233	348	4.743	4.371	348	153				
028	234	11.991	4.751	234	349	4.868	4.496	349	154				
029	235	12.241	5.001	235	425	5.099	4.622	425	155				
030	236	12.491	5.251	236	426	5.224	4.747	426	156				
031	237	12.741	5.501	237	427	5.349	4.872	427	157				
032	238	12.991	5.751	238	428	5.474	4.997	428	158				
033	239	13.241	6.001	239	429	5.599	5.122	429	159				
034	240	13.491	6.251	240	430	5.724	5.247	430	160				
035	241	13.741	6.501	241	431	5.849	5.372	431	161				
036	242	13.991	6.751	242	432	5.974	5.497	432	162				
037	243	14.241	7.001	243	433	6.099	5.622	433	163				
038	244	14.491	7.251	244	434	6.224	5.747	434	164				

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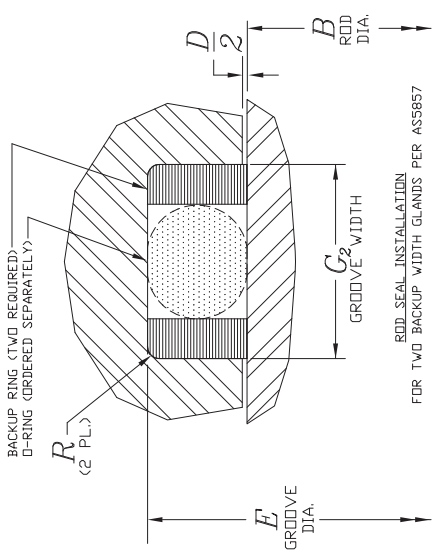
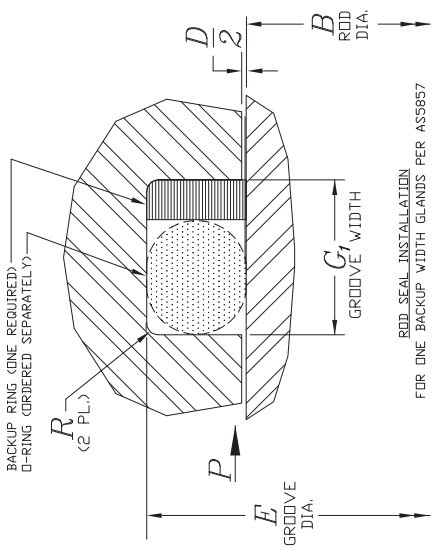
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TRELLEBORG SEALING SOLUTIONS

TITLE: BACKUP RING, SOLID, EXTERNAL
 DRAWING NO. BV47LG000

Back-up Ring and Stakbak®

DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084	+0.01	+0.00	004	210	+0.002	+0.002	210	084-087	.174/.184	.230/.240	.005/.015	.004
085	-0.01	-0.01	005	211	.746	.974	211	088-092	.164/.174	.220/.230	.005/.015	.004
086	0.06	0.21	006	212	.816	1.026	212	013-028	.104-019	.275/.285	.005/.015	.004
087	0.123	0.231	007	213	.873	1.099	213	110-126	.200/.210	.265/.275	.005/.015	.006
088	0.154	0.262	008	214	.938	1.161	214	130-132	.250/.260	.320/.330	.010/.025	.006
089	0.177	0.293	009	215	1.060	1.286	215	133-139				.006
090	0.217	0.325	010	216	1.123	1.349	216	140-147				.007
091	0.246	0.356	011	217	1.183	1.412	217	225-227				.006
092	0.271	0.386	012	218	1.248	1.474	218	228-230				.006
093	0.311	0.417	013	219	1.310	1.536	219	325-327				.007
094	0.351	0.448	014	220	1.373	1.599	220	328-329				.006
095	0.391	0.479	015	221	1.435	1.661	221	330-345	.360/.370	.455/.465	.020/.035	.007
096	0.431	0.510	016	222	1.498	1.724	222	425-437	.475/.485	.610/.620	.020/.035	.007
097	0.471	0.541	017	223	1.563	1.787	223					.007
098	0.511	0.572	018	224	1.628	1.850	224					.007
099	0.551	0.603	019	225	1.693	1.913	225					.009
100	0.591	0.634	020	226	1.758	1.976	226					.009
101	0.631	0.665	021	227	1.823	2.039	227					.009
102	0.671	0.696	022	228	1.888	2.102	228					.009
103	0.711	0.727	023	229	1.953	2.165	229					.009
104	0.751	0.758	024	230	2.018	2.228	230					.009
105	0.791	0.765	025		+0.001	+0.002						
106	0.831	0.771	026		-0.002	-0.001						
107	0.871	0.777	027									
108	0.911	0.783	028									
109	0.951	0.789	029									
110	0.991	0.795	030									
111	1.031	0.801	031									
112	1.071	0.807	032									
113	1.111	0.813	033									
114	1.151	0.819	034									
115	1.191	0.825	035									
116	1.231	0.831	036									
117	1.271	0.837	037									
118	1.311	0.843	038									
119	1.351	0.849	039									
120	1.391	0.855	040									
121	1.431	0.861	041									
122	1.471	0.867	042									
123	1.511	0.873	043									
124	1.551	0.879	044									
125	1.591	0.885	045									
126	1.631	0.891	046									
127	1.671	0.897	047									
128	1.711	0.903	048									
129	1.751	0.909	049									
130	1.791	0.915	050									
131	1.831	0.921	051									
132	1.871	0.927	052									
133	1.911	0.933	053									
134	1.951	0.939	054									
135	1.991	0.945	055									
136	2.031	0.951	056									
137	2.071	0.957	057									
138	2.111	0.963	058									
139	2.151	0.969	059									



- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, INTERNAL BACKUP RINGS IN ASS857 ROD GLANDS.
 - ORDERING EXAMPLE: BG580E214A122
 BACKUP RING, SCARF-CUT, INTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 O = PER SPECIFICATION
 GLAND DESIGNATOR
 E = ASS857 GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO ASS857
 QUALITY REFERENCE CERTIFICATE OF CONFORMANCE
 TRELLEBORG BACKUP RING MATH CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - FOR SOLID, INTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BU580E000.
 - ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE.

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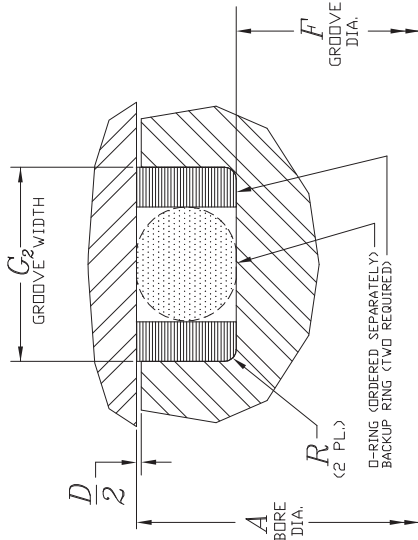
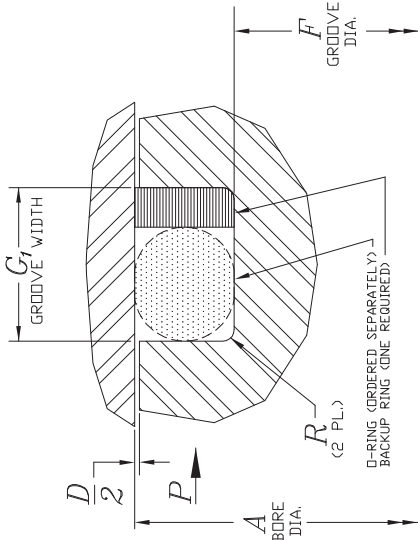
TRELLEBORG SEALING SOLUTIONS

TITLE: BACKUP RING, SCARF-CUT, INTERNAL
 DRAWING NO. BG580E000



WORLD AEROSPACE TITLE BLOCK REV.

Back-up Ring and Stakbak®



DASH NO.	G_1 ONE BACKUP WIDTH	G_2 TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084-007	.174/.184	.230/.240	.005/.015	.004
009-012	.164/.174	.220/.230	.005/.015	.004
013-028	.210/.220	.275/.285	.005/.015	.004
104-109	.200/.210	.265/.275	.005/.015	.005
110-129	.250/.260	.320/.330	.010/.025	.005
210-222	.360/.370	.455/.465	.020/.035	.006
223-227	.475/.485	.610/.620	.020/.035	.007
525-529				.006
330-345				.007
346-349				.008
425-437				.009

DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.
004	+0.001	+0.001	004	210	+0.002	+0.002	210
005	-0.001	0.000	005	211	-0.002	-0.002	211
006	+0.001	0.000	006	212	+0.002	+0.002	212
007	-0.001	0.000	007	213	-0.002	-0.002	213
008	+0.001	0.000	008	214	+0.002	+0.002	214
009	-0.001	0.000	009	215	-0.002	-0.002	215
010	+0.001	0.000	010	216	+0.002	+0.002	216
011	-0.001	0.000	011	217	-0.002	-0.002	217
012	+0.001	0.000	012	218	+0.002	+0.002	218
013	-0.001	0.000	013	219	-0.002	-0.002	219
014	+0.001	0.000	014	220	+0.002	+0.002	220
015	-0.001	0.000	015	221	-0.002	-0.002	221
016	+0.001	0.000	016	222	+0.002	+0.002	222
017	-0.001	0.000	017	223	-0.002	-0.002	223
018	+0.001	0.000	018	224	+0.002	+0.002	224
019	-0.001	0.000	019	225	-0.002	-0.002	225
020	+0.001	0.000	020	226	+0.002	+0.002	226
021	-0.001	0.000	021	227	-0.002	-0.002	227
022	+0.001	0.000	022	228	+0.002	+0.002	228
023	-0.001	0.000	023	229	-0.002	-0.002	229
024	+0.001	0.000	024	230	+0.002	+0.002	230
025	-0.001	0.000	025	325	-0.002	-0.002	325
026	+0.001	0.000	026	326	+0.002	+0.002	326
027	-0.001	0.000	027	327	-0.002	-0.002	327
028	+0.001	0.000	028	328	+0.002	+0.002	328
104	-0.001	0.000	104	329	-0.002	-0.002	329
105	+0.001	0.000	105	330	+0.002	+0.002	330
106	-0.001	0.000	106	331	-0.002	-0.002	331
107	+0.001	0.000	107	332	+0.002	+0.002	332
108	-0.001	0.000	108	333	-0.002	-0.002	333
109	+0.001	0.000	109	334	+0.002	+0.002	334
110	-0.001	0.000	110	335	-0.002	-0.002	335
111	+0.001	0.000	111	336	+0.002	+0.002	336
112	-0.001	0.000	112	337	-0.002	-0.002	337
113	+0.001	0.000	113	338	+0.002	+0.002	338
114	-0.001	0.000	114	339	-0.002	-0.002	339
115	+0.001	0.000	115	340	+0.002	+0.002	340
116	-0.001	0.000	116	341	-0.002	-0.002	341
117	+0.001	0.000	117	342	+0.002	+0.002	342
118	-0.001	0.000	118	343	-0.002	-0.002	343
119	+0.001	0.000	119	344	+0.002	+0.002	344
120	-0.001	0.000	120	345	-0.002	-0.002	345
121	+0.001	0.000	121	346	+0.002	+0.002	346
122	-0.001	0.000	122	347	-0.002	-0.002	347
123	+0.001	0.000	123	348	+0.002	+0.002	348
124	-0.001	0.000	124	349	-0.002	-0.002	349
125	+0.001	0.000	125	425	+0.002	+0.002	425
126	-0.001	0.000	126	426	-0.002	-0.002	426
127	+0.001	0.000	127	427	+0.002	+0.002	427
128	-0.001	0.000	128	428	-0.002	-0.002	428
129	+0.001	0.000	129	429	+0.002	+0.002	429
130	-0.001	0.000	130	430	-0.002	-0.002	430
131	+0.001	0.000	131	431	+0.002	+0.002	431
132	-0.001	0.000	132	432	-0.002	-0.002	432
133	+0.001	0.000	133	433	+0.002	+0.002	433
134	-0.001	0.000	134	434	-0.002	-0.002	434
135	+0.001	0.000	135	435	+0.002	+0.002	435
136	-0.001	0.000	136	436	-0.002	-0.002	436
137	+0.001	0.000	137	437	+0.002	+0.002	437
138	-0.001	0.000	138	6.204	-0.002	-0.002	6.204
139	+0.001	0.000	139	2.368	+0.002	+0.002	2.368

- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, EXTERNAL BACKUP RINGS IN AS5857 PISTON GLANDS.
 - ORDERING EXAMPLE:
 BHS8 0 E 214 A T22
 BACKUP RING, SCARF-CUT, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 0 = PER SPECIFICATION
 GLAND DESIGNATOR
 E = AS5857 GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO AS5857
 QUALITY AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCIN® BACKUP RING MATL CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - FOR SOLID, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BV580E000.
 - ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE.

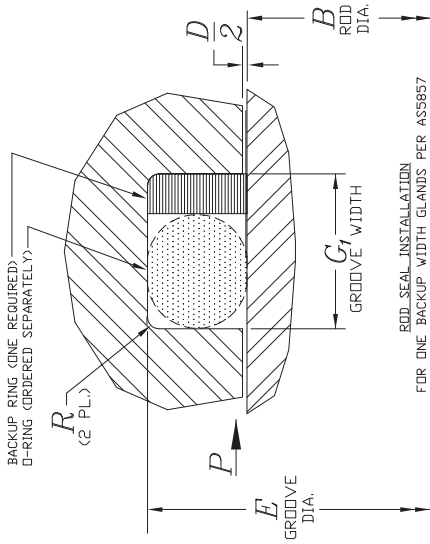
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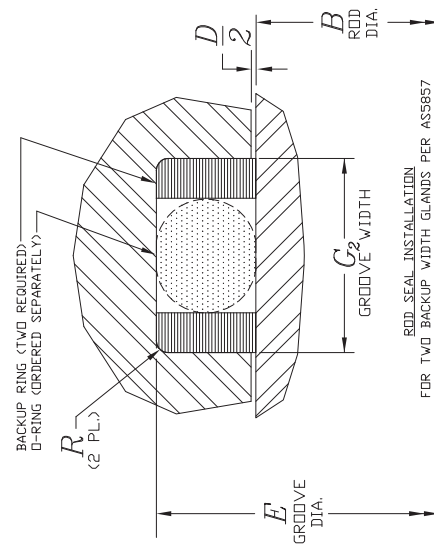
TRELLEBORG SEALING SOLUTIONS

TITLE BACKUP RING, SCARF-CUT, EXTERNAL
 DRAWING NO. BH580E000

Back-up Ring and Stakbak®



FOR ONE BACKUP WIDTH GLANDS PER ASS857



FOR TWO BACKUP WIDTH GLANDS PER ASS857

DASH NO.	B DIA.	E DIA.	D-RING ND.	B DIA.	E DIA.	D-RING ND.	DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.000/-0.001	+0.001/-0.000	004	0.76	1.974	210	435	3.748	6.206	435	084-007	.174/.184	.230/.240	.005/.015	.004
005	+0.076	1.84	005	0.81	1.974	211	436	3.748	6.206	436	085-007	.164/.174	.220/.230	.005/.015	.004
006	+0.152	1.714	006	0.873	1.999	212	437	3.997	6.456	437	013-028	.210/.220	.275/.285	.005/.015	.004
007	+0.154	1.262	007	0.935	1.161	213	438	6.247	6.706	438	104-109	.110-126			.005
008	+0.185	2.93	008	1.161	1.224	214	439	6.497	6.956	439	127-129	.200/.210	.265/.275	.005/.015	.006
009	+0.217	3.25	009	1.060	1.286	215	440	6.747	7.206	440	130-132				.006
010	+0.248	3.56	010	1.123	1.349	216	441	5.997	7.456	441	133-150				.007
011	+0.279	4.81	011	1.184	1.411	217	442	7.247	7.706	442	131-150				.007
012	+0.312	4.81	012	1.248	1.474	218	443	7.497	7.956	443	210-222				.006
013	+0.343	5.43	013	1.310	1.536	219	444	7.747	8.206	444	223-224				.006
014	+0.435	5.43	014	1.373	1.599	220	445	7.997	8.456	445	225-227	.250/.260	.320/.330	.010/.025	.007
015	+0.498	6.06	015	1.435	1.661	221	446	8.497	8.956	446	228-243				.007
016	+0.562	6.68	016	1.498	1.724	222	447	+0.004		447	244-245				.008
017	+0.623	7.31	017	1.563	1.849	223	448	8.497	9.256	448	246-247				.007
018	+0.748	8.56	018	1.748	1.974	224	449	9.497	9.956	449	328-329	.360/.370	.455/.465	.020/.035	.007
019	+0.818	9.81	019	1.998	2.099	225	448	9.497	10.456	448	330-345				.007
020	+0.873	9.81	020	2.099	2.224	226	450	10.497	10.956	450	346-349				.009
021	+0.935	10.43	021	2.123	2.349	227	451	10.997	11.456	451	425-438				.010
022	+0.998	11.06	022	2.248	2.474	228	452	11.497	11.956	452	439-445				.010
023	+1.060	11.68	023	2.373	2.599	229	453	11.997	12.456	453	446				.010
024	+1.123	12.31	024	2.498	2.724	230	454	12.497	12.956	454	447				.010
025	+1.185	12.93	025	2.623	2.849	231	455	12.997	13.456	455	448				.010
026	+1.248	13.56	026	2.748	2.974	232	456	13.497	13.956	456	449				.010
027	+1.310	1.418	027	2.873	3.099	233	457	13.997	14.456	457	450				.010
028	+1.373	1.481	028	2.997	3.223	234	458	14.497	14.956	458	451				.010
029	+0.000	+0.001	029	3.123	3.348	235	459	14.997	15.456	459	452				.010
030	+0.000	+0.001	030	3.248	3.473	236	460	15.497	15.956	460	447-460				.010
104	+0.123	-0.268	104	3.373	3.598	237									
105	+0.154	3.19	105	3.50	3.723	238									
106	+0.185	3.50	106	3.627	3.848	239									
107	+0.217	3.82	107	3.752	3.973	240									
108	+0.248	4.13	108	3.877	4.098	241									
109	+0.310	4.75	109	4.002	4.219	242									
110	+0.373	5.38	110	4.127	4.348	243									
111	+0.435	6.00	111	4.252	4.473	244									
112	+0.498	6.63	112	4.377	4.598	245									
113	+0.560	7.25	113	4.502	4.723	246									
114	+0.623	7.88	114	4.627	4.848	247									
115	+0.685	8.50	115	4.752	4.973	248									
116	+0.748	9.13	116	4.877	5.098	249									
117	+0.810	9.75	117	5.002	5.223	250									
118	+0.873	10.38	118	5.127	5.348	251									
119	+0.935	11.00	119	5.252	5.473	252									
120	+0.998	11.63	120	5.377	5.598	253									
121	+1.060	12.25	121	5.502	5.723	254									
122	+1.123	12.88	122	5.627	5.848	255									
123	+1.185	13.50	123	5.752	5.973	256									
124	+1.248	14.13	124	5.877	6.098	257									
125	+1.310	14.75	125	6.002	6.223	258									
126	+1.373	15.38	126	6.127	6.348	259									
127	+1.435	16.00	127	6.252	6.473	260									
128	+1.498	16.63	128	6.377	6.598	261									
129	+1.560	17.25	129	6.502	6.723	262									
130	+1.623	17.88	130	6.627	6.848	263									
131	+1.685	18.50	131	6.752	6.973	264									
132	+1.748	19.13	132	6.877	7.098	265									
133	+1.810	19.75	133	7.002	7.223	266									
134	+1.873	20.38	134	7.127	7.348	267									
135	+1.936	21.00	135	7.252	7.473	268									
136	+1.998	21.63	136	7.377	7.598	269									
137	+2.060	22.25	137	7.502	7.723	270									
138	+2.123	22.88	138	7.627	7.848	271									
139	+2.186	23.50	139	7.752	7.973	272									
140	+2.248	24.13	140	7.877	8.098	273									
141	+2.310	24.75	141	8.002	8.223	274									
142	+2.373	25.38	142	8.127	8.348	275									
143	+2.435	26.00	143	8.252	8.473	276									
144	+2.498	26.63	144	8.377	8.598	277									
145	+2.560	27.25	145	8.502	8.723	278									
146	+2.623	27.88	146	8.627	8.848	279									
147	+2.685	28.50	147	8.752	8.973	280									
148	+2.748	29.13	148	8.877	9.098	281									
149	+2.810	29.75	149	9.002	9.223	282									

BACKUP RING (ONE REQUIRED)
O-RING (ORDERED SEPARATELY)

R₁ (2 PL.)

GROOVE DIA. E

GROOVE WIDTH G₁

ROD DIA. B

D

FOR ONE BACKUP WIDTH GLANDS PER ASS857

BACKUP RING (TWO REQUIRED)
O-RING (ORDERED SEPARATELY)

R₂ (2 PL.)

GROOVE DIA. E

GROOVE WIDTH G₂

ROD DIA. B

D

FOR TWO BACKUP WIDTH GLANDS PER ASS857

NOTES:
1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SOLID, INTERNAL BACKUP RINGS IN ASS857 ROD GLANDS.
2. ORDERING EXAMPLE: BU580 E 214 A 122
BACKUP RING SOLID, INTERNAL DESIGNATOR
DESIGN CHARACTERISTICS
0 = PER SPECIFICATION
GLAND DESIGNATOR
E = ASS857 GLAND STANDARD
SIZE DESIGNATOR
ACCORDING TO ASS857
QUALITY INDEX: OF CERTIFICATE OF CONFORMANCE
TURCIN® BACKUP RING MTL CODE
CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
3. FOR SCARF-CUT INTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BU580E000.
4. ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE.

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TRELLEBORG SEALING SOLUTIONS

TITLE: BACKUP RING, SOLID, INTERNAL
DRAWING NO: BU580E000



WORLD AEROSPACE TITLE BLOCK REV.

Back-up Ring and Stakbak®

FOR ONE BACKUP WIDTH GLANDS PER ASS857

FOR TWO BACKUP WIDTH GLANDS PER ASS857

DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084	076	076	004	210	1.747/184	.230/240	.005/.015	.004
095	217	193	011	436	1.647/174	.220/230	.005/.015	.004
096	230	253	012	437	1.03-108	.275/285	.005	.004
097	261	154	006	438	10-129	.265/.275	.005/.015	.005
098	293	186	008	439	130-140	.200/210	.005	.006
099	326	219	009	440	141-149	.250/260	.010/.025	.007
100	357	250	010	441	202-222			.005
101	389	282	011	442	233-243			.005
102	421	314	012	443	244-247			.009
103	453	346	013	444	325-329			.008
104	485	378	014	445	330-345			.006
105	517	410	015	446	346-349			.007
106	549	442	016	447	425-445			.008
107	581	474	017	448	447-460			.006
108	613	506	018	449				.007
109	645	538	019	450				.006
110	677	570	020	451				.008
111	709	602	021	452				.006
112	741	634	022	453				.007
113	773	666	023	454				.006
114	805	698	024	455				.008
115	837	730	025	456				.006
116	869	762	026	457				.007
117	901	794	027	458				.006
118	933	826	028	459				.008
119	965	858	029	460				.006
120	997	890	030					.007
121	1029	922	031					.006
122	1061	954	032					.008
123	1093	986	033					.006
124	1125	1018	034					.007
125	1157	1050	035					.006
126	1189	1082	036					.008
127	1221	1114	037					.006
128	1253	1146	038					.007
129	1285	1178	039					.006
130	1317	1210	040					.008
131	1349	1242	041					.006
132	1381	1274	042					.007
133	1413	1306	043					.006
134	1445	1338	044					.008
135	1477	1370	045					.006
136	1509	1402	046					.007
137	1541	1434	047					.006
138	1573	1466	048					.008
139	1605	1498	049					.006
140	1637	1530	050					.007
141	1669	1562	051					.006
142	1701	1594	052					.008
143	1733	1626	053					.006
144	1765	1658	054					.007
145	1797	1690	055					.006
146	1829	1722	056					.008
147	1861	1754	057					.006
148	1893	1786	058					.007
149	1925	1818	059					.006

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR SOLID, EXTERNAL BACKUP RINGS IN ASS857 GLANDS.
- ORDERING EXAMPLE: **BV580 E F 214 A T22**
- BACKUP RING, SOLID, EXTERNAL DESIGNATOR
DESIGN CHARACTERISTICS
0 = PER SPECIFICATION
GLAND DESIGNATOR
E = ASS857 GLAND STANDARD
SIZE DESIGNATOR
ACCORDING TO ASS857
- QUALITY INSPECTION CERTIFICATE OF CONFORMANCE
TURCIN BACKUP RING MAT'L CODE
CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SCARF-CUT, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBERG SEALING SOLUTIONS PART NUMBER BHB06000.
- ONLY AVAILABLE IN AMS3678/10 MATERIAL, CARBON FIBER-FILLED PTFE.

DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
084	076	076	004	210	1.747/184	.230/240	.005/.015	.004
095	217	193	011	436	1.647/174	.220/230	.005/.015	.004
096	230	253	012	437	1.03-108	.275/285	.005	.004
097	261	154	006	438	10-129	.265/.275	.005/.015	.005
098	293	186	008	439	130-140	.200/210	.005	.006
099	326	219	009	440	141-149	.250/260	.010/.025	.007
100	357	250	010	441	202-222			.005
101	389	282	011	442	233-243			.005
102	421	314	012	443	244-247			.009
103	453	346	013	444	325-329			.008
104	485	378	014	445	330-345			.006
105	517	410	015	446	346-349			.007
106	549	442	016	447	425-445			.008
107	581	474	017	448	447-460			.006
108	613	506	018	449				.007
109	645	538	019	450				.006
110	677	570	020	451				.008
111	709	602	021	452				.006
112	741	634	022	453				.007
113	773	666	023	454				.006
114	805	698	024	455				.008
115	837	730	025	456				.006
116	869	762	026	457				.007
117	901	794	027	458				.006
118	933	826	028	459				.008
119	965	858	029	460				.006
120	997	890	030					.007
121	1029	922	031					.006
122	1061	954	032					.008
123	1093	986	033					.006
124	1125	1018	034					.007
125	1157	1050	035					.006
126	1189	1082	036					.008
127	1221	1114	037					.006
128	1253	1146	038					.007
129	1285	1178	039					.006
130	1317	1210	040					.008
131	1349	1242	041					.006
132	1381	1274	042					.007
133	1413	1306	043					.006
134	1445	1338	044					.008
135	1477	1370	045					.006
136	1509	1402	046					.007
137	1541	1434	047					.006
138	1573	1466	048					.008
139	1605	1498	049					.006
140	1637	1530	050					.007
141	1669	1562	051					.006
142	1701	1594	052					.008
143	1733	1626	053					.006
144	1765	1658	054					.007
145	1797	1690	055					.006
146	1829	1722	056					.008
147	1861	1754	057					.006
148	1893	1786	058					.007
149	1925	1818	059					.006

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TRELLEBERG SEALING SOLUTIONS

TITLE
BACKUP RING, SOLID, EXTERNAL
DRAWING NO.
BV580E000

2009_1

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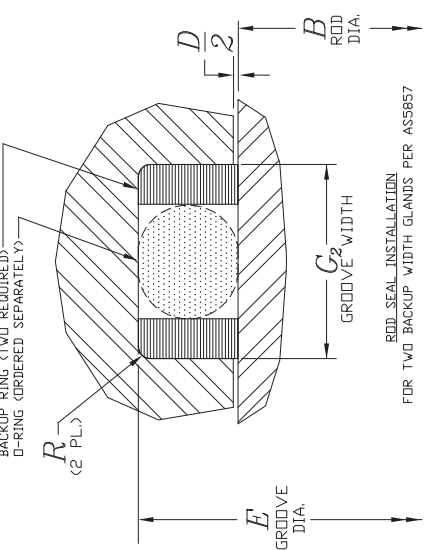
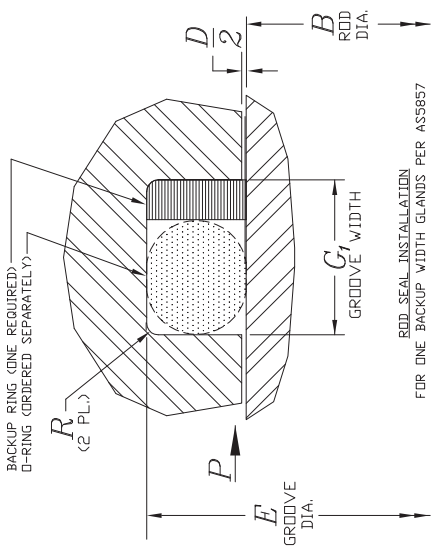
WORLD AEROSPACE TITLE BLOCK REV.

Back-up Ring and Stakbak®

DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	B DIA.	E DIA.	D-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.01	+0.00	004	210	+0.00	+0.00	210	004-007	.174/.184	.230/.240	.005/.015	.004
005	+0.02	+0.01	005	211	0.74	0.74	211	008-012	.164/.174	.220/.230	.005	.004
006	+0.03	+0.02	006	212	0.73	0.73	212	013-028	.104-.109	.275/.285	.005	.004
007	+0.04	+0.03	007	213	0.98	0.98	213	110-126	.200/.210	.265/.275	.005/.015	.006
008	+0.05	+0.04	008	214	1.06	1.06	214	127-129	.250/.260	.320/.330	.010/.025	.007
009	+0.06	+0.05	009	215	1.12	1.12	215	130-132	.360/.370	.455/.465	.020/.035	.006
010	+0.07	+0.06	010	216	1.44	1.44	216	328-329	.475/.485	.610/.620	.020/.035	.007
011	+0.08	+0.07	011	217	1.48	1.48	217	331-333				.007
012	+0.09	+0.08	012	218	1.24	1.24	218	334-345				.007
	+0.00	+0.00	012	219	1.31	1.31	219	425-437				.009
013	+0.02	+0.02	013	220	1.37	1.37	220					
014	+0.03	+0.03	014	221	1.43	1.43	221					
015	+0.04	+0.04	015	222	1.49	1.49	222					
016	+0.05	+0.05	016	223	1.54	1.54	223					
017	+0.06	+0.06	017	224	1.74	1.74	224					
018	+0.07	+0.07	018	225	1.87	1.87	225					
019	+0.08	+0.08	019	226	1.98	1.98	226					
020	+0.09	+0.09	020	227	2.12	2.12	227					
021	+0.10	+0.10	021	228	2.24	2.24	228					
022	+0.11	+0.11	022	229	2.37	2.37	229					
023	+0.12	+0.12	023	230	2.49	2.49	230					
024	+0.13	+0.13	024									
025	+0.14	+0.14	025									
026	+0.15	+0.15	026									
027	+0.16	+0.16	027									
028	+0.17	+0.17	028									
	+0.00	+0.00										
	+0.01	+0.01										
	+0.02	+0.02										
104	+0.12	+0.12	104	325	1.49	1.49	325					
105	+0.13	+0.13	105	326	1.62	1.62	326					
106	+0.14	+0.14	106	327	1.71	1.71	327					
107	+0.15	+0.15	107	328	1.87	1.87	328					
108	+0.16	+0.16	108	329	1.99	1.99	329					
109	+0.17	+0.17	109	330	2.12	2.12	330					
110	+0.18	+0.18	110	331	2.24	2.24	331					
111	+0.19	+0.19	111	332	2.37	2.37	332					
112	+0.20	+0.20	112	333	2.49	2.49	333					
113	+0.21	+0.21	113	334	2.63	2.63	334					
114	+0.22	+0.22	114	335	2.74	2.74	335					
115	+0.23	+0.23	115	336	2.87	2.87	336					
116	+0.24	+0.24	116	337	2.99	2.99	337					
117	+0.25	+0.25	117	338	3.12	3.12	338					
118	+0.26	+0.26	118	339	3.27	3.27	339					
119	+0.27	+0.27	119	340	3.42	3.42	340					
120	+0.28	+0.28	120	341	3.57	3.57	341					
121	+0.29	+0.29	121	342	3.72	3.72	342					
122	+0.30	+0.30	122	343	3.87	3.87	343					
123	+0.31	+0.31	123	344	4.02	4.02	344					
124	+0.32	+0.32	124	345	4.17	4.17	345					
125	+0.33	+0.33	125	346	4.32	4.32	346					
126	+0.34	+0.34	126	347	4.47	4.47	347					
127	+0.35	+0.35	127	348	4.62	4.62	348					
128	+0.36	+0.36	128	349	4.77	4.77	349					
129	+0.37	+0.37	129	425	4.92	4.92	425					
130	+0.38	+0.38	130	426	5.07	5.07	426					
131	+0.39	+0.39	131	427	5.22	5.22	427					
132	+0.40	+0.40	132	428	5.37	5.37	428					
133	+0.41	+0.41	133	429	5.52	5.52	429					
134	+0.42	+0.42	134	430	5.67	5.67	430					
135	+0.43	+0.43	135	431	5.82	5.82	431					
136	+0.44	+0.44	136	432	5.97	5.97	432					
137	+0.45	+0.45	137	433	6.12	6.12	433					
138	+0.46	+0.46	138	434	6.27	6.27	434					
139	+0.47	+0.47	139	435	6.42	6.42	435					
	+0.00	+0.00		436	6.57	6.57	436					
	+0.01	+0.01		437	6.72	6.72	437					
	+0.02	+0.02		438	6.87	6.87	438					
	+0.03	+0.03		439	7.02	7.02	439					

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, INTERNAL BACKUP RINGS IN ASS857 ROD GLANDS.
- ORDERING EXAMPLE:
BG58LE214A105
 BACKUP RING, SCARF-CUT, INTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBORG SEALING SOLUTIONS DESIGN
 GLAND DESIGNATOR
 E = ASS857 GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO ASS857
 QUALITY REFERENCE CERTIFICATE OF CONFORMANCE
 TRELLEBORG BACKUP RING MATH CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SOLID, INTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BG58LE000.



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TRELLEBORG SEALING SOLUTIONS

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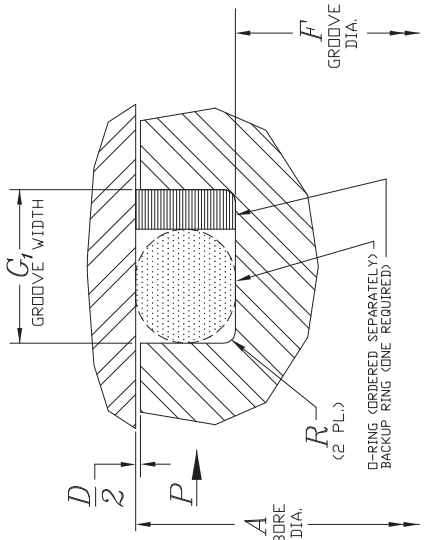
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REV. NO. BG58LE000

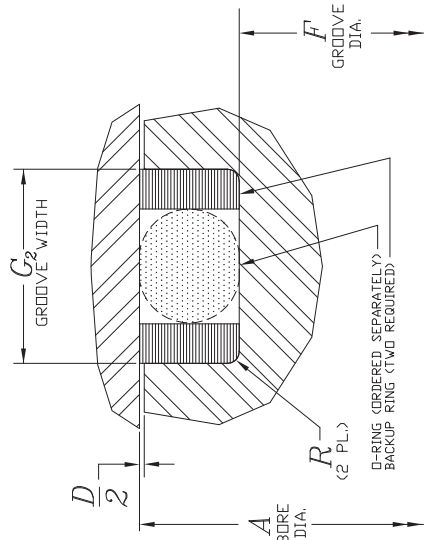


Back-up Ring and Stakbak®

DASH NO.	A DIA.	F DIA.	D-RING ND.	DASH NO.	A DIA.	F DIA.	D-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.001	+0.000	004	210	+0.002	+0.000	210	084-007	.174/.184	.230/.240	.005/.015	.004
005	+0.001	+0.000	005	211	+0.002	+0.000	211	009-012	.164/.174	.220/.230	.005/.015	.004
006	+0.001	+0.000	006	212	+0.002	+0.000	212	013-028	.104-109	.210/.220	.005/.015	.004
007	+0.001	+0.000	007	213	+0.002	+0.000	213	110-129	.200/.210	.265/.275	.005/.015	.005
008	+0.001	+0.000	008	214	+0.002	+0.000	214	210-222	.250/.260	.320/.330	.010/.025	.005
009	+0.001	+0.000	009	215	+0.002	+0.000	215	223-227	.330-349	.455/.465	.020/.035	.007
010	+0.001	+0.000	010	216	+0.002	+0.000	216	485-497	.475/.485	.610/.620	.020/.035	.009
011	+0.001	+0.000	011	217	+0.002	+0.000	217					
012	+0.002	+0.002	012	218	+0.002	+0.002	218					
013	+0.000	+0.002	013	219	+0.002	+0.002	219					
014	+0.000	+0.002	014	220	+0.002	+0.002	220					
015	+0.000	+0.002	015	221	+0.002	+0.002	221					
016	+0.000	+0.002	016	222	+0.002	+0.002	222					
017	+0.000	+0.002	017	223	+0.002	+0.002	223					
018	+0.000	+0.002	018	224	+0.002	+0.002	224					
019	+0.000	+0.002	019	225	+0.002	+0.002	225					
020	+0.000	+0.002	020	226	+0.002	+0.002	226					
021	+0.000	+0.002	021	227	+0.002	+0.002	227					
022	+0.000	+0.002	022	228	+0.002	+0.002	228					
023	+0.000	+0.002	023	229	+0.002	+0.002	229					
024	+0.000	+0.002	024	230	+0.002	+0.002	230					
025	+0.000	+0.002	025	325	+0.002	+0.002	325					
026	+0.000	+0.002	026	326	+0.002	+0.002	326					
027	+0.000	+0.002	027	327	+0.002	+0.002	327					
028	+0.000	+0.002	028	328	+0.002	+0.002	328					
104	+0.000	+0.002	104	329	+0.002	+0.002	329					
105	+0.000	+0.002	105	330	+0.002	+0.002	330					
106	+0.000	+0.002	106	331	+0.002	+0.002	331					
107	+0.000	+0.002	107	332	+0.002	+0.002	332					
108	+0.000	+0.002	108	333	+0.002	+0.002	333					
109	+0.000	+0.002	109	334	+0.002	+0.002	334					
110	+0.000	+0.002	110	335	+0.002	+0.002	335					
111	+0.000	+0.002	111	336	+0.002	+0.002	336					
112	+0.000	+0.002	112	337	+0.002	+0.002	337					
113	+0.000	+0.002	113	338	+0.002	+0.002	338					
114	+0.000	+0.002	114	339	+0.002	+0.002	339					
115	+0.000	+0.002	115	340	+0.002	+0.002	340					
116	+0.000	+0.002	116	341	+0.002	+0.002	341					
117	+0.000	+0.002	117	342	+0.002	+0.002	342					
118	+0.000	+0.002	118	343	+0.002	+0.002	343					
119	+0.000	+0.002	119	344	+0.002	+0.002	344					
120	+0.000	+0.002	120	345	+0.002	+0.002	345					
121	+0.000	+0.002	121	346	+0.002	+0.002	346					
122	+0.000	+0.002	122	347	+0.002	+0.002	347					
123	+0.000	+0.002	123	348	+0.002	+0.002	348					
124	+0.000	+0.002	124	349	+0.002	+0.002	349					
125	+0.000	+0.002	125	425	+0.002	+0.002	425					
126	+0.000	+0.002	126	426	+0.002	+0.002	426					
127	+0.000	+0.002	127	427	+0.002	+0.002	427					
128	+0.000	+0.002	128	428	+0.002	+0.002	428					
129	+0.000	+0.002	129	429	+0.002	+0.002	429					
130	+0.000	+0.002	130	430	+0.002	+0.002	430					
131	+0.000	+0.002	131	431	+0.002	+0.002	431					
132	+0.000	+0.002	132	432	+0.002	+0.002	432					
133	+0.000	+0.002	133	433	+0.002	+0.002	433					
134	+0.000	+0.002	134	434	+0.002	+0.002	434					
135	+0.000	+0.002	135	435	+0.002	+0.002	435					
136	+0.000	+0.002	136	436	+0.002	+0.002	436					
137	+0.000	+0.002	137	437	+0.002	+0.002	437					
138	+0.000	+0.002	138	438	+0.002	+0.002	438					
139	+0.000	+0.002	139	439	+0.002	+0.002	439					



BACKUP RING INSTALLATION FOR ONE BACKUP WIDTH GLANDS PER AS5857



BACKUP RING INSTALLATION FOR TWO BACKUP WIDTH GLANDS PER AS5857

NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SCARF-CUT, EXTERNAL BACKUP RINGS IN AS5857 PISTON GLANDS.
 2. ORDERING EXAMPLE:
 BACKUP RING, SCARF-CUT, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBORG SEALING SOLUTIONS DESIGN
 GLAND DESIGNATOR
 E = AS5857 GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO AS5857
 QUALITY AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCIN® BACKUP RING MAT'L CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 3. FOR SOLID, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BV58LE000.

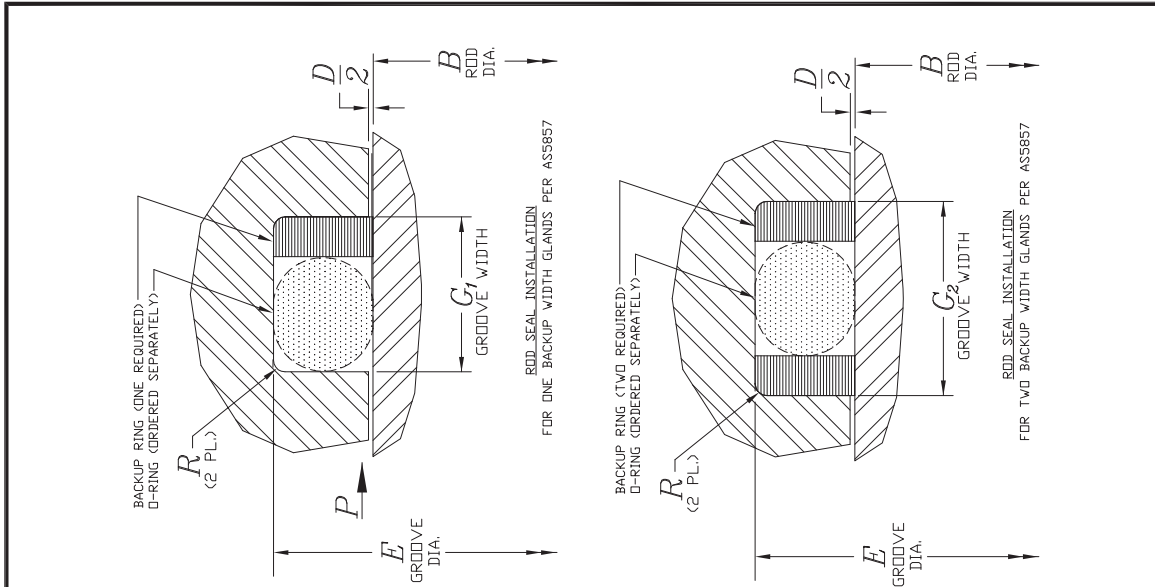
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INCH 2011_8

TRELLEBORG SEALING SOLUTIONS

TITLE BACKUP RING, SCARF-CUT, EXTERNAL
 DRAWING NO. BH58LE000

Back-up Ring and Stakbak®



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INCH	2009_11
TITLE	BACKUP RING, SOLID, INTERNAL
DRAWING NO.	BU58LE000

DASH NO.	B DIA.	E DIA.	O-RING ND.	DASH NO.	B DIA.	E DIA.	O-RING ND.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRICAL CLEARANCE MAX.
004	+0.000	+0.001	-0.000	210	+0.000	+0.002	-0.000	435	.174/.184	.230/.240	.005/.015	.004
005	.076	.184	.974	211	.748	.974	1.099	436	.164/.174	.220/.230	.005/.015	.004
006	.076	.231	1.099	212	.873	1.099	1.224	437	.210/.220	.275/.285	.005/.015	.004
007	.076	.262	1.161	213	.935	1.161	1.224	438	.110-.126	.165/.175	.005/.015	.004
008	.155	.293	1.224	214	.998	1.224	1.286	439	.127-.129	.180/.190	.005/.015	.006
009	.217	.325	1.286	215	1.060	1.286	1.349	440	.130-.132	.190/.200	.005/.015	.006
010	.248	.356	1.349	216	1.123	1.349	1.411	441	.133-.135	.200/.210	.005/.015	.007
011	.279	.387	1.411	217	1.185	1.411	1.474	442	.135-.137	.210/.220	.005/.015	.007
012	.310	.418	1.474	218	1.248	1.474	1.536	443	.137-.140	.220/.230	.005/.015	.008
013	+0.000	+0.001	-0.000	219	1.310	1.536	1.599	444	.223-.224	.230/.240	.010/.025	.006
014	.435	.543	1.599	220	1.373	1.599	1.661	445	.225-.227	.250/.260	.010/.025	.007
015	.498	.606	1.661	221	1.435	1.661	1.724	446	.228-.243	.320/.330	.020/.035	.007
016	.562	.668	1.724	222	1.498	1.724	1.786	447	.244-.245	.455/.465	.020/.035	.007
017	.625	.731	1.786	223	1.562	1.786	1.847	448	.246-.247	.475/.485	.020/.035	.008
018	.688	.795	1.847	224	1.625	1.847	1.908	449	.323-.325	.610/.620	.020/.035	.007
019	.751	.858	1.908	225	1.688	1.908	2.069	450	.338-.339			.007
020	.814	.921	2.069	226	1.751	2.069	2.130	451	.340-.345			.007
021	.877	.984	2.130	227	1.814	2.130	2.192	452	.345-.349			.007
022	.940	1.041	2.192	228	1.877	2.192	2.254	453	.425-.438			.009
023	1.003	1.104	2.254	229	1.940	2.254	2.316	454	.439-.443			.010
024	1.066	1.167	2.316	230	2.003	2.316	2.378	455	.446			.010
025	1.129	1.230	2.378	231	2.066	2.378	2.440	456	.447			.010
026	1.192	1.293	2.440	232	2.129	2.440	2.502	457				.010
027	1.255	1.356	2.502	233	2.192	2.502	2.564	458				.010
028	1.318	1.418	2.564	234	2.255	2.564	2.626	459				.010
029	1.381	1.481	2.626	235	2.318	2.626	2.688	460				.010
030	+0.000	+0.001	-0.000	236	2.381	2.688	2.750	461				.010
031	.435	.543	2.750	237	2.444	2.750	2.812	462				.010
032	.498	.606	2.812	238	2.507	2.812	2.874	463				.010
033	.562	.668	2.874	239	2.570	2.874	2.936	464				.010
034	.625	.731	2.936	240	2.633	2.936	3.061	465				.010
035	.688	.795	3.061	241	2.696	3.061	3.123	466				.010
036	.751	.858	3.123	242	2.759	3.123	3.185	467				.010
037	.814	.921	3.185	243	2.822	3.185	3.247	468				.010
038	.877	.984	3.247	244	2.885	3.247	3.309	469				.010
039	.940	1.041	3.309	245	2.948	3.309	3.371	470				.010
040	1.003	1.104	3.371	246	3.011	3.371	3.433	471				.010
041	1.066	1.167	3.433	247	3.074	3.433	3.495	472				.010
042	1.129	1.230	3.495	248	3.137	3.495	3.557	473				.010
043	1.192	1.293	3.557	249	3.200	3.557	3.619	474				.010
044	1.255	1.356	3.619	250	3.263	3.619	3.681	475				.010
045	1.318	1.418	3.681	251	3.326	3.681	3.743	476				.010
046	1.381	1.481	3.743	252	3.389	3.743	3.805	477				.010
047	1.444	1.545	3.805	253	3.452	3.805	3.867	478				.010
048	1.507	1.608	3.867	254	3.515	3.867	3.929	479				.010
049	1.570	1.671	3.929	255	3.578	3.929	3.991	480				.010
050	1.633	1.734	3.991	256	3.641	3.991	4.053	481				.010
051	1.696	1.797	4.053	257	3.704	4.053	4.115	482				.010
052	1.759	1.860	4.115	258	3.767	4.115	4.177	483				.010
053	1.822	1.923	4.177	259	3.830	4.177	4.239	484				.010
054	1.885	1.986	4.239	260	3.893	4.239	4.301	485				.010
055	1.948	2.049	4.301	261	3.956	4.301	4.363	486				.010
056	2.011	2.112	4.363	262	4.019	4.363	4.425	487				.010
057	2.074	2.175	4.425	263	4.082	4.425	4.487	488				.010
058	2.137	2.238	4.487	264	4.145	4.487	4.549	489				.010
059	2.200	2.301	4.549	265	4.208	4.549	4.611	490				.010
060	2.263	2.364	4.611	266	4.271	4.611	4.673	491				.010
061	2.326	2.427	4.673	267	4.334	4.673	4.735	492				.010
062	2.389	2.490	4.735	268	4.397	4.735	4.797	493				.010
063	2.452	2.553	4.797	269	4.460	4.797	4.859	494				.010
064	2.515	2.616	4.859	270	4.523	4.859	4.921	495				.010
065	2.578	2.679	4.921	271	4.586	4.921	4.983	496				.010
066	2.641	2.742	4.983	272	4.649	4.983	5.045	497				.010
067	2.704	2.805	5.045	273	4.712	5.045	5.107	498				.010
068	2.767	2.868	5.107	274	4.775	5.107	5.169	499				.010
069	2.830	2.931	5.169	275	4.838	5.169	5.231	500				.010
070	2.893	2.994	5.231	276	4.901	5.231	5.293	501				.010
071	2.956	3.057	5.293	277	4.964	5.293	5.355	502				.010
072	3.019	3.120	5.355	278	5.027	5.355	5.417	503				.010
073	3.082	3.183	5.417	279	5.090	5.417	5.479	504				.010
074	3.145	3.246	5.479	280	5.153	5.479	5.541	505				.010
075	3.208	3.309	5.541	281	5.216	5.541	5.603	506				.010
076	3.271	3.372	5.603	282	5.279	5.603	5.665	507				.010
077	3.334	3.435	5.665	283	5.342	5.665	5.727	508				.010
078	3.397	3.498	5.727	284	5.405	5.727	5.789	509				.010
079	3.460	3.561	5.789	285	5.468	5.789	5.851	510				.010
080	3.523	3.624	5.851	286	5.531	5.851	5.913	511				.010
081	3.586	3.687	5.913	287	5.594	5.913	5.975	512				.010
082	3.649	3.750	5.975	288	5.657	5.975	6.037	513				.010
083	3.712	3.813	6.037	289	5.720	6.037	6.099	514				.010
084	3.775	3.876	6.099	290	5.783	6.099	6.161	515				.010
085	3.838	3.939	6.161	291	5.846	6.161	6.223	516				.010
086	3.901	4.002	6.223	292	5.909	6.223	6.285	517				.010
087	3.964	4.065	6.285	293	5.972	6.285	6.347	518				.010
088	4.027	4.128	6.347	294	6.035	6.347	6.409	519				.010
089	4.090	4.191	6.409	295	6.098	6.409	6.471	520				.010
090	4.153	4.254	6.471	296	6.161	6.471	6.533	521				.010
091	4.216	4.317	6.533	297	6.224	6.533	6.595	522				.010
092	4.279	4.380	6.595	298	6.287	6.595	6.657	523				.010
093	4.342	4.443	6.657	299	6.350	6.657	6.719	524				.010
094	4.405	4.506	6.719	300	6.413	6.719	6.781	525				.010
095	4.468	4.569	6.781	301	6.476	6.781	6.843	526				.010
096	4.531	4.632	6.843	302	6.539	6.843	6.905	527				.010
097	4.594	4.695	6.905	303	6.602	6.905	6.967	528				.010
098	4.657	4.758	6.967	304	6.665	6.967	7.029	529				.010
099	4.720	4.821	7.029	305	6.728	7.029	7.091	530				.010
100	4.783	4.884	7.091	306	6.791	7.091	7.153	531				.010
101	4.846	4.947	7.153	307	6.854	7.153	7.215	532				.010
102	4.909	5.050	7.215	308	6.917	7.215	7.277	533				.010
103	4.972	5.113	7.277	309	6.980	7.277	7.339	534				.010
104	5.035	5.176	7.339	310	7.043	7.339	7.401	535				.010
105	5.098	5.239	7.401	311	7.106	7.401	7.463	536				.010
106	5.161	5.302	7.463	312	7.169	7.463	7.525	537				.010
107	5.224	5.365	7.525	313	7.232	7.525	7.587	538				.010
108	5.287	5.428	7.587	314	7.295	7.587	7.649					

Back-up Ring and Stakbak®

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SOLID, EXTERNAL BACKUP RINGS IN ASS857 DESIGN.
- ORDERING EXAMPLE: **BV58LE214A105**
 BACKUP RING, SOLID, EXTERNAL DESIGNATOR
 DESIGN CHARACTERISTICS
 L = TRELLEBORG SEALING SOLUTIONS DESIGN
 GLAND DESIGNATOR
 E = ASS857 GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO ASS857
 QUALITY INDEX CERTIFICATE OF CONFORMANCE
 TURCIN BACKUP RING MAT'L CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR SCARF-CUT, EXTERNAL BACKUP RINGS, PLEASE REFERENCE TRELLEBORG SEALING SOLUTIONS PART NUMBER BHS8LE000.

DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	A DIA.	F DIA.	D-RING NO.	DASH NO.	G ₁ ONE BACKUP WIDTH	G ₂ TWO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
004	+0.01	+0.00	004	210	+0.02	-0.02	210	435	+0.03	-0.03	435	084-007	.174/.184	.230/.240	.005/.015	.004
005	.207	.076	005	211	1.951	.869	211	436	6.294	5.769	436	085-002	.164/.174	.220/.230	.005/.015	.004
006	.230	.123	006	212	1.178	.892	212	437	6.474	6.019	437	013-028	.210/.220	.275/.285	.005	.004
007	.261	.154	007	213	1.178	.954	213	438	6.724	6.269	438	104-109	.200/.210	.265/.275	.005/.015	.005
008	.293	.186	008	214	1.241	1.017	214	439	6.974	6.519	439	130-140	.250/.260	.320/.330	.010/.025	.006
009	.326	.219	009	215	1.303	1.079	215	440	7.224	6.769	440	141-149			.020/.035	.007
010	.357	.250	010	216	1.366	1.142	216	441	7.474	7.019	441	200-222			.020/.035	.005
011	.389	.283	011	217	1.429	1.206	217	442	7.724	7.269	442	200-222			.020/.035	.007
012	+0.02	+0.01	012	218	1.491	1.267	218	443	7.974	7.519	443	244-247			.020/.035	.008
013	.550	.443	013	220	1.616	1.392	220	444	8.224	7.769	444	325-329			.020/.035	.006
014	.613	.506	014	221	1.678	1.454	221	445	8.474	8.019	445	330-345			.020/.035	.007
015	.675	.568	015	222	1.741	1.517	222	446	8.724	8.269	446	346-349			.020/.035	.008
016	.738	.631	016	223	1.804	1.580	223	447	8.974	8.519	447	453-445			.020/.035	.009
017	.800	.693	017	224	1.867	1.643	224	448	9.224	8.769	448	453-445			.020/.035	.010
018	.863	.756	018	225	1.929	1.706	225	449	9.474	9.019	449	447-460			.020/.035	.011
019	.925	.818	019	226	2.118	1.894	226	449	10.474	10.020	449					
020	.991	.884	020	227	2.243	2.019	227	450	10.974	10.520	450					
021	1.053	.946	021	228	2.368	2.144	228	451	11.474	11.020	451					
022	1.116	1.009	022	229	2.493	2.269	229	452	11.974	11.520	452					
023	1.178	1.071	023	230	2.618	2.394	230	453	12.474	12.020	453					
024	1.241	1.134	024	231	2.743	2.519	231	454	12.974	12.520	454					
025	1.303	1.196	025	232	2.868	2.644	232	455	13.474	13.020	455					
026	1.366	1.259	026	233	2.993	2.769	233	456	13.974	13.520	456					
027	1.428	1.321	027	234	3.118	2.894	234	457	14.474	14.020	457					
028	1.491	1.384	028	235	3.243	3.019	235	458	14.974	14.520	458					
029	+0.01	+0.00	029	236	3.368	3.144	236	459	15.474	15.020	459					
030	.286	.121	104	237	3.493	3.269	237	460	15.974	15.520	460					
104	.317	.152	105	238	3.618	3.394	238									
105	.349	.184	106	239	3.743	3.519	239									
106	.382	.217	107	240	3.868	3.644	240									
107	.414	.249	108	241	3.993	3.769	241									
108	.446	.281	109	242	4.118	3.894	242									
109	.478	.312	110	243	4.243	4.019	243									
110	.510	.344	111	244	4.368	4.144	244									
111	.542	.377	112	245	4.493	4.269	245									
112	.574	.410	113	246	4.618	4.394	246									
113	.606	.442	114	247	4.743	4.519	247									
114	.638	.474	115	248	4.868	4.644	248									
115	.670	.506	116	249	4.993	4.769	249									
116	.702	.538	117	250	5.118	4.894	250									
117	.734	.570	118	251	5.243	5.019	251									
118	.766	.602	119	252	5.368	5.144	252									
119	.798	.634	120	253	5.493	5.269	253									
120	.830	.666	121	254	5.618	5.394	254									
121	.862	.698	122	255	5.743	5.519	255									
122	.894	.730	123	256	5.868	5.644	256									
123	.926	.762	124	257	5.993	5.769	257									
124	.958	.794	125	258	6.118	5.894	258									
125	.990	.826	126	259	6.243	6.019	259									
126	1.022	.858	127	260	6.368	6.144	260									
127	1.054	.890	128	261	6.493	6.269	261									
128	1.086	.922	129	262	6.618	6.394	262									
129	1.118	.954	130	263	6.743	6.519	263									
130	1.150	.986	131	264	6.868	6.644	264									
131	1.182	1.018	132	265	6.993	6.769	265									
132	1.214	1.050	133	266	7.118	6.894	266									
133	1.246	1.082	134	267	7.243	7.019	267									
134	1.278	1.114	135	268	7.368	7.144	268									
135	1.310	1.146	136	269	7.493	7.269	269									
136	1.342	1.178	137	270	7.618	7.394	270									
137	1.374	1.210	138	271	7.743	7.519	271									
138	1.406	1.242	139	272	7.868	7.644	272									
139	1.438	1.274	140	273	7.993	7.769	273									
140	1.470	1.306	141	274	8.118	7.894	274									
141	1.502	1.338	142	275	8.243	8.019	275									
142	1.534	1.370	143	276	8.368	8.144	276									
143	1.566	1.402	144	277	8.493	8.269	277									
144	1.598	1.434	145	278	8.618	8.394	278									
145	1.630	1.466	146	279	8.743	8.519	279									
146	1.662	1.498	147	280	8.868	8.644	280									
147	1.694	1.530	148	281	8.993	8.769	281									
148	1.726	1.562	149	282	9.118	8.894	282									
149	1.758	1.594	150	283	9.243	9.019	283									

INCH

TRELLEBORG SEALING SOLUTIONS

TITLE: BACKUP RING, SOLID, EXTERNAL

2009_1

DRAWING NO. BV58LE000

Seals for AS4716

Rod and bore sizes only

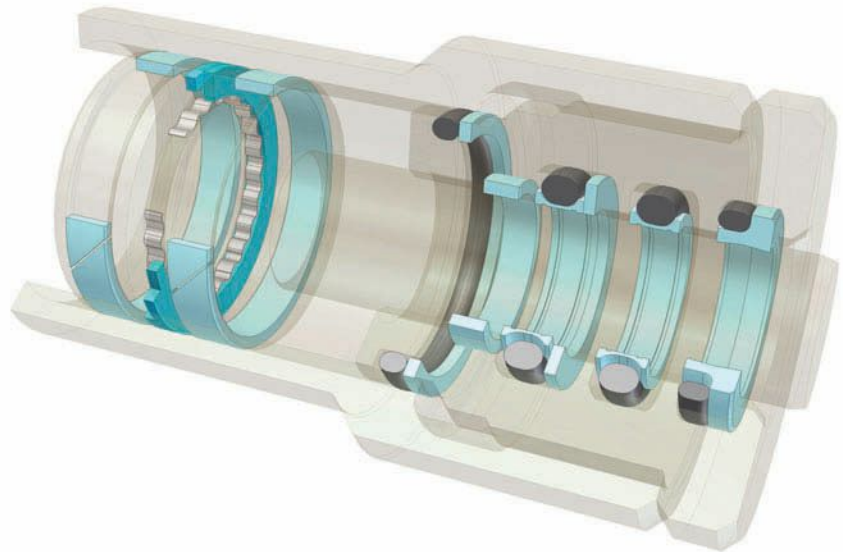
Turcon® Dual Piston Ring.....	179
Turcon® Glyd Ring®	183
Turcon® Stepseal® 2K.....	191



Turcon® Dual Piston Ring

Features and benefits

- Suitable for demanding dynamic applications
- Very low friction
- Wide operating temperature range
- Fits into narrow grooves
- Excellent chemical resistance
- React to pressure changes very quickly
- Low hysteresis
- Sealing characteristics remain constant over time
- Easy installation
- Available for AS4716 bore diameters from -112 to -447
- Bidirectional seal



Seals for AS4716
Rod/Bore only

Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Dual Piston Ring.

Turcon® Dual Piston Ring

Description

Turcon® Dual Piston Ring consists of two Turcon® rings, each with a step-cut. These rings are activated by a wave-shaped Stainless Steel expander. On the inside of the Turcon® rings there is a small notch into which a tab on the springs fits. This prevents the rings from rotating relative to each other. When installed correctly the step-cuts of the two rings will be separated by 180 degrees.

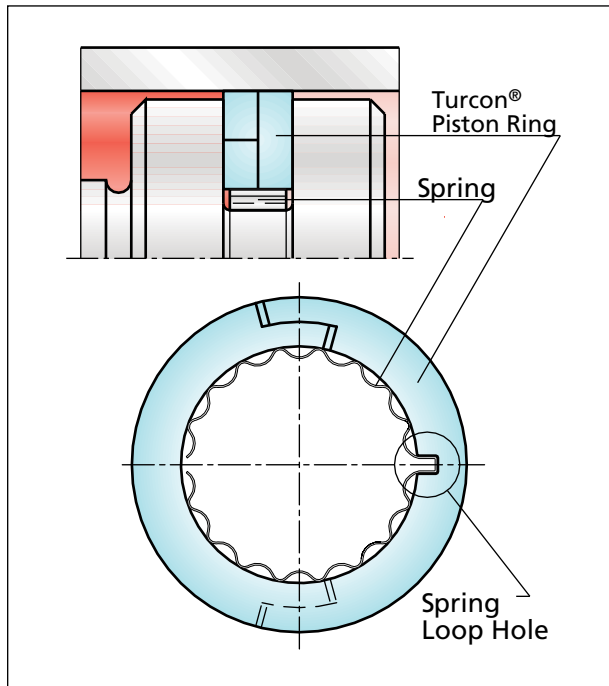


Figure 1 Turcon® Dual Piston Ring

Method of Operation

With zero or low system pressure, the two Turcon® rings of the Turcon® Dual Piston Ring are kept in contact with the bore by spring force. As the system pressure increases it acts on the side and inner diameter of the rings, forcing them against the bore.

Groove and ring width tolerances are very tight. This means that the Turcon® Dual Piston Ring can be made to fit the sealing groove closely. The seal will therefore react to pressure changes very quickly. Fly-by-wire flight controls, where minimum hysteresis is important, use this feature to its full extent.

The narrow seal design provides low friction in comparison to other seals for groove widths per AS4716. The use of metal expanders allows for a broader operating temperature range and improves the chemical resistance of the assembly. With no elastomer element, it also means that sealing characteristics remain constant over time.

The surface finish of the groove sidewalls is an integral part of sealing performance. It should be controlled within an average roughness range of 12 – 24 μin / 0.4 to 0.8 μm to achieve optimum performance from the interface.

Turcon® Dual Piston Ring

Technical Data

Operation pressure: Up to 5,000 psi / 35 MPa for standard design
Special versions are available for higher pressures

Speed: Up to 49 ft/s/ 15 m/s

Temperature range: -94°F to +500°F/ -70°C to +260°C
Special versions are available that can operate in higher temperatures

Clearance: As per AS4716

Media: Compatible with virtually all media and gases
At high temperatures and pressures the seal can operate at the upper speed level

Avoid combining extreme limits.


To provide greater strength in demanding dynamic applications, an insert can be added to the anti-rotation tab (a.r.t.). This option can be ordered by inserting a K in the fifth character of the part number.

Spring materials

The standard spring material is 17-7 PH Stainless Steel condition CH900, spring code PH. This will be supplied if the spring code is omitted.

Other spring materials are 17-7 PH Stainless Steel condition C, spring code CC and Stainless Steel 301 per AMS 5519, fully hard, spring code SS.

Table I Turcon® Dual Piston Ring

Cross Section	Description	Part Number	Gland Standard
	Dual Piston Ring Set	PF52_	TSS Gland Bore per AS4716

Series

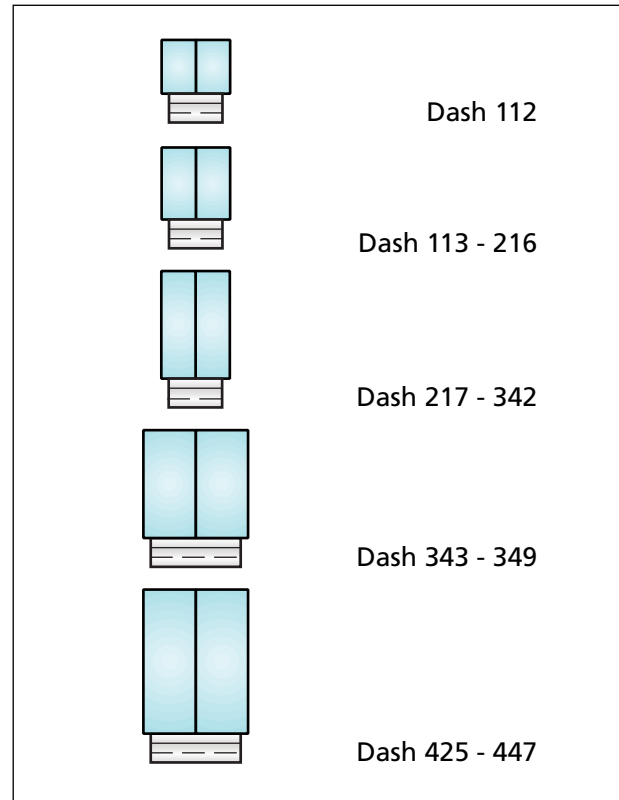


Figure 2 Relative size of Turcon® Dual Piston Ring cross section

Turcon® Dual Piston Ring

DASH NO.	A DIA.	F DIA.
112	-.002	-.004
113	.675	.429
114	.800	.460
115	.863	.553
116	.925	.615
210	.991	.681
211	1.053	.743
212	1.116	.806
213	1.178	.869
214	1.241	.931
215	1.303	.993
216	1.366	1.056
217	1.428	.994
218	1.491	1.057
219	1.553	1.119
220	1.616	1.182
221	1.678	1.244
222	1.741	1.307
325	1.867	1.423
326	1.930	1.506
327	1.992	1.589
328	2.054	1.672
329	2.116	1.755
330	2.178	1.838
331	2.240	1.921
332	2.302	2.004
333	2.364	2.087
334	2.426	2.170
335	2.488	2.253
336	2.550	2.336
337	2.612	2.419
338	2.674	2.502
339	2.736	2.585
340	2.798	2.668
341	2.860	2.751
342	2.922	2.834
343	2.984	2.917
344	3.046	3.000
345	3.108	3.083
346	3.170	3.166
347	3.232	3.249
348	3.294	3.332
349	3.356	3.415
425	-.002	-.004
426	.509	4.559
427	.572	4.642
428	.634	4.725
429	.697	4.808
430	.759	4.891
431	.822	4.974
432	.884	5.057
433	.947	5.140
434	1.009	5.223
435	1.072	5.306
436	1.134	5.389
437	1.197	5.472
438	1.259	5.555
439	1.322	5.638
440	1.384	5.721
441	1.447	5.804
442	1.509	5.887
443	1.572	5.970
444	1.634	6.053
445	1.697	6.136
446	1.759	6.219
447	1.822	6.302

DASH NO.	G ₀ ZERO BACKUP WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
112-334	.125/.127	.010/.020	.005
335-342	.125/.127	.010/.020	.005
425-447	.188/.190	.010/.020	.008

Technical drawing of a Turcon Dual Piston Ring. The drawing shows a cross-section of the ring with various dimensions labeled: A (BORE DIA.), D/2 (BORE DIA.), R (RADIUS), G (WIDTH), F' (GROOVE DIA.), and .002 (Ø) (PISTON). The drawing is oriented vertically on the page.

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR DUAL PISTON RING IN PISTON RING SET GLANDS.
- ORDERING EXAMPLE:
 DUAL PISTON RING SET DESIGNATOR: PESE K B 214 A 105 S
 DESIGN OPTIONS:
 0 = STANDARD
 A = ANTI-ROTATION TAB
 K = TRELLEBORG SEALING SOLUTIONS
 B = TRELLEBORG SEALING SOLUTIONS
 G = GROOVE STANDARD
 DASH SIZE: ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 GLAND STANDARD: ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 QUALITY INDEX: ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 TURCON® PISTON RING MAT'L CODE: ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 STANDARD EXPANDER MAT'L CODE: ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- FOR DEMANDING APPLICATIONS A PTFE INSERT CAN BE ADDED TO THE ANTI-ROTATION TAB (ART). TO PROVIDE GREATER SURFACE CONTACT WITH THE GLAND AND TO BE ORDERED BY INSERTING "KR" IN THE DESIGN OPTION LOCATION (5TH CHARACTER) OF THE PART NUMBER.
- BORE DIAMETERS PER AS4716 REVISION A.
- DASH NUMBERS OF THIS DRAWING CORRESPOND TO DASH NUMBERS OF AS568 UNIFORM DASH NUMBERING SYSTEMS FOR O-RINGS.

FOR TRELLEBORG SEALING SOLUTIONS PISTON RING SET GLANDS

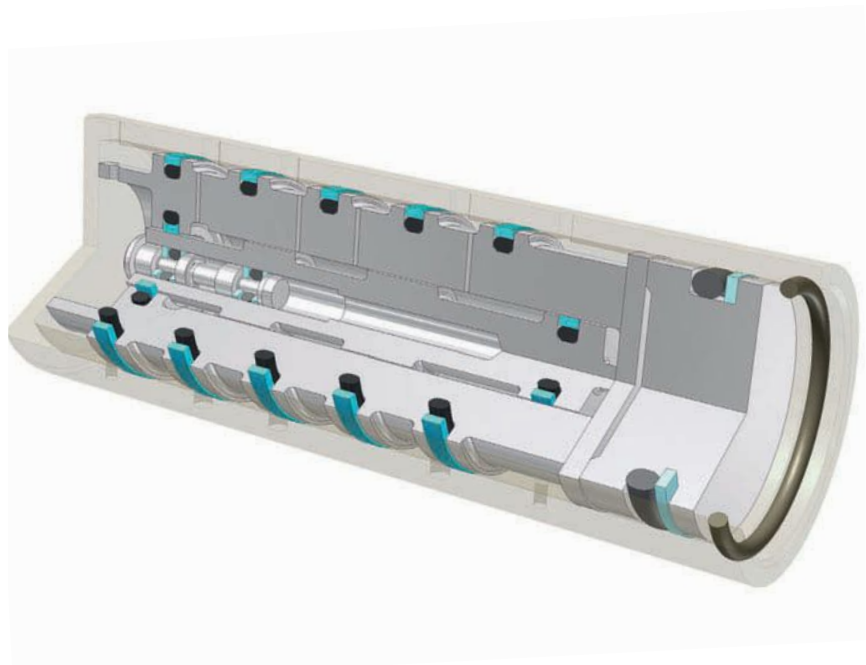
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INCH 2010_7
 TITLE DUAL PISTON RING
 DRAWING NO. PF520B000
 TRELLEBORG SEALING SOLUTIONS

Turcon® Glyd Ring®

Features and benefits

- High sealing efficiency
- Low wear
- Long service life
- High operational reliability
- Low friction
- Stick-slip-free operation
- Suitable for narrow grooves
- Design flexibility – adaptable for almost all groove sizes
- Easy installation
- Available for all MIL-G-5514F and AS4716 Rod and Bore diameters
- Custom designs available
- Bidirectional seal



Seals for AS4716
Rod/Bore only

Illustration shows typical hydraulic valve fitted with Turcon® Glyd Ring®.

Turcon® Glyd Ring®

Description

Turcon® Glyd Ring® is a simple and reliable seal consisting of a Turcon® seal cap activated by an elastomer O-Ring.

A full range of sizes is offered to suit all MIL-G-5514F and AS4716 rods and bores. Custom designs are available on request.

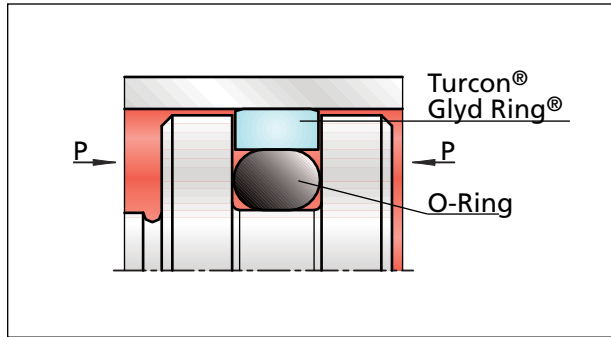


Figure 1 Turcon® Glyd Ring®

Method of Operation

The slight interference fit of Turcon® Glyd Ring® ensures initial contact with the mating surface. A true slipper seal, Turcon® Glyd Ring® is energized by an elastomer O-Ring at zero or low pressure. As the pressure increases, the Turcon® Glyd Ring® is energized by hydraulic pressure, forcing it against the sealing surface. The seal's geometry allows the formation of a lubricating hydro-dynamic oil film under the seal in reciprocating applications. This results in low wear and long service life with high sealing efficiency.

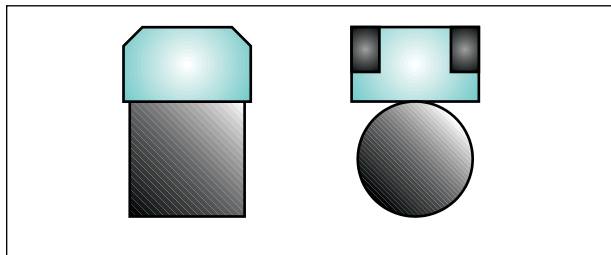


Figure 2 Square-ring energized Glyd Ring®, Turcon® Glyd Ring® CR

Optional Configurations

As mentioned above, the Turcon® Glyd Ring® is versatile and capable of being designed to meet specific application requirements. Some common custom configurations include the Turcon® Glyd Ring® CR and the square-ring energized Glyd Ring®

Notches

Where Turcon® Glyd Ring® is subjected to bidirectional pressure, pressure from both sides alternately, it should always be equipped with sidewall notches. See figure 2. This allows the pressure to properly activate the elastomer. See Figure 3.

Turcon® Glyd Ring® for piston use is equipped as standard with notches. For rod versions notches must be specified if required.

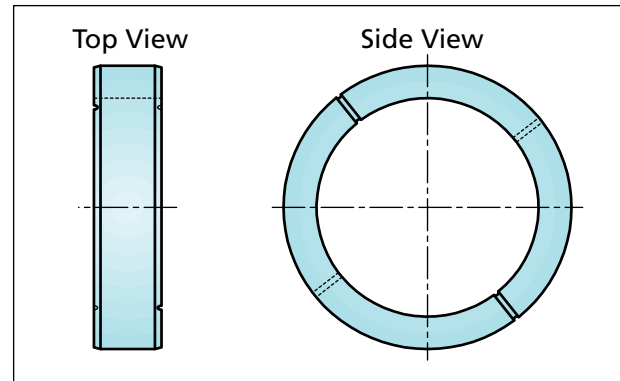


Figure 3 Turcon® Glyd Ring® notches

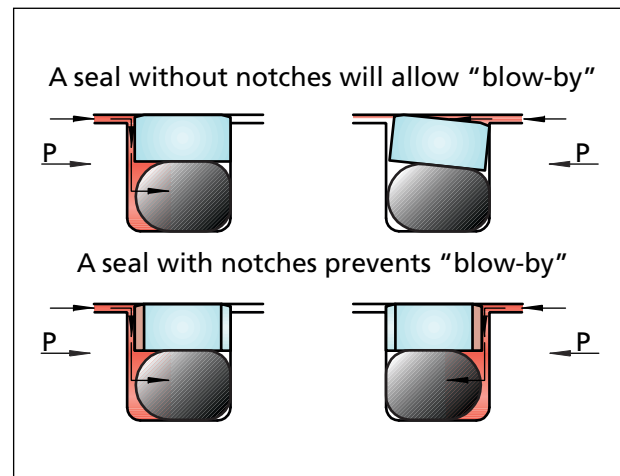


Figure 4 Functioning of Turcon® Glyd Ring® with notches

Using a seal without notches may allow blow-by, where the pressure shoots over the top of the Turcon® Glyd Ring® cap and forces the seal down into the groove. See SAE document AIR 1243 for more information on this topic.

Turcon® Glyd Ring®

Technical Data

Operation pressure: 5,000 psi/ 35 MPa static 3,000 psi/ 21 MPa dynamic

Speed: Up to 49.2 ft/s/ 15 m/s for reciprocating movements

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer

Clearance: Per the AS4716 rod and bore clearances

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Series

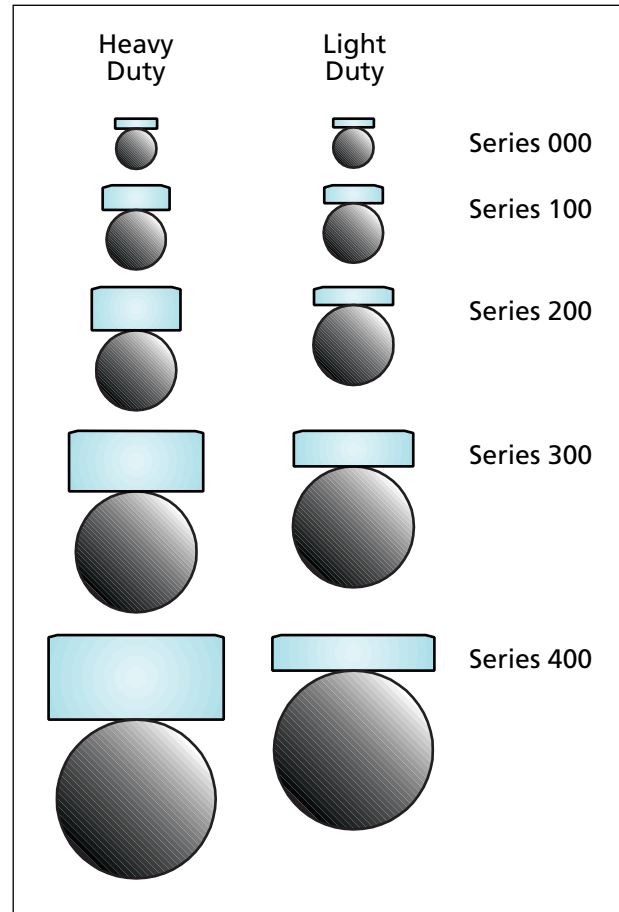
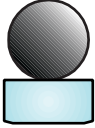
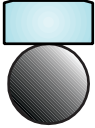

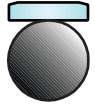


Figure 5 Relative Size of Turcon® Glyd Ring® cross section

Seals for AS4716
Rod/Bore only

Turcon® Glyd Ring®

Table I Turcon® Glyd Ring® Types

Cross Section	Description	Part Number	Gland Standard
	<p>Series J Rod</p>	<p>RG27_B</p>	<p>TSS Gland Rod per AS4716</p>
	<p>Series J Piston</p>	<p>PG28_B</p>	<p>TSS Gland Piston per AS4716</p>
	<p>Series B Rod</p>	<p>RG66_B</p>	<p>TSS Gland Rod per AS4716</p>
	<p>Series B Piston</p>	<p>PG68_B</p>	<p>TSS Gland Piston per AS4716</p>

Turcon® Glyd Ring®

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
006	.153	.259	007	210	.748	1.182	212	435	5.747	6.497	437	.081/.086	.005/.015	.004
007	.154	.260	008	211	.810	1.184	213	436	5.872	6.622	438	.126/.131	.005/.015	.004
008	.185	.321	009	212	.923	1.309	214	438	6.597	7.247	440	.166/.171	.010/.025	.005
009	.217	.353	010	214	1.060	1.434	216	439	6.497	7.247	440			.006
010	.248	.422	011	215	1.123	1.497	218	440	6.747	7.497	441			.007
011	.310	.484	012	216	1.185	1.559	219	442	6.997	7.747	443			.007
012	.373	.547	013	218	1.248	1.622	220	443	7.497	8.247	444			.006
013	.435	.609	014	219	1.310	1.684	221	444	7.747	8.497	445			.007
014	.498	.672	015	220	1.373	1.747	222	445	7.997	8.747	445			.008
015	.560	.734	016	221	1.435	1.809	222	446	8.497	9.247	446			.007
016	.623	.797	017	222	1.498	1.872	223	446	8.497	9.247	446			.006
017	.685	.859	018	223	1.623	1.997	224	447	8.997	9.747	447			.007
018	.748	.922	019	224	1.685	2.122	225	447	9.247	10.000	447			.007
019	.810	.984	020	225	1.748	2.247	226	448	9.997	10.547	448			.007
020	.873	1.047	021	226	1.810	2.372	227	450	10.497	11.247	450			.009
021	.935	1.109	022	228	1.873	2.497	228	451	10.997	11.747	451			.010
022	.998	1.172	023	229	1.935	2.622	229	452	11.497	12.247	452			.010
023	1.060	1.234	024	230	2.000	2.747	230	452	11.997	12.747	452			.010
024	1.123	1.307	025	231	2.063	2.872	231	454	12.497	13.247	454			.010
025	1.185	1.359	026	232	2.125	3.000	232	456	13.497	14.247	456			.010
026	1.248	1.422	027	233	2.188	3.125	233	456	13.997	14.747	456			.010
027	1.310	1.484	028	234	2.250	3.250	234	457	13.997	14.747	457			.010
028	1.373	1.547	028	235	2.313	3.375	235	458	14.497	15.247	458			.010
029	1.435	1.610	029	236	2.375	3.500	236	460	14.997	15.747	460			.010
030	1.498	1.672	030	237	2.438	3.625	237	460	15.497	16.247	460			.010
031	1.560	1.734	031	238	2.500	3.750	238	460	15.497	16.247	460			.010
032	1.623	1.797	032	239	2.563	3.875	239	460	15.497	16.247	460			.010
033	1.685	1.859	033	240	2.625	4.000	240	460	15.497	16.247	460			.010
034	1.748	1.922	034	241	2.688	4.125	241	460	15.497	16.247	460			.010
035	1.810	1.984	035	242	2.750	4.250	242	460	15.497	16.247	460			.010
036	1.873	2.047	036	243	2.813	4.375	243	460	15.497	16.247	460			.010
037	1.935	2.109	037	244	2.875	4.500	244	460	15.497	16.247	460			.010
038	2.000	2.172	038	245	2.938	4.625	245	460	15.497	16.247	460			.010
039	2.063	2.234	039	246	3.000	4.750	246	460	15.497	16.247	460			.010
040	2.125	2.297	040	247	3.063	4.875	247	460	15.497	16.247	460			.010
041	2.188	2.359	041	248	3.125	5.000	248	460	15.497	16.247	460			.010
042	2.250	2.422	042	249	3.188	5.125	249	460	15.497	16.247	460			.010
043	2.313	2.484	043	250	3.250	5.250	250	460	15.497	16.247	460			.010
044	2.375	2.547	044	251	3.313	5.375	251	460	15.497	16.247	460			.010
045	2.438	2.610	045	252	3.375	5.500	252	460	15.497	16.247	460			.010
046	2.500	2.672	046	253	3.438	5.625	253	460	15.497	16.247	460			.010
047	2.563	2.734	047	254	3.500	5.750	254	460	15.497	16.247	460			.010
048	2.625	2.797	048	255	3.563	5.875	255	460	15.497	16.247	460			.010
049	2.688	2.859	049	256	3.625	6.000	256	460	15.497	16.247	460			.010
050	2.750	2.922	050	257	3.688	6.125	257	460	15.497	16.247	460			.010
051	2.813	2.984	051	258	3.750	6.250	258	460	15.497	16.247	460			.010
052	2.875	3.047	052	259	3.813	6.375	259	460	15.497	16.247	460			.010
053	2.938	3.109	053	260	3.875	6.500	260	460	15.497	16.247	460			.010
054	3.000	3.172	054	261	3.938	6.625	261	460	15.497	16.247	460			.010
055	3.063	3.234	055	262	4.000	6.750	262	460	15.497	16.247	460			.010
056	3.125	3.297	056	263	4.063	6.875	263	460	15.497	16.247	460			.010
057	3.188	3.359	057	264	4.125	7.000	264	460	15.497	16.247	460			.010
058	3.250	3.422	058	265	4.188	7.125	265	460	15.497	16.247	460			.010
059	3.313	3.484	059	266	4.250	7.250	266	460	15.497	16.247	460			.010
060	3.375	3.547	060	267	4.313	7.375	267	460	15.497	16.247	460			.010
061	3.438	3.610	061	268	4.375	7.500	268	460	15.497	16.247	460			.010
062	3.500	3.672	062	269	4.438	7.625	269	460	15.497	16.247	460			.010
063	3.563	3.734	063	270	4.500	7.750	270	460	15.497	16.247	460			.010
064	3.625	3.797	064	271	4.563	7.875	271	460	15.497	16.247	460			.010
065	3.688	3.859	065	272	4.625	8.000	272	460	15.497	16.247	460			.010
066	3.750	3.922	066	273	4.688	8.125	273	460	15.497	16.247	460			.010
067	3.813	3.984	067	274	4.750	8.250	274	460	15.497	16.247	460			.010
068	3.875	4.047	068	275	4.813	8.375	275	460	15.497	16.247	460			.010
069	3.938	4.109	069	276	4.875	8.500	276	460	15.497	16.247	460			.010
070	4.000	4.172	070	277	4.938	8.625	277	460	15.497	16.247	460			.010
071	4.063	4.234	071	278	5.000	8.750	278	460	15.497	16.247	460			.010
072	4.125	4.297	072	279	5.063	8.875	279	460	15.497	16.247	460			.010
073	4.188	4.359	073	280	5.125	9.000	280	460	15.497	16.247	460			.010
074	4.250	4.422	074	281	5.188	9.125	281	460	15.497	16.247	460			.010
075	4.313	4.484	075	282	5.250	9.250	282	460	15.497	16.247	460			.010
076	4.375	4.547	076	283	5.313	9.375	283	460	15.497	16.247	460			.010
077	4.438	4.610	077	284	5.375	9.500	284	460	15.497	16.247	460			.010
078	4.500	4.672	078	285	5.438	9.625	285	460	15.497	16.247	460			.010
079	4.563	4.734	079	286	5.500	9.750	286	460	15.497	16.247	460			.010
080	4.625	4.797	080	287	5.563	9.875	287	460	15.497	16.247	460			.010
081	4.688	4.859	081	288	5.625	10.000	288	460	15.497	16.247	460			.010
082	4.750	4.922	082	289	5.688	10.125	289	460	15.497	16.247	460			.010
083	4.813	4.984	083	290	5.750	10.250	290	460	15.497	16.247	460			.010
084	4.875	5.047	084	291	5.813	10.375	291	460	15.497	16.247	460			.010
085	4.938	5.109	085	292	5.875	10.500	292	460	15.497	16.247	460			.010
086	5.000	5.172	086	293	5.938	10.625	293	460	15.497	16.247	460			.010
087	5.063	5.234	087	294	6.000	10.750	294	460	15.497	16.247	460			.010
088	5.125	5.297	088	295	6.063	10.875	295	460	15.497	16.247	460			.010
089	5.188	5.359	089	296	6.125	11.000	296	460	15.497	16.247	460			.010
090	5.250	5.422	090	297	6.188	11.125	297	460	15.497	16.247	460			.010
091	5.313	5.484	091	298	6.250	11.250	298	460	15.497	16.247	460			.010
092	5.375	5.547	092	299	6.313	11.375	299	460	15.497	16.247	460			.010
093	5.438	5.610	093	300	6.375	11.500	300	460	15.497	16.247	460			.010
094	5.500	5.672	094	301	6.438	11.625	301	460	15.497	16.247	460			.010
095	5.563	5.734	095	302	6.500	11.750	302	460	15.497	16.247	460			.010
096	5.625	5.797	096	303	6.563	11.875	303	460	15.497	16.247	460			.010
097	5.688	5.859	097	304	6.625	12.000	304	460	15.497	16.247	460			.010
098	5.750	5.922	098	305	6.688	12.125	305	460	15.497	16.247	460			.010
099</														

Turcon® Glyd Ring®

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
006	.123	.266	007	210	.748	1.053	211	425	4.497	5.099	426	006-012	.079/.084	.005/.015	.004
007	.154	.297	008	211	.810	1.116	212	426	4.622	5.224	427	013-028			.005
008	.178	.320	009	212	.872	1.178	213	427	4.747	5.349	428	029-112	.112/.117	.005/.015	.005
009	.201	.343	010	213	.934	1.240	214	428	4.872	5.474	429	113-155			.006
010	.248	.422	011	214	.996	1.303	215	429	4.997	5.599	430	156-210			.007
011	.310	.485	012	215	1.060	1.366	216	430	5.122	5.724	431	210-222			.007
012	.373	.547	013	216	1.123	1.428	217	431	5.247	5.849	432	223-224	.149/.154	.010/.025	.006
013	.435	.610	014	217	1.185	1.491	218	432	5.372	5.974	433	225-245			.007
014	.498	.672	015	218	1.248	1.553	219	433	5.497	6.099	434	246-247	.221/.226	.020/.035	.006
015	.560	.735	016	219	1.310	1.616	220	434	5.622	6.224	435	248-327	.297/.302	.020/.035	.006
016	.623	.797	017	220	1.373	1.678	221	435	5.747	6.349	436	328-425			.007
017	.685	.860	018	221	1.435	1.741	222	436	5.872	6.474	437	426-432			.007
018	.748	.925	019	222	1.498	1.806	223	437				433-434			
019	.810	.996	020	223	1.560	1.869	224	438				435-436			
020	.873	1.047	021	224	1.623	1.931	225	439							
021	.935	1.110	022	225	1.685	1.994	226	440							
022	.998	1.172	023	226	1.748	2.057	227	441							
023	1.060	1.235	024	227	1.810	2.120	228	442							
024	1.123	1.297	025	228	1.873	2.183	229	443							
025	1.185	1.360	026	229	1.935	2.245	230	444							
026	1.248	1.422	027	230	2.000	2.308	231	445							
027	1.310	1.485	028	231	2.062	2.370	232	446							
028	1.373	1.547	029	232	2.125	2.433	233	447							
029	1.435	1.610	030	233	2.187	2.495	234	448							
030	1.498	1.672	031	234	2.250	2.558	235	449							
031	1.560	1.735	032	235	2.312	2.620	236	450							
032	1.623	1.797	033	236	2.375	2.683	237	451							
033	1.685	1.860	034	237	2.437	2.745	238	452							
034	1.748	1.922	035	238	2.500	2.808	239	453							
035	1.810	1.985	036	239	2.562	2.870	240	454							
036	1.873	2.047	037	240	2.625	2.933	241	455							
037	1.935	2.110	038	241	2.687	2.995	242	456							
038	2.000	2.172	039	242	2.750	3.058	243	457							
039	2.062	2.235	040	243	2.812	3.120	244	458							
040	2.125	2.297	041	244	2.875	3.183	245	459							
041	2.187	2.360	042	245	2.937	3.245	246	460							
042	2.250	2.422	043	246	3.000	3.308	247	461							
043	2.312	2.485	044	247	3.062	3.370	248	462							
044	2.375	2.547	045	248	3.125	3.433	249	463							
045	2.437	2.610	046	249	3.187	3.495	250	464							
046	2.500	2.672	047	250	3.250	3.558	251	465							
047	2.562	2.735	048	251	3.312	3.620	252	466							
048	2.625	2.797	049	252	3.375	3.683	253	467							
049	2.687	2.860	050	253	3.437	3.745	254	468							
050	2.750	2.922	051	254	3.500	3.808	255	469							
051	2.812	2.985	052	255	3.562	3.870	256	470							
052	2.875	3.047	053	256	3.625	3.933	257	471							
053	2.937	3.110	054	257	3.687	3.995	258	472							
054	3.000	3.172	055	258	3.750	4.058	259	473							
055	3.062	3.235	056	259	3.812	4.120	260	474							
056	3.125	3.297	057	260	3.875	4.183	261	475							
057	3.187	3.360	058	261	3.937	4.245	262	476							
058	3.250	3.422	059	262	4.000	4.308	263	477							
059	3.312	3.485	060	263	4.062	4.370	264	478							
060	3.375	3.547	061	264	4.125	4.433	265	479							
061	3.437	3.610	062	265	4.187	4.495	266	480							
062	3.500	3.672	063	266	4.250	4.558	267	481							
063	3.562	3.735	064	267	4.312	4.620	268	482							
064	3.625	3.797	065	268	4.375	4.683	269	483							
065	3.687	3.860	066	269	4.437	4.745	270	484							
066	3.750	3.922	067	270	4.500	4.808	271	485							
067	3.812	3.985	068	271	4.562	4.870	272	486							
068	3.875	4.047	069	272	4.625	4.933	273	487							
069	3.937	4.110	070	273	4.687	4.995	274	488							
070	4.000	4.172	071	274	4.750	5.058	275	489							
071	4.062	4.235	072	275	4.812	5.120	276	490							
072	4.125	4.297	073	276	4.875	5.183	277	491							
073	4.187	4.360	074	277	4.937	5.245	278	492							
074	4.250	4.422	075	278	5.000	5.308	279	493							
075	4.312	4.485	076	279	5.062	5.370	280	494							
076	4.375	4.547	077	280	5.125	5.433	281	495							
077	4.437	4.610	078	281	5.187	5.495	282	496							
078	4.500	4.672	079	282	5.250	5.558	283	497							
079	4.562	4.735	080	283	5.312	5.620	284	498							
080	4.625	4.797	081	284	5.375	5.683	285	499							
081	4.687	4.860	082	285	5.437	5.745	286	500							
082	4.750	4.922	083	286	5.500	5.808	287	501							
083	4.812	4.985	084	287	5.562	5.870	288	502							
084	4.875	5.047	085	288	5.625	5.933	289	503							
085	4.937	5.110	086	289	5.687	5.995	290	504							
086	5.000	5.172	087	290	5.750	6.058	291	505							
087	5.062	5.235	088	291	5.812	6.120	292	506							
088	5.125	5.297	089	292	5.875	6.183	293	507							
089	5.187	5.360	090	293	5.937	6.245	294	508							
090	5.250	5.422	091	294	6.000	6.308	295	509							
091	5.312	5.485	092	295	6.062	6.370	296	510							
092	5.375	5.547	093	296	6.125	6.433	297	511							
093	5.437	5.610	094	297	6.187	6.495	298	512							
094	5.500	5.672	095	298	6.250	6.558	299	513							
095	5.562	5.735	096	299	6.312	6.620	300	514							
096	5.625	5.797	097	300	6.375	6.683	301	515							
097	5.687	5.860	098	301	6.437	6.745	302	516							
098	5.750	5.922	099	302	6.500	6.808	303	517							
099	5.812	5.985	100	303	6.562	6.870	304	518							
100	5.875	6.047	101	304	6.625	6.933	305	519							
101	5.937	6.110	102	305	6.687	6.995	306	520							
102	6.000	6.172	103	306	6.750	7.058	307	521							
103	6.062	6.235	104	307	6.812	7.120	308	522							
104	6.125	6.297	105	308	6.875	7.183	309	523							
105	6.187	6.360	106	309	6.937	7.245	310	524							
106	6.250	6.422	107	310	7.000	7.308	311	525							
107	6.312	6.485	108	311	7.062	7.370	312	526							
108	6.375	6.547	109	312	7.125	7.433	313	527							
109	6.437	6.610	110	313	7.187	7.495	314	528							
110	6.500	6.672	111	314											

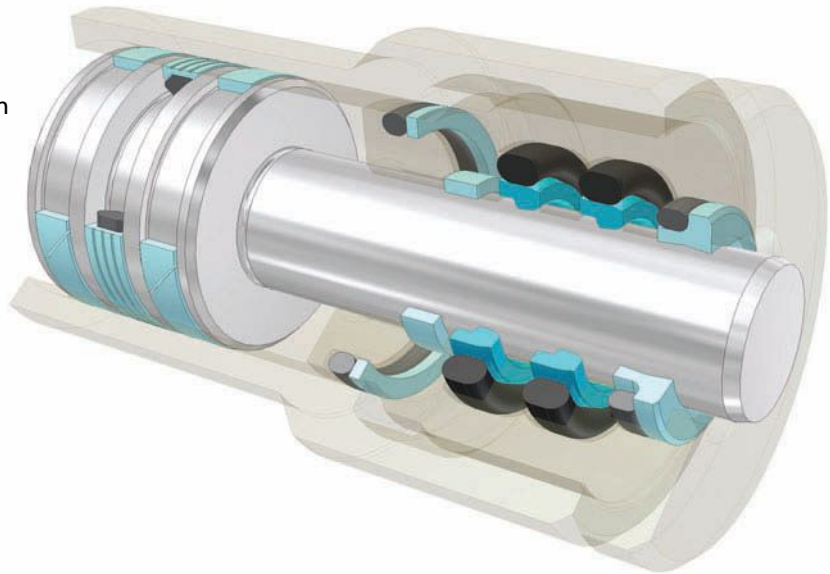
Turcon® Glyd Ring®

DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
007	.266	.123	006	210	.991	.686	209	491	.007-.012	.005/.015	.004
008	.327	.185	007	211	1.053	.748	210	512	.079/.084		
009	.387	.247	008	212	1.115	.810	211	532			
010	.447	.271	009	213	1.178	.873	212	547	.112/.117	.005/.015	.005
011	.442	.248	010	214	1.241	.935	213	562			.006
012	.485	.310	011	215	1.303	.998	214	577	.141-.149	.007	.007
013	.547	.372	012	216	1.366	1.060	215	592	.210-.222	.005	.005
014	.613	.438	013	217	1.428	1.123	216	607	.223-.227	.006	.006
015	.675	.501	014	218	1.491	1.185	217	622	.244-.248	.007	.007
016	.738	.563	015	219	1.553	1.248	218	637	.268-.273	.008	.008
017	.800	.626	016	220	1.616	1.310	219	652	.300-.305	.009	.009
018	.863	.688	017	221	1.678	1.373	220	667	.346-.352	.010/.025	.010
019	.925	.751	018	222	1.741	1.435	221	682	.281/.286	.020/.035	.020
020	.988	.814	019	223	1.803	1.498	222	697	.297/.302	.020/.035	.020
021	1.053	.879	020	224	1.866	1.561	223	712			
022	1.116	.941	021	225	1.928	1.624	224	727			
023	1.178	1.004	022	226	2.018	1.750	225	742			
024	1.241	1.066	023	227	2.081	1.875	226	757			
025	1.303	1.129	024	228	2.144	2.000	227	772			
026	1.366	1.191	025	229	2.207	2.125	228	787			
027	1.428	1.254	026	230	2.270	2.250	229	802			
028	1.491	1.316	027	231	2.333	2.375	230	817			
029	1.553	1.379	028	232	2.396	2.500	231	832			
030	1.616	1.441	029	233	2.459	2.625	232	847			
031	1.678	1.504	030	234	2.522	2.750	233	862			
032	1.741	1.566	031	235	2.585	2.875	234	877			
033	1.803	1.629	032	236	2.648	3.000	235	892			
034	1.866	1.691	033	237	2.711	3.125	236	907			
035	1.928	1.754	034	238	2.774	3.250	237	922			
036	1.991	1.816	035	239	2.837	3.375	238	937			
037	2.053	1.879	036	240	2.900	3.500	239	952			
038	2.116	1.941	037	241	2.963	3.625	240	967			
039	2.178	2.004	038	242	3.026	3.750	241	982			
040	2.241	2.066	039	243	3.089	3.875	242	997			
041	2.303	2.129	040	244	3.152	4.000	243	1012			
042	2.366	2.191	041	245	3.215	4.125	244	1027			
043	2.428	2.254	042	246	3.278	4.250	245	1042			
044	2.491	2.316	043	247	3.341	4.375	246	1057			
045	2.553	2.379	044	248	3.404	4.500	247	1072			
046	2.616	2.441	045	249	3.467	4.625	248	1087			
047	2.678	2.504	046	250	3.530	4.750	249	1102			
048	2.741	2.566	047	251	3.593	4.875	250	1117			
049	2.803	2.629	048	252	3.656	5.000	251	1132			
050	2.866	2.691	049	253	3.719	5.125	252	1147			
051	2.928	2.754	050	254	3.782	5.250	253	1162			
052	2.991	2.816	051	255	3.845	5.375	254	1177			
053	3.053	2.879	052	256	3.908	5.500	255	1192			
054	3.116	2.941	053	257	3.971	5.625	256	1207			
055	3.178	3.004	054	258	4.034	5.750	257	1222			
056	3.241	3.066	055	259	4.097	5.875	258	1237			
057	3.303	3.129	056	260	4.160	6.000	259	1252			
058	3.366	3.191	057	261	4.223	6.125	260	1267			
059	3.428	3.254	058	262	4.286	6.250	261	1282			
060	3.491	3.316	059	263	4.349	6.375	262	1297			
061	3.553	3.379	060	264	4.412	6.500	263	1312			
062	3.616	3.441	061	265	4.475	6.625	264	1327			
063	3.678	3.504	062	266	4.538	6.750	265	1342			
064	3.741	3.566	063	267	4.601	6.875	266	1357			
065	3.803	3.629	064	268	4.664	7.000	267	1372			
066	3.866	3.691	065	269	4.727	7.125	268	1387			
067	3.928	3.754	066	270	4.790	7.250	269	1402			
068	3.991	3.816	067	271	4.853	7.375	270	1417			
069	4.053	3.879	068	272	4.916	7.500	271	1432			
070	4.116	3.941	069	273	4.979	7.625	272	1447			
071	4.178	4.004	070	274	5.042	7.750	273	1462			
072	4.241	4.066	071	275	5.105	7.875	274	1477			
073	4.303	4.129	072	276	5.168	8.000	275	1492			
074	4.366	4.191	073	277	5.231	8.125	276	1507			
075	4.428	4.254	074	278	5.294	8.250	277	1522			
076	4.491	4.316	075	279	5.357	8.375	278	1537			
077	4.553	4.379	076	280	5.420	8.500	279	1552			
078	4.616	4.441	077	281	5.483	8.625	280	1567			
079	4.678	4.504	078	282	5.546	8.750	281	1582			
080	4.741	4.566	079	283	5.609	8.875	282	1597			
081	4.803	4.629	080	284	5.672	9.000	283	1612			
082	4.866	4.691	081	285	5.735	9.125	284	1627			
083	4.928	4.754	082	286	5.798	9.250	285	1642			
084	4.991	4.816	083	287	5.861	9.375	286	1657			
085	5.053	4.879	084	288	5.924	9.500	287	1672			
086	5.116	4.941	085	289	5.987	9.625	288	1687			
087	5.178	5.004	086	290	6.050	9.750	289	1702			
088	5.241	5.066	087	291	6.113	9.875	290	1717			
089	5.303	5.129	088	292	6.176	10.000	291	1732			
090	5.366	5.191	089	293	6.239	10.125	292	1747			
091	5.428	5.254	090	294	6.302	10.250	293	1762			
092	5.491	5.316	091	295	6.365	10.375	294	1777			
093	5.553	5.379	092	296	6.428	10.500	295	1792			
094	5.616	5.441	093	297	6.491	10.625	296	1807			
095	5.678	5.504	094	298	6.554	10.750	297	1822			
096	5.741	5.566	095	299	6.617	10.875	298	1837			
097	5.803	5.629	096	300	6.680	11.000	299	1852			
098	5.866	5.691	097	301	6.743	11.125	300	1867			
099	5.928	5.754	098	302	6.806	11.250	301	1882			
100	5.991	5.816	099	303	6.869	11.375	302	1897			
101	6.053	5.879	100	304	6.932	11.500	303	1912			
102	6.116	5.941	101	305	6.995	11.625	304	1927			
103	6.178	6.004	102	306	7.058	11.750	305	1942			
104	6.241	6.066	103	307	7.121	11.875	306	1957			
105	6.303	6.129	104	308	7.184	12.000	307	1972			
106	6.366	6.191	105	309	7.247	12.125	308	1987			
107	6.428	6.254	106	310	7.310	12.250	309	2002			
108	6.491	6.316	107	311	7.373	12.375	310	2017			
109	6.553	6.379	108	312	7.436	12.500	311	2032			
110	6.616	6.441	109	313	7.499	12.625	312	2047			
111	6.678	6.504	110	314	7.562	12.750	313	2062			
112	6.741	6.566	111	315	7.625	12.875	314	2077			
113	6.803	6.629	112	316	7.688	13.000	315	2092			
114	6.866	6.691	113	317	7.751	13.125	316	2107			
115	6.928	6.754	114	318	7.814	13.250	317	2122			
116	6.991	6.816	115	319	7.877	13.375	318	2137			
117	7.053	6.879	116	320	7.940	13.500	319	2152			
118	7.116	6.941	117	321	8.003	13.625	320	2167			
119	7.178	7.004	118	322	8.066	13.750	321	2182			
120	7.241	7.066	119	323	8.129	13.875	322	2197			
121	7.303	7.129	120	324	8.192	14.000	323	2212			
122	7.366	7.191	121	325	8.255	14.125	324	2227			
123	7.428	7.254	122	326	8.318	14.250	325	2242			
124	7.491	7.316	123	327	8.381	14.375	326	2257			
125	7.553	7.379	124	328	8.444	14.500	327	2272			
126	7.616	7.441	125	329	8.507	14.625	328	2287			
127	7.678	7.504	126	330	8.570	14.750	329	2302			
128	7.741	7.566	127	331	8.633	14.875	330	2317			
129	7.803	7.629	128	332	8.696	15.000	331	2332		</	

Turcon® Stepseal® 2K

Features and benefits

- High static and dynamic sealing effect
- Eliminates the build-up of disruptive intermediate pressures between seals
- High extrusion resistance, to suit wide hardware clearances
- Operational at pressures up to 11,600 psi/ 80 MPa
- Operational at speeds up to 49 ft/sec/ 15 m/s with reciprocating movements
- High-frequency operation
- Operating temperatures of -65°F to +500°F/ -55°C to +260°C depending on the elastomer
- Low friction, increasing performance and working life
- Stick-slip-free starting, no sticking even after extended periods of rest
- High abrasion resistance, maximum operational reliability
- Compatible with virtually all media
- Suited to mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), water and other media
- Simple installation without seal edge deformation
- Unidirectional seal



Seals for AS4716
Rod/Bore only

Illustration shows typical hydraulic cylinder with a sealing configuration incorporating Turcon® Stepseal® 2K.

Turcon® Stepseal® 2K

Description

Developing a hydraulic cylinder sealing arrangement with certainty of performance over a wide range of applications has provided a long-term engineering challenge for Trelleborg Sealing Solutions. The first breakthrough was in the 1970s, when Turcon® Stepseal® revolutionized fluid sealing in cylinder applications. Through ongoing research and development Stepseal® has been further refined and improved, with the latest version, Turcon® Stepseal® 2K, achieving new levels in cylinder sealing performance.

With Turcon® Stepseal® 2K it is possible to arrange several seals, one behind the other, to create a static and dynamic sealing arrangement. This double-acting tandem seal eliminates the build-up of disruptive intermediate pressures between seals that can cause a loss of operating efficiency, seal destruction and leakage.

Turcon® Stepseal® 2K enhances sealing efficiency. Better extrusion resistance gives superior leakage control and allows larger hardware tolerances, making cylinder production more economic. It is also more uniform, showing low-friction characteristics throughout an extended life and even during the run-in period when friction forces can have the greatest effect on hydraulic seals.

Offering unsurpassed sealing security, Turcon® Stepseal® 2K can be used with all lubricating and non-lubricating hydraulic fluids, including zinc-free oils and water-based hydraulic fluids. They can also be matched to specific mating surfaces and media. Seals can be specified to meet the precise degree of extrusion and abrasion tolerance required for an application.

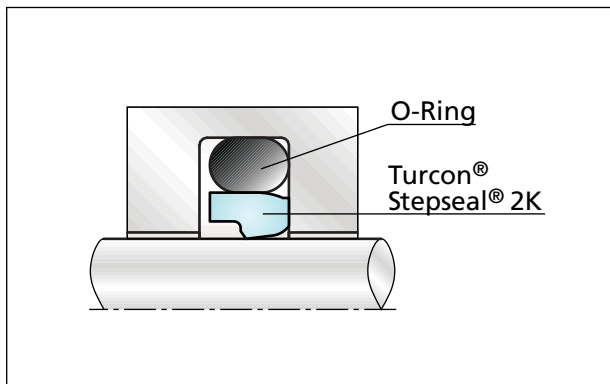


Figure 1 Turcon® Stepseal® 2K

Method of Operation

The sealing performance of Turcon® Stepseal® 2K is a result of its hydrodynamic properties. The 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 enable residual fluid film on the rod to be returned into the system on the return stroke.

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

Turcon® Stepseal® 2K

Technical Data

Operation pressure: Up to 11,600 psi/ 80 MPa

Speed: Up to 49.2 ft/s/ 15.0 m/s

Temperature range: -65°F to +500°F/ -55°C to +260°C depending on elastomer

Clearance: As per AS4716
Clearance can be larger when combined with a Slydring® bearing.

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Series

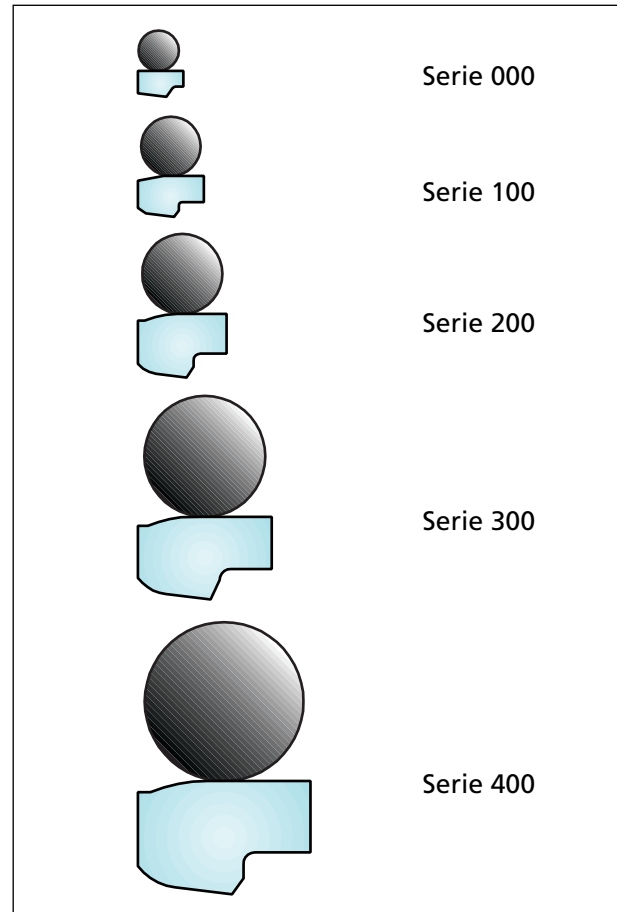


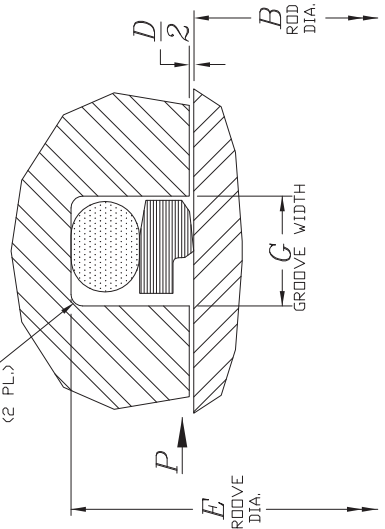
Figure 2 Relative size of Turcon® Stepseal® 2K cross section

Table I Turcon® Stepseal® 2K Types

Cross Section	Description	Part Number	Gland Standard
	Rod	RSF00B	TSS Gland Rod per AS4716
	Piston	PSF00B	TSS Gland Piston per AS4716

Turcon® Stepseal® 2K

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRICAL CLEARANCE MAX.
010	.248	.441	011	210	1.169	213	435	.087/.094	.005/.020	.004	
011	.313	.503	012	211	1.231	214	436	.126/.134	.005/.020	.005	
012	.370	.566	013	212	1.304	215	437	.165/.173	.010/.025	.005	
				213	1.376	216	438			.006	
				214	1.449	217	439			.006	
013	.435	.628	014	215	1.521	218	440			.007	
014	.498	.691	015	216	1.594	219	441			.007	
015	.560	.753	016	217	1.666	220	442			.008	
016	.623	.816	017	218	1.739	221	443			.008	
017	.685	.878	018	219	1.811	222	444			.009	
				220	1.884	223	445			.010	
018	.748	.941	019	221	1.956	224	446			.010	
019	.810	1.003	020	222	2.029	225	447			.010	
020	.873	1.066	021	223	2.101	226	448			.010	
021	.935	1.128	022	224	2.174	227	449			.010	
022	.998	1.191	023	225	2.246	228	450			.010	
				226	2.319	229	451			.010	
				227	2.391	230	452			.010	
023	1.060	1.253	024	228	2.464	231	453			.010	
024	1.123	1.316	025	229	2.536	232	454			.010	
025	1.185	1.378	026	230	2.609	233	455			.010	
026	1.248	1.441	027	231	2.681	234	456			.010	
027	1.310	1.503	028	232	2.754	235	457			.010	
028	1.373	1.566	029	233	2.826	236	458			.010	
				234	2.899	237	459			.010	
				235	2.971	238	460			.010	
				236	3.044	239				.010	
108	.248	.441	109	237	3.116	240				.010	
109	.310	.503	110	238	3.189	241				.010	
				239	3.261	242				.010	
				240	3.334	243				.010	
				241	3.406	244				.010	
				242	3.479	245				.010	
110	.373	.660	111	243	3.551	246				.010	
111	.435	.722	112	244	3.624	247				.010	
112	.498	.785	113	245	3.696	248				.010	
113	.560	.847	114	246	3.769	249				.010	
114	.623	.910	115	247	3.841	250				.010	
115	.685	.972	116	248	3.914	251				.010	
116	.748	1.035	117	249	3.986	252				.010	
117	.810	1.097	118	250	4.059	253				.010	
118	.873	1.160	119	251	4.131	254				.010	
119	.935	1.222	120	252	4.204	255				.010	
120	.998	1.285	121	253	4.276	256				.010	
121	1.060	1.347	122	254	4.349	257				.010	
122	1.123	1.410	123	255	4.421	258				.010	
123	1.185	1.472	124	256	4.494	259				.010	
124	1.248	1.535	125	257	4.566	260				.010	
125	1.310	1.597	126	258	4.639	261				.010	
126	1.373	1.660	127	259	4.711	262				.010	
127	1.435	1.722	128	260	4.784	263				.010	
128	1.498	1.785	129	261	4.856	264				.010	
129	1.560	1.847	130	262	4.929	265				.010	
130	1.623	1.910	131	263	5.001	266				.010	
131	1.685	1.972	132	264	5.074	267				.010	
132	1.748	2.035	133	265	5.146	268				.010	
133	1.810	2.097	134	266	5.219	269				.010	
134	1.873	2.160	135	267	5.291	270				.010	
135	1.936	2.223	136	268	5.364	271				.010	
136	1.998	2.285	137	269	5.436	272				.010	
137	2.061	2.348	138	270	5.509	273				.010	
138	2.123	2.410	139	271	5.581	274				.010	
139	2.186	2.473	140	272	5.654	275				.010	
140	2.248	2.535	141	273	5.726	276				.010	
141	2.310	2.598	142	274	5.799	277				.010	
142	2.373	2.660	143	275	5.871	278				.010	
143	2.436	2.723	144	276	5.944	279				.010	
144	2.498	2.785	145	277	6.016	280				.010	
145	2.561	2.848	146	278	6.089	281				.010	
146	2.623	2.910	147	279	6.161	282				.010	
147	2.685	2.973	148	280	6.234	283				.010	
148	2.748	3.035	149	281	6.306	284				.010	
149	2.811	3.098	150	282	6.379	285				.010	



ROD SEAL INSTALLATION
FOR TRELLEBORG SEALING SOLUTIONS GLAND SPECIFICATION

- NOTES:
1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR STEPSEAL® 2K IN TRELLEBORG SEALING SOLUTIONS STEPSEAL® 2K ROD GLANDS.
2. ORDERING EXAMPLE:
STEPSEAL® 2K ROD DESIGNATOR
SEAL CROSS SECTION
0 = -0XX SERIES
1 = -1XX SERIES
2 = -2XX SERIES
3 = -3XX SERIES
4 = -4XX SERIES
DESIGN CHARACTERISTICS
0 = STANDARD
A = ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
B = TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
DASH NO. OF TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
QUALITY INDEX
A = AEROSPACE CERTIFICATE OF CONFORMANCE
TURCON® STEPSEAL® 2K MAT'L. CODE
TURCON® O-RING MAT'L. CODE
CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

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INCH 2009_1

TRELLEBORG SEALING SOLUTIONS

TITLE STEPSEAL® 2K
DRAWING NO. RSFO0B00

Turcon® Stepseal® 2K

DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
011	4.22	2.29	009	210	0.91	0.70	207	435	6.224	5.417	431	011-012	087/094	0.05/020	0.004
012	4.85	2.92	010	211	1.053	0.82	208	436	6.349	5.542	432	013-028			0.005
013	5.16	3.06	011	212	1.116	0.88	209	437	6.474	5.667	433	108-109			0.004
014	5.80	3.70	012	214	1.241	0.99	211	438	6.724	5.917	435	121-126			0.006
015	6.35	4.20	011	215	1.303	0.882	212	439	6.974	6.167	437	130-132	126/134	0.05/020	0.006
016	6.75	4.82	013	216	1.366	0.945	213	440	7.224	6.417	438	141-149			0.007
017	7.38	5.45	014	217	1.428	1.007	214	442	7.724	6.917	440	210-222			0.005
018	8.00	6.07	015	218	1.491	1.070	215	443	7.974	7.167	441	223-224			0.006
019	8.63	6.70	016	219	1.553	1.132	216	444	8.224	7.417	442	225-233			0.007
020	9.25	7.32	017	220	1.616	1.195	217	445	8.474	7.667	443	244-245	165/173	0.10/025	0.007
021	10.53	8.60	018	221	1.678	1.257	218	446	8.974	8.167	445	246-247			0.008
022	11.16	9.23	020	222	1.741	1.320	219	447	9.224	8.417	446	325-327			0.005
023	11.78	9.85	021	224	1.952	1.571	222	448	9.474	8.667	447	330-345			0.007
024	12.41	10.48	022	225	2.118	1.697	223	449	9.724	8.917	448	346-348			0.007
025	13.03	11.10	023	226	2.243	1.822	224	450	10.074	10.167	449	425-438			0.009
026	13.66	11.73	024	227	2.368	1.947	225	451	11.474	10.667	450	439-445			0.010
027	14.28	12.35	025	228	2.493	2.072	226	452	11.974	11.167	451	446			0.010
028	14.91	12.98	026	229	2.618	2.197	227	453	12.474	11.667	452	447-460			0.010
029	15.53	13.60	027	230	2.743	2.322	228	454	12.974	12.167	453				
030	16.15	14.22	028	231	2.868	2.447	229	455	13.474	12.667	454				
031	16.77	14.85	029	232	2.993	2.572	230	456	13.974	13.167	455				
032	17.40	15.47	030	234	3.243	2.822	232	457	14.474	13.667	455				
033	18.02	16.10	031	235	3.368	2.947	233	458	14.974	14.167	456				
034	18.65	16.72	032	236	3.493	3.072	234	459	15.474	14.667	457				
035	19.27	17.35	033	237	3.618	3.197	235	460			458				
036	19.89	17.97	034	238	3.743	3.322	236				459				
037	20.52	18.60	035	239	3.868	3.447	237				460				
038	21.14	19.22	036	240	3.993	3.572	238								
039	21.77	19.85	037	241	4.118	3.697	239								
040	22.39	20.47	038	242	4.243	3.822	240								
041	23.02	21.10	039	243	4.368	3.947	241								
042	23.64	21.72	040	244	4.493	4.072	242								
043	24.27	22.35	041	245	4.618	4.197	243								
044	24.89	22.97	042	246	4.743	4.322	244								
045	25.52	23.60	043	247	4.868	4.447	245								
046	26.14	24.22	044	325	5.097	4.677	322								
047	26.77	24.85	045	326	5.222	4.802	323								
048	27.39	25.47	046	327	5.347	4.927	324								
049	28.02	26.10	047	328	5.472	5.052	325								
050	28.64	26.72	048	329	5.597	5.177	326								
051	29.27	27.35	049	330	5.722	5.302	327								
052	29.89	27.97	050	331	5.847	5.427	328								
053	30.52	28.60	051	332	5.972	5.552	329								
054	31.14	29.22	052	333	6.097	5.677	330								
055	31.77	29.85	053	334	6.222	5.802	331								
056	32.39	30.47	054	335	6.347	5.927	332								
057	33.02	31.10	055	336	6.472	6.052	333								
058	33.64	31.72	056	337	6.597	6.177	334								
059	34.27	32.35	057	338	6.722	6.302	335								
060	34.89	32.97	058	339	6.847	6.427	336								
061	35.52	33.60	059	340	6.972	6.552	337								
062	36.14	34.22	060	341	7.097	6.677	338								
063	36.77	34.85	061	342	7.222	6.802	339								
064	37.39	35.47	062	343	7.347	6.927	340								
065	38.02	36.10	063	344	7.472	7.052	341								
066	38.64	36.72	064	345	7.597	7.177	342								
067	39.27	37.35	065	346	7.722	7.302	343								
068	39.89	37.97	066	347	7.847	7.427	344								
069	40.52	38.60	067	348	7.972	7.552	345								
070	41.14	39.22	068	349	8.097	7.677	346								
071	41.77	39.85	069	425	8.327	7.907	425								
072	42.39	40.47	070	426	8.452	8.032	426								
073	43.02	41.10	071	427	8.577	8.157	427								
074	43.64	41.72	072	428	8.702	8.282	428								
075	44.27	42.35	073	429	8.827	8.407	429								
076	44.89	42.97	074	430	8.952	8.532	430								
077	45.52	43.60	075	431	9.077	8.657	431								
078	46.14	44.22	076	432	9.202	8.782	432								
079	46.77	44.85	077	433	9.327	8.907	433								
080	47.39	45.47	078	434	9.452	9.032	434								
081	48.02	46.10	079	435	9.577	9.157	435								
082	48.64	46.72	080	436	9.702	9.282	436								
083	49.27	47.35	081	437	9.827	9.407	437								
084	49.89	47.97	082	438	9.952	9.532	438								
085	50.52	48.60	083	439	10.077	9.657	439								
086	51.14	49.22	084	440	10.202	9.782	440								
087	51.77	49.85	085	441	10.327	9.907	441								
088	52.39	50.47	086	442	10.452	10.032	442								
089	53.02	51.10	087	443	10.577	10.157	443								
090	53.64	51.72	088	444	10.702	10.282	444								
091	54.27	52.35	089	445	10.827	10.407	445								
092	54.89	52.97	090	446	10.952	10.532	446								
093	55.52	53.60	091	447	11.077	10.657	447								
094	56.14	54.22	092	448	11.202	10.782	448								
095	56.77	54.85	093	449	11.327	10.907	449								
096	57.39	55.47	094	450	11.452	11.032	450								
097	58.02	56.10	095	451	11.577	11.157	451								
098	58.64	56.72	096	452	11.702	11.282	452								
099	59.27	57.35	097	453	11.827	11.407	453								
100	59.89	57.97	098	454	11.952	11.532	454								
101	60.52	58.60	099	455	12.077	11.657	455								
102	61.14	59.22	100	456	12.202	11.782	456								
103	61.77	59.85	101	457	12.327	11.907	457								
104	62.39	60.47	102	458	12.452	12.032	458								
105	63.02	61.10	103	459	12.577	12.157	459								
106	63.64	61.72	104	460	12.702	12.282	460								
107	64.27	62.35	105	457	12.827	12.407									
108	64.89	62.97	106	458	12.952	12.532									
109	65.52	63.60	107	459	13.077	12.657									
110	66.14	64.22	108	460	13.202	12.782									
111	66.77	64.85	109	457	13.327	12.907									
112	67.39	65.47	110	458	13.452	13.032									
113	68.02	66.10	111	459	13.577	13.157									
114	68.64	66.72	112	460	13.702	13.282									

Turcon® Stepseal® 2K

Rotary seals for AS4716 – Rod and bore sizes only

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Rotary Seals

Specialized High-Performance Rotary Sealing Products

Rotary seals are installed in rotating or pivoting components to keep in the lubrication fluid that is needed for long-term operation of these devices. Sealing configurations need to be leak-free while preventing ingress of mud and water.

When it comes to successfully sealing in rotary applications, specialized products are required. Trelleborg Sealing Solutions offers a range of unique options, both standard and custom, that give exceptional performance characteristics in demanding rotary situations.





Within aerospace application the most commonly used types are Turcon® Roto Glyd Ring®, Turcon® Varilip® PDR, Turcon® Roto Variseal® and Turel® Radial Oil Seals. One of these options can provide the optimum solution for your rotary sealing requirements.



Illustration shows a typical application for rotary seals. Turcon® Varilip® PDR keeps grease round a ball bearing while excluding dirt and water spray from the outside.





Rotary Seals

Table I Rotary seal types

Cross Section	Description	Gland Standard	Pressure	Velocity
	Turcon® Roto Glyd Ring®	Trelleborg Standard Gland	< 2,100 psi < 15 MPa	< 3.3 ft/s < 1 m/s
	Turcon® Varilip® PDR	ISO 16859	< 300 psi < 2 MPa	< 164 ft/s < 100 m/s
	Turcon® Roto Variseal®	Trelleborg Standard Gland	< 4,200 psi < 30 MPa	< 6.6 ft/s < 2 m/s
	Turel® Radial Oil Seal	DIN 3760 and ISO 6194/1	< 15 psi < 0.1 MPa	< 115 ft/s < 35 m/s

Service life depends on PV factor (pressure x velocity)
Avoid combining extreme limits

Table II Typical features of rotary seal types

Main features	 Turcon® Roto Glyd Ring®	 Turcon® Varilip® PDR	 Turcon® Roto Variseal®	 Turel® Radial Oil Seal
Static sealing	Good	Good	Good	Excellent
Dynamic sealing	Good	Very good	Good	Very good
Hardware surface requirements	Low	High	Medium	Low
Installation	Closed gland	Open or split housing	Split housing	Open or split housing
Chemical resistance	Good with correctly selected seal material	Excellent	Excellent	Good with correctly selected seal material
Start friction/Stick-slip	Medium	Very low	Low	Medium
Running friction	Medium to high	Very low	Low	Medium
Shelf life	As for selected elastomer	Unlimited*	Unlimited*	As for selected elastomer
Application	Rod and piston	Rod	Rod and piston	Rod
Pressure capability	High	Low to Medium	Medium	Low
Speed capability	Medium to low	High	Medium to high	Medium to high

*Certain versions may contain elastomer. Shelf life then as specified for selected elastomer.

■ Critical Factors in Seal Selection

To ensure long seal life several factors must be considered in selection of the optimal material for the elastomer element.

Chemical Compatibility

Seal materials must be compatible with system media, in particular with lubricants.

The various oils used in rotary applications as lubricants have differing effects on elastomers. In aerospace these are primarily mineral based and synthetic hydrocarbon based oils and greases. Trelleborg Sealing Solutions offers materials that will give optimized performance in contact with this media. Turcon® PTFE based compounds are compatible with virtually all media.

Temperature Resistance

The aging of elastomers has a significant effect on their useful life and higher temperatures accelerate the aging of these materials. Elastomers can become hard and brittle, elongation may decrease and compression set increase. Axial cracks at the sealing edge are a typical indication that the seal has been exposed to excessively high temperature.

Turcon® PTFE based compounds are capable of operating at more elevated temperatures than elastomers.

For guidance on temperature limits for different materials, see materials section.

Peripheral Speed and Number of Revolutions

Different designs of sealing elements affect the magnitude of friction, resulting in varying temperature rises. As a result the various designs of the sealing element allow different maximum peripheral speeds. Below are the approximate maximum values for the permissible peripheral speeds for sealing elements without a dust lip in NBR, EP, FKM, FVMQ and PTFE when there is no differential pressure and where adequate lubrication or cooling of the sealing edge by the sealing medium exists. The curve shows that higher peripheral speeds are permissible for larger shaft diameters. This is due to the fact that the cross-sectional area increases in proportion to the square of the diameter, thus increasing the heat dissipation capacity of the shaft.

Rotary Seals

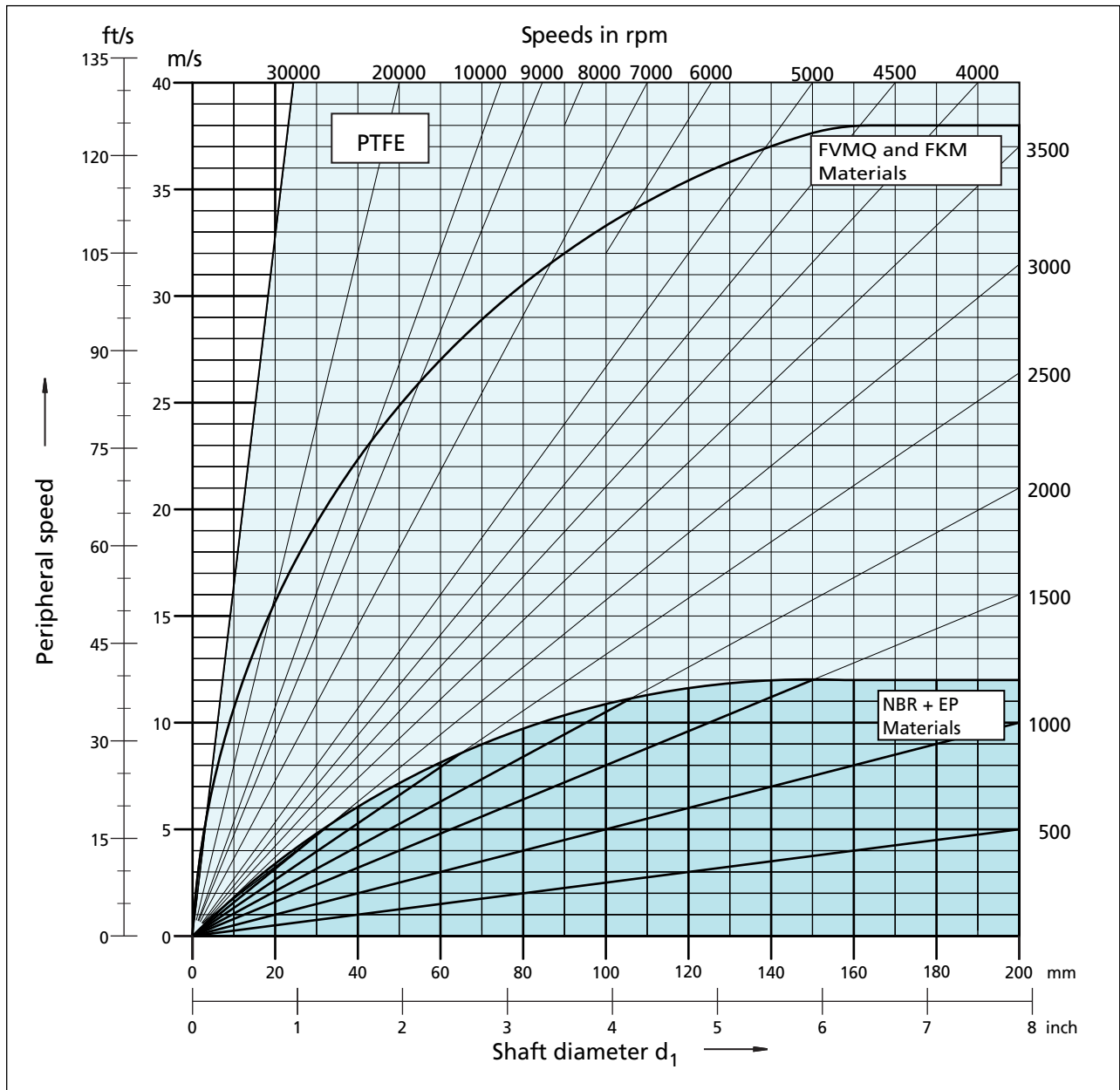


Figure 1 Peripheral speed capability of rotary seal materials

Rotary Seals

Eccentricity

The graph in Figure 3 shows the maximum recommended operating envelope for various elastomer sealing materials and for Turcon® Varilip® PDR. The levels of eccentricity should be kept within the limits shown. In order to achieve a uniform radial load of the sealing lip on the shaft, the best possible coaxiality, or static offset, should be maintained between the housing bore and the shaft, as shown in Figure 4.

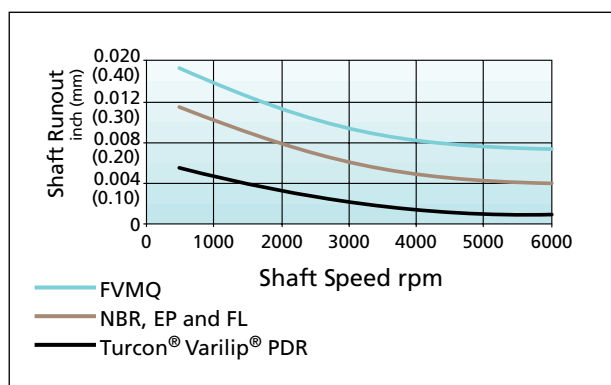


Figure 2 Dynamic Eccentricity Capability

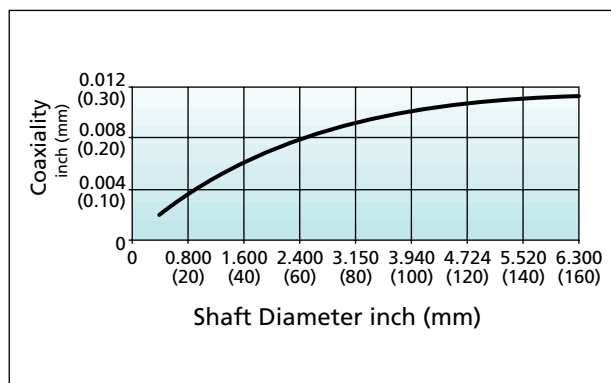


Figure 3 Coaxial Tolerance Capabilities

Surface Finish Recommendations – Radial Oil Seals and PTFE Lip Seals

It is important to control the shaft preparation for rotary applications and to ensure the desired non-orientation of the shaft surface finish as it relates to sealing. The recommended shaft condition is to have no machining leads and be free from scratches, nicks or defects as well as any contamination.

Plunge grinding is recommended for the finishing process. This gives short to medium grind marks which are good for lip lubrication. It also produces a lay that is perpendicular to the shaft axis with no lead angle. Additionally, there should be traversing during the plunge grinding process to eliminate any smear or detrimental patterns on the shaft.

Surface hardness is recommended to be 55 HRc, hardness depth minimum .012 in/ 0.3 mm. In certain circumstances such as low circumferential velocity, good lubrication and no contamination, surfaces with hardness levels below 55 HRc are suitable.

Surface Finish Recommendations

Measurement	Standard Recommendation
Ra	< 8 µin/ < 0.2 µm
Rz (Rtm)	39 -157 µin max. 1.0 - 4.0 µm max.
Tp (Mr)	50 - 90% @ depth of p = 0.25 Rz (Rtm) relative to reference line = 5 %
Rsk	-0.1 to -3

Rotary Seals

Turel® Radial Oil Seal

Features and benefits

- Good static sealing
- Compensates for different levels of thermal expansion
- No risk of corrosion due to fretting
- Can have a rougher bore surface
- Lip design gives low radial forces
- Can be installed in split housings
- Unidirectional seal

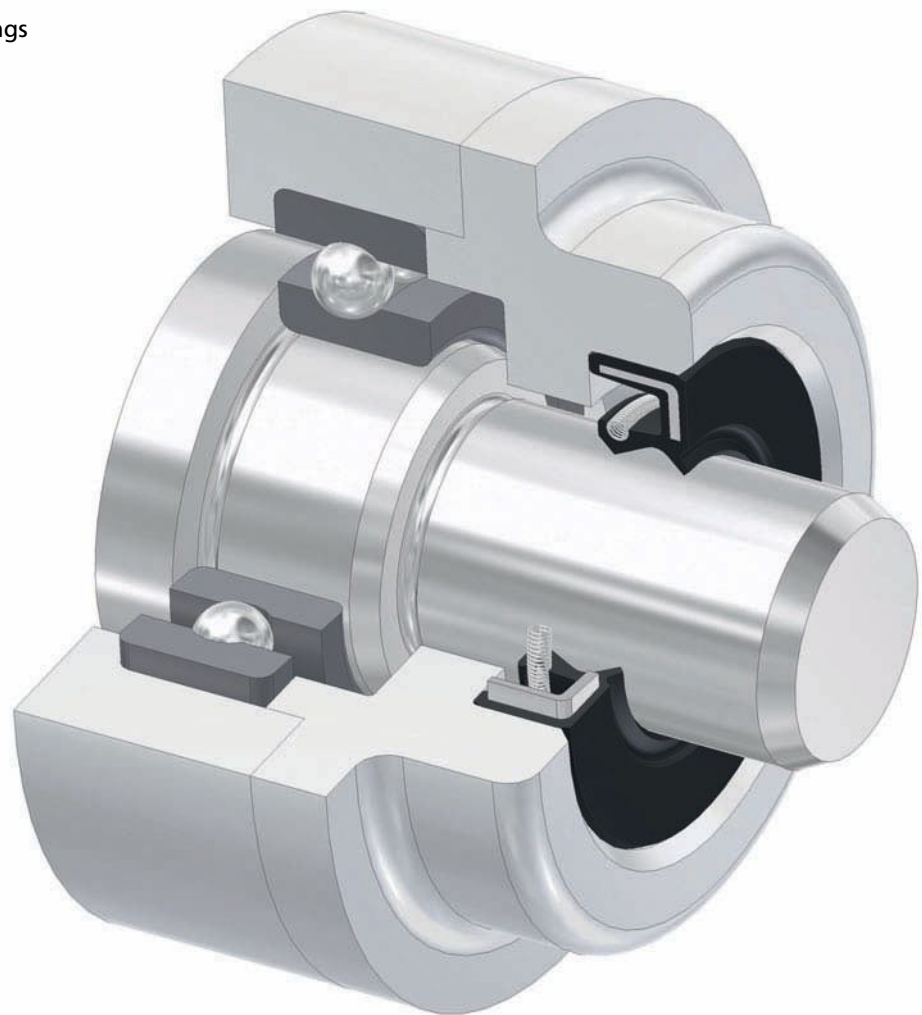


Illustration shows typical Turel® Radial Oil Seal application.

Turel® Radial Oil Seal

Description

Turel® Radial Oil Seal consists of a single elastomer lip bonded to a metal support with a garter spring. There are many different variations of the Turel® Radial Oil Seal, both with and without an integral dust excluding lip. These dust lips can be positioned either within the seal width or beyond the seal base.

A successful Turel® Radial Oil Seal runs with a thin film of fluid under the sealing lip. The film acts as a lubricant and allows a meniscus to form on the other side of the sealing lip. Turel® Radial Oil Seals can also include hydrodynamic aids, which create positive sealing by returning any oil leaking back into the system.

Turel® Radial Oil Seal type A and E are recommended for aerospace applications. A wide range of other types are available if required.

Method of Operation

The total radial force of the sealing lip is given by elastomer pre-tension together with tensile spring force. The former depends on the deformation and elasticity of the elastomer, geometry of the sealing lip and interference between shaft and seal.

Further information

More detailed design recommendations for Turel® Radial Oil Seals can be found in the Rotary Seals catalog. This can be downloaded from the Trelleborg Sealing Solutions website at www.tss.trelleborg.com or a copy obtained from your local marketing company.

Technical Data

Operation pressure: Up to 7.2 psi/ 0.05 MPa

Speed: Up to 98 ft/s/ 30 m/s depending on elastomer material



Temperature range: Up to -40°F to +390°F/ -40°C to +200°C depending on elastomer material

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Turel® Radial Oil Seal

Table I Radial Oil Seals to DIN 3760 type A and AS

Cross Section	Description	Part Number	Gland Standard
	DIN 3760 Type AS	TRA	TSS Gland
	DIN 3760 Type A	TRE	Rod per AS4716

Design Instructions

See the specific national and international standards that contain instructions for design and assembly (e.g. DIN 3760/3761 and ISO 6194/1).

Installation in the Gland

The static seal in the mounting bore is provided by the corresponding force fit allowance at the outer sheath of the seal.

Turel® Radial Oil Seals are referred to according to the design of their outer cover – rubber-coated (smooth or corrugated) or metallic. The bore is dimensioned to fit ISO H8.

Values for the surface roughness in the gland are specified in ISO 6194/1.

Installation on the Shaft, Depth and Lead-In Chamfer

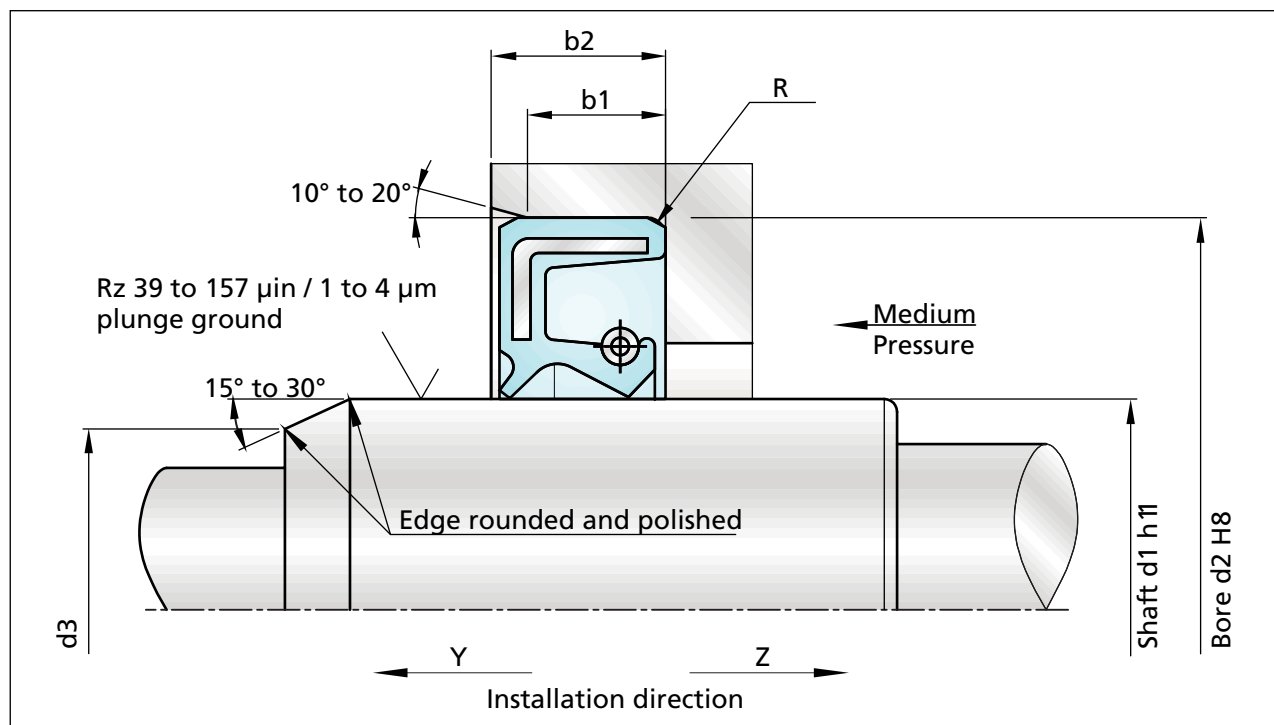


Figure 1 Installation of the Radial Oil Seal
Depending on the installation direction (Y or Z), a chamfer or radius on the shaft is recommended.

Turel® Radial Oil Seal

Table II Housing Dimensions

Ring Width b in b mm	b1 .033 x b in (0.85 x b mm)	b2 b + .012 in (b + 0.3 mm)	r2 max. in (mm)
.276 7	.234 5.95	.287 7.3	.020 0.5
.315 8	.268 6.80	.327 8.3	
.394 10	.335 8.5	.406 10.3	
.472 12	.406 10.30	.484 12.3	.028 0.7
.591 15	.502 12.75	.602 15.3	
.787 20	.669 17.00	.799 20.3	

Table III Shaft Chamfer and Radius Dimensions

d1 inch (mm)	D2 inch mm	R Inch mm
< .393 (< 10)	d1 – .059 d1 – 1.50	.079 2.0
.393 – .787 (10 – 20)	d1 – .079 d1 – 2.01	.079 2.0
.787 – 1.181 (20 – 30)	d1 – .098 d1 – 2.49	.118 3.0
1.181 – 1.575 (30 – 40)	d1 – .118 d1 – 3.00	.118 3.0
1.181 – 1.575 (30 – 40)	d1 – .118 d1 – 3.00	.118 3.0
1.575 – 1.969 (40 – 50)	d1 – .138 d1 – 3.50	.157 4.0
1.969 – 2.756 (50 – 60)	d1 – .157 d1 – 4.00	.157 4.0
2.756 – 3.740 (70 – 95)	d1 – .177 d1 – 4.50	.197 5.0
3.740 – 5.118 (95 – 130)	d1 – .217 d1 – 5.50	.236 6.0
5.118 – 9.449 (130 – 240)	d1 – .276 d1 – 7.00	.315 8.0
9.449 – 19.685 (240 – 500)	d1 – .433 d1 – 11.00	.472 12.0

Features and benefits

- Suitable for rotary, reciprocating and static service
- Remains tight in gland even when subject to oscillating or helical movements
- Low coefficient of friction
- Good scraping effect
- Stick-slip-free operating for precise control
- High abrasion resistance and dimensional stability
- Withstands rapid changes in temperature
- Protects against mechanical torsion
- No contamination in contact with fuel, oxygen or air
- Excellent resistance to aging
- Unlimited shelf life
- Unidirectional seal



Illustration shows typical Turcon® Roto Variseal® application.

Turcon® Roto Variseal®

Description

Turcon® Roto Variseal® is excellent in rotary, reciprocating and static applications when there is a need to lock the seal in the groove. It is a single-acting seal consisting of a U-shaped seal jacket and a V-shaped corrosion-resistant metal spring.

The flanged heel of Turcon® Roto Variseal® prevents the seal from rotating by clamping it in the gland. The seal's short and heavy dynamic lip offers reduced friction, long service life and a good scraping effect, even in highly viscous media.

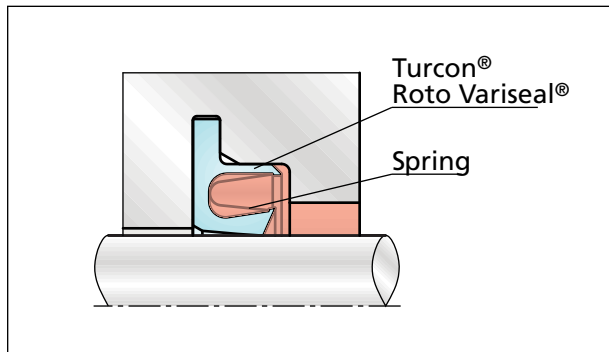


Figure 1 Turcon® Roto Variseal®

The Turcon® jacket material and that of the spring can be matched to specific requirements. This allows Turcon® Roto Variseal® to be used in a wide range of applications. These are not confined to hydraulics but also in fuel and environmental control systems, as well as oxygen and space applications.

Turcon® Roto Variseal® is available in a special Hi-Clean version where the spring cavity is filled with a Silicone elastomer. Preventing contaminants from being trapped in the seal, this design works well in applications involving mud or slurries. It keeps grit or ice from packing into the seal cavity, which can inhibit the spring action.

Method of operation

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. This ensures a tight seal from zero to high pressure.

Technical data

Operation pressure: Up to 2,000 psi/ 15 MPa for dynamic loads
Up to 3,500 psi/ 25 MPa for static loads

Speed: Up to 6.5 ft/s/ 2.0 m/s rotating

Temperature range: -148°F to +500°F/ -100°C to +260°C
For specific applications at lower temperatures, contact your local Trelleborg Sealing Solutions marketing company.

Media: Virtually all fluids, chemicals and gases

Avoid combining extreme limits.

Mating surface materials

Sealing of applications with rotating movements requires very good mating surfaces. A minimum hardness of 55 HRC is recommended to a hardening depth of at least .012 in/ 0.3 mm.


Coated surfaces must be finished with particular care:

- Chrome-plating must not peel off in service
- Good heat dissipation must be assured by the coating

Unhardened mating surfaces should have a Brinell hardness of at least 1,700 N/mm².

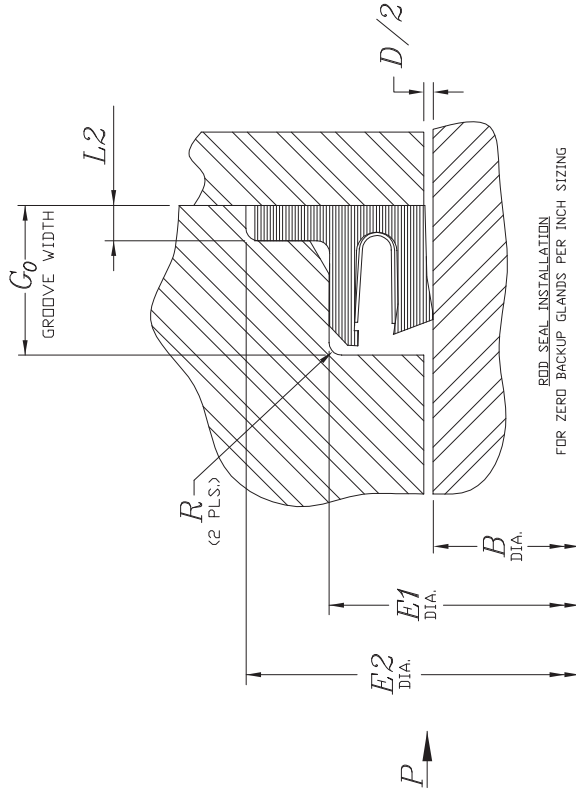
Turcon® Roto Variseal®

Table I Turcon® Roto Variseal®

Cross Section	Description	Part Number	Gland Standard
	Turcon® Roto Variseal®	TVM_50000 (inch) TVM_00000 (metric)	TSS Gland Rod per AS4716

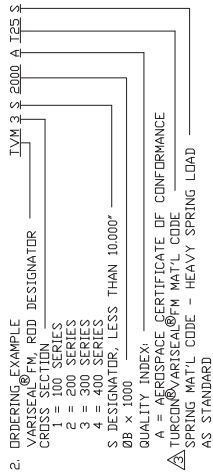
Turcon® Roto Variseal®

SERIES NO.	B DIA.	G ₀ ZERO BACKUP WIDTH	L/2 FLANGE WIDTH	R RADIUS	D/2 MAX.	
					290 PSI MAX	2900 PSI MAX
TYM1	0.200 - 8.000	.141/.151	.033/.029	.012	.006	.004
TYM2	0.400 - 16.000	.188/.198	.053/.047	.016	.008	.006
TYM3	0.800 - 28.000	.281/.291	.071/.063	.020	.010	.008
TYM4	1.500 - 40.000	.375/.385	.110/.090	.020	.012	.010



ROD SEAL INSTALLATION FOR ZERO BACKUP GLANDS PER INCH SIZING

NOTES:
1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VARISEAL®PM



FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE. SPRING MATERIAL OPTIONS LISTED BELOW

SPRING MATERIAL CODE	HEAVY DUTY AS STANDARD	MATERIAL
S		301 STAINLESS STEEL
H		HASTELLOY
E		ELGILOY

4. DIMENSIONS PER ISO 286-2 SPECIFICATION

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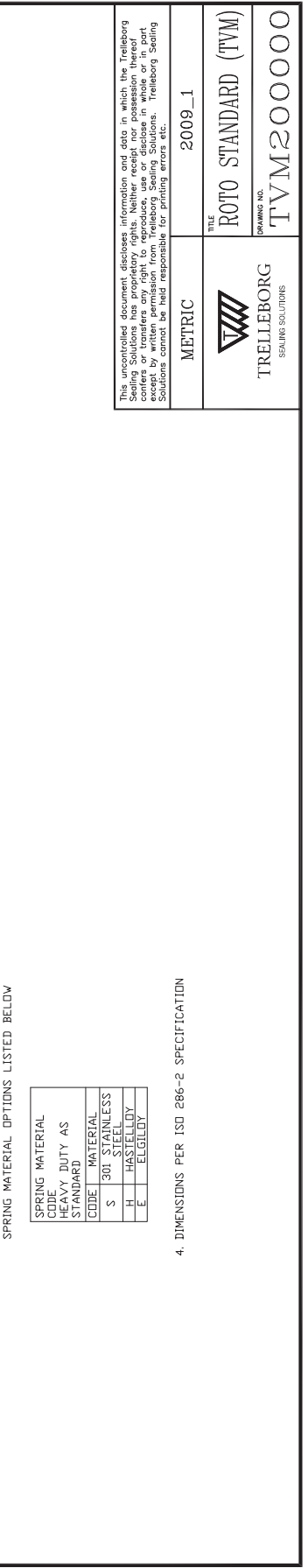
TRELLEBORG SEALING SOLUTIONS

THE ROTO STANDARD (TYM)

DRAWING NO. TYM2S0000

Turcon® Roto Variseal®

Series No.	B DIA.	E1 DIA.	E2 DIA.	Part No.
	F8/H9	H9	H10	
	5.0	10.0	14.0	TM1000050
	6.0	11.0	15.0	TM1000060
	8.0	13.0	17.0	TM1000100
	10.0	15.0	19.0	TM1000120
	12.0	17.0	21.0	TM1000140
	14.0	19.0	23.0	TM1000150
	15.0	20.0	24.0	TM1000150
	16.0	21.0	25.0	TM1000160
	18.0	23.0	27.0	TM1000180
	20.0	25.0	29.0	TM2000200
	22.0	27.0	31.0	TM2000220
	25.0	30.0	34.0	TM2000250
	28.0	33.0	37.0	TM2000280
	30.0	35.0	40.0	TM2000300
	32.0	37.0	42.0	TM2000320
	35.0	40.0	45.0	TM2000350
	36.0	42.0	47.0	TM2000350
	40.0	43.0	48.5	TM2000360
	42.0	45.0	50.5	TM3000400
	45.0	48.0	53.0	TM3000420
	48.0	50.0	55.0	TM3000480
	48.0	52.0	55.0	TM3000480
	45.0	55.0	62.0	TM3000450
	48.0	58.0	65.0	TM3000480
	50.0	60.0	67.0	TM3000500
	55.0	65.0	72.0	TM3000550
	56.0	66.0	73.0	TM3000560
	60.0	70.0	77.0	TM3000600
	63.0	73.0	80.0	TM3000630
	65.0	75.0	82.0	TM3000650
	70.0	80.0	87.0	TM3000700
	75.0	85.0	92.0	TM3000750
	80.0	90.0	97.0	TM3000800
	85.0	95.0	102.0	TM3000850
	90.0	100.0	107.0	TM3000900
	95.0	105.0	112.0	TM3000950
	100.0	110.0	117.0	TM3001000
	105.0	115.0	122.0	TM3001050
	110.0	120.0	127.0	TM3001100
	115.0	125.0	132.0	TM3001150
	120.0	130.0	137.0	TM3001200
	125.0	135.0	142.0	TM3001250
	130.0	140.0	147.0	TM3001300
	135.0	145.0	152.0	TM3001350
	140.0	150.0	157.0	TM3001400
	150.0	160.0	167.0	TM3001500
	160.0	170.0	177.0	TM3001600
	170.0	180.0	187.0	TM3001700
	180.0	190.0	197.0	TM3001800
	190.0	200.0	207.0	TM3001900
	200.0	210.0	217.0	TM3002000
	210.0	220.0	227.0	TM3002100
	220.0	230.0	237.0	TM3002200
	230.0	240.0	247.0	TM3002300
	240.0	250.0	257.0	TM3002400
	250.0	260.0	267.0	TM3002500
	260.0	270.0	277.0	TM3002600
	280.0	290.0	297.0	TM3002800
	300.0	310.0	317.0	TM3003000
	320.0	330.0	337.0	TM3003200
	350.0	360.0	367.0	TM3003500
	360.0	370.0	377.0	TM3003600
	400.0	410.0	420.0	TM4004000
	420.0	430.0	440.0	TM4004200
	440.0	450.0	460.0	TM4004400
	480.0	490.0	500.0	TM4004800
	500.0	510.0	520.0	TM4005000
	600.0	610.0	620.0	TM4006000
	700.0	710.0	720.0	TM4007000



NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VARISEAL® FM
 2. ORDERING EXAMPLE:
 VARISEAL® FM, ROD DESIGNATOR ———— TVM 3 0 0508 A 125 S
 CROSS SECTION
 1 = 100 SERIES
 2 = 200 SERIES
 3 = 300 SERIES
 4 = 400 SERIES
 0. DESIGNATOR, LESS THAN 1000 MM
 QUALITY INDEX:
 A = AEROSPACE, CERTIFICATE OF CONFORMANCE
 TVM VARISEAL® FM MAT'L CODE
 SPRING MAT'L CODE - HEAVY SPRING LOAD
 AS STANDARD

SPRING MATERIAL
HEAVY DUTY AS STANDARD
CODE MATERIAL
S 301 STAINLESS STEEL
H HASTELLOY
E ELGILOY

FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE.
 SPRING MATERIAL OPTIONS LISTED BELOW

4. DIMENSIONS PER ISO 286-2 SPECIFICATION

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METRIC	2009_1
TITLE	ROTO STANDARD (TVM)
DRAWING NO.	TVM200000
TRELLEBORG SEALING SOLUTIONS	





Features and benefits

Benefits of Turcon® Varilip® PDR include:

Turcon® PTFE based sealing lip

- Low-friction to facilitate reduced power loss and friction-induced heat
- Unique self-lubricating hydrodynamic feature further reduces friction
- Advanced geometries engineered to give excellent performance in almost every high-speed rotary situation
- Multiple lip configurations to address most sealing needs
- Material compatible with virtually all media
- Available in FDA-compliant grades

Metal body

- Durability in harsh environments
- Effective sealing on static outer diameter
- Resistance to thermal cycling
- Choice of high-quality metals including Stainless Steel, aluminum and other specialized metals such as Hastelloy® or Titanium
- High corrosion resistance
- Superior precision-machined finish for improved sealing on the static interface

Overall Turcon® Varilip® PDR seal

- Contributes to a reduction in power consumption of equipment
- High speed capability up to 328 ft/s / 100 m/s
- Wide operating temperature range from -76° to +392°F/ -60° to +200°C
- Options available for dry-running applications and for soft shafts
- Retrofits in radial oil seal grooves
- Unlimited shelf life with no special storage requirements



Turcon® Varilip® PDR has several lip combinations that retain oil or grease while giving excellent protection from dust and sand.

Turcon® Varilip® PDR

Description

Turcon® Varilip® PDR rotary shaft seal is a metal bodied seal with a mechanically retained Turcon® sealing element. It extends the boundaries imposed by elastomer radial shaft seals, utilizing advanced materials and design techniques to provide optimum sealing performance for each application. The outcome is a superior sealing solution, which retains a compact seal envelope.

Standard elastomer rotary shaft seals have a limited application range with respect to temperature, surface speed, media compatibility, pressure or a combination of these. This is due to the inherent limitations of different elastomer grades. They also have limited suitability for applications with inadequate lubrication.

Turcon® Varilip® PDR rotary shaft seals are characterized in particular by low friction and their stick-slip-free running, reducing temperature generation and permitting higher peripheral speeds.

Method of operation

Turcon® Varilip® PDR seals are constructed from two parts – a precision manufactured metal body and a mechanically retained Turcon® sealing element. Unlike seals with pressed metal cases, Turcon® Varilip® PDR does not require a gasket to provide mechanical retention of the lip. This improves both the chemical resistance and temperature range of the sealing system.

Turcon® has inherent memory. A distorted Turcon® component will attempt to recover to the profile it had during the sintering cycle of its manufacturing process. This feature is used to provide the necessary radial loading of the sealing lip onto the shaft.

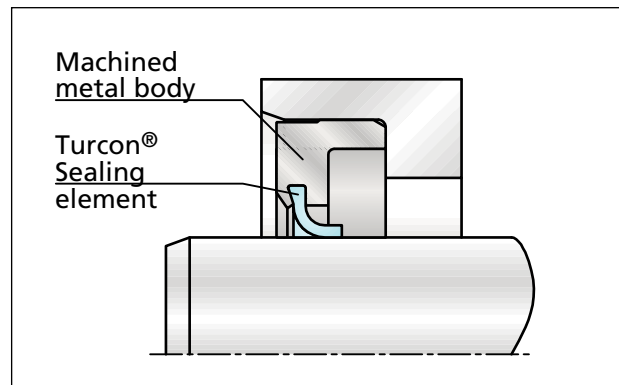



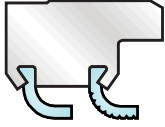



Figure 1 Turcon® Varilip® PDR seal

When required, Turcon® Varilip® PDR is available with a hydrodynamic feature on the Turcon® sealing lip. This provides a positive displacement of fluid as a result of shaft rotation, giving improved sealing in applications where the shaft only rotates in a single direction. The feature also increases the flexibility of the lip, allowing a wider contact band between the Turcon® lip and the shaft. This helps to reduce shaft load and associated wear.

Turcon® Varilip® PDR

Table I Turcon® Varilip® PDR Types

Turcon® Varilip® PDR seals are produced in one of five basic design styles, detailed in table below.

Cross Section	Part Number	Description
 <p>Turcon® Varilip® PDR Type A / Type 1</p>	<p>TJ1 _ B (Inch)</p> <p>TJA _ B (Metric)</p>	<p>Type A is a single lip seal suitable for applications up to a pressure of 73 psi/ 0.5 MPa. It is used when an elastomer radial shaft seal is unable to withstand the temperature or friction, in medium or poor lubrication. It operates at sealing surface speeds up to 328 ft/s / 100 m/s with sufficient cooling and lubrication of the sealing lip.</p>
 <p>Turcon® Varilip® PDR Type B / Type 3</p>	<p>TJ3 _ B (Inch)</p> <p>TJB _ B (Metric)</p>	<p>Type B is the preferred choice for applications in which high seal integrity is demanded or where contaminated media are to be sealed. This type offers a back-up sealing lip to provide secondary sealing. Pressure limit is 73 psi/ 0.5 MPa.</p>
 <p>Turcon® Varilip® PDR Type C / Type 4</p>	<p>TJ4 _ B (Inch)</p> <p>TJC _ B (Metric)</p>	<p>Type C can be used for applications with higher pressures when an elastomer radial shaft seal can no longer be considered. Due to reinforcement of the sealing lip, pressures up to 145 psi/ 1 MPa are possible as pump, shaft or rotor seals.</p>
 <p>Turcon® Varilip® PDR Type D / Type 5</p>	<p>TJ5 _ B (Inch)</p> <p>TJD _ B (Metric)</p>	<p>Type D can operate with pressure from both sides. Pressure differential of up to 73 psi/ 0.5 MPa is permissible. It is also possible to separate two different media with this single seal.</p>
 <p>Turcon® Varilip® PDR Type G / Type 6</p>	<p>TJ6 _ B (Inch)</p> <p>TJG _ B (Metric)</p>	<p>Type G is similar to Type D but has a non-contacting environmental sealing element rather than a full lay-down lip. This prevents ingress of dust and dirt into the system while also ensuring torque and resulting power consumption are kept to a minimum.</p>

All designs are to Trelleborg Sealing Solutions gland standard and rod per AS4716.

Lip style B is selected as default for bi-directional shaft rotation. For anti-clockwise shaft rotation select A and for clock-wise shaft rotation select C.

Turcon® Varilip® PDR





Materials

Sealing lip

The proper function of Turcon® Varilip® PDR depends on the material used for the sealing lip. The compounds used for these are manufactured specially modified for Turcon® Varilip® PDR. Particular importance is attached to the optimization of friction and wear properties, while providing excellent sealing performance, even at high peripheral speeds.

The table below shows the Turcon® materials available as Turcon® Varilip® PDR seals. Additional compounds have been developed for specific applications and these are available on request.

Table II Turcon® sealing element materials

Material, Applications, Properties, Fillers	Code	Operating temp.		Mating surface hardness	psi/ MPa Maximum
		F°	C°		
Turcon® T25 Standard material with exceptional wear and friction characteristics. For lubricated running, e.g. oil, grease-filled gearboxes Glass fiber, lubricant	T25 	-76 to +392	-60 to +200	Min. 55 HRC At low pressure Min. 45 HRC up to 13 ft/s 4 m/s	290 psi 2 MPa
Turcon® T40 For all lubricating and non-lubricating fluids, especially water. Used with medium hard shafts in applications where there is risk of shaft wear. Carbon fiber	T40 	-76 to +392	-60 to +200	Min. 30 HRC	290 psi 2 MPa
Turcon® T78 Particularly good running behavior allows use in dry running situations or when lubrication is poor. Can be used with soft shaft surfaces, e.g. Stainless Steel shafts in fuel systems and electronic devices. Aromatic polymer	T78 	-76 to +392	-60 to +200	Min. 170 HB	290 psi 2 MPa
Turcon® M83 Specially designed for dry-running situations. Gives particularly good results in electrical and electronic applications. Can also be used lubricated. Glass fiber, pigment	M83 	-76 to +392	-60 to +200	Min. 55 HRC	290 psi 2 MPa

Other Turcon® materials are available by using the relevant material code when ordering. FDA compliant materials, for use in environmental control systems and oxygen supply, are available on request.

Metal Body

The preferred material for the metal body of Turcon® Varilip® PDR is Stainless Steel 304L. Other materials such as Stainless Steel 316L and Zinc-Plated Mild Steel are available within the standard range. The table below shows the codes for these materials. Other specialized materials are available on request. Ordering Turcon® Varilip® PDR in any material other than Stainless Steel 304L may result in extended lead-time.

Metal Body Materials

Code	Material
1	Stainless Steel 304
2	Stainless Steel 316
4	Mild Steel (Zinc-Plated)
5	Aluminum

Turcon® Varilip® PDR

Technical Data

Speed

The graph below shows the superior surface speed capability of Turcon® PDR compared to elastomer shaft seals.

The operating speed directly impacts the temperature generated by the seal and is an important factor when considering the requirements for the sealing system.

The actual limiting speed will depend on temperature, pressure, media, lubrication, heat dissipation and shaft condition within a specific application.

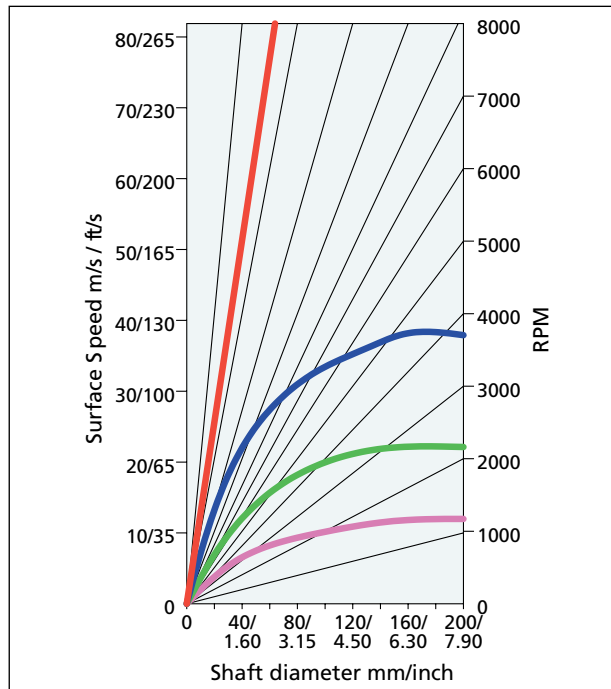


Figure 2 Surface speed as a function of shaft diameter and RPM

Table III Surface Speed

General recommended maximum surface speed			
Turcon® Varilip® PDR		19,680 ft/min	100 m/s
Fluoroelastomer		7,500 ft/min	38 m/s
Silicone		7,500 ft/min	38 m/s
Polyacrylic		4,320 ft/min	22 m/s
Nitrile		2,340 ft/min	12 m/s

Speed capability depends on application conditions

Temperature

All Turcon® PDR seals are capable of outstanding high and low temperature performance compared to those including elastomer materials. So, unlike other PTFE lip seals, the Turcon® PDR seal is not limited in its temperature performance by the presence of an elastomer gasket. This gives it excellent temperature range capability.

The temperatures in the figure below are general working limits for the seal material. In all cases the effective limit for a rotary shaft seal application would be lower.

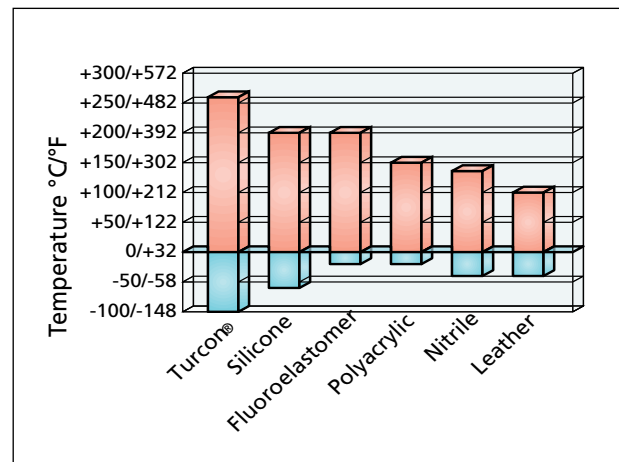


Figure 3 Maximum and minimum temperatures for different materials

Table IV Temperature

General recommended minimum / maximum temperature		
Filled PTFE	-148 to +500°F	-100 to +260° C
Fluoroelastomer	-4 to +392°F	-20 to +200° C
Silicone	-76 to +392°F	-60 to +200° C
Polyacrylic	-4 to +300°F	-20 to +150° C
Nitrile	-40 to +275°F	-40 to +135° C
Leather	-40 to +212°F	-40 to +100° C

Turcon® Varilip® PDR

Pressure

Turcon® Varilip® PDR Types A, B, D and G are suitable for pressures up to 73 psi/ 0.5 MPa. Turcon® Varilip® PDR Type C provides a double sealing lip design for pressures up to 145 psi/ 1 MPa.

Pressures heavily influence the contact force between the Turcon® lip and the shaft, which in turn determines heat generation. This must be taken into consideration when selecting the appropriate seal type.

Turcon® Varilip® PDR seals can remain leak-tight when exposed to pressurization during static shaft conditions.

Fluid resistance

Turcon® consists of fully substituted carbon-carbon chains. The outstanding physical and chemical properties of Turcon® can be attributed to the resulting carbon-fluorine bonds, which are among the strongest known in organic chemistry.

Turcon® Varilip® PDR seals are resistant to mineral acids, bases, common organic fluids and solvents.

A particular benefit of Turcon® Varilip® PDR is a resistance to oil additives and biofuels, which have an adverse effect on many elastomers. Specification of Turcon® Varilip® PDR allows increased use of additives within applications, leading to a longer oil service life.

Environmental exposure

Turcon® Varilip® PDR is unaffected by oxidation, ultraviolet radiation or ozone. This makes the seal ideal for use in applications exposed to the atmosphere or in outer space.

Lubrication starvation

Turcon® Varilip® PDR is capable of running without lubrication for long periods of time without adversely affecting their ultimate life. This not only allows the seal to be used in applications where the lubrication may be intermittent but it is also effective in dirt, dust and powder.

Custom designs

Higher speeds and pressure capabilities can be achieved with the use of custom designs.

Further information

Additional more detailed information on Turcon® Varilip® PDR can be found in the Trelleborg Sealing Solutions Turcon® Varilip® PDR catalog. This can be downloaded from the services section of the website at www.tss.trelleborg.com or a printed copy ordered from your local Trelleborg Sealing Solutions marketing company.

Turcon® Varilip® PDR

Design Guidelines

Housing

Turcon® Varilip® PDR is designed to meet global standards, including ISO 6194/1 and ISO 16589.

Turcon® Varilip® PDR requires an interference fit with the housing bore to provide adequate sealing of this interface. It also ensures that the seal remains in place when subjected to pressure, axial movement and induced torsion produced by the relative rotary motion of shaft to housing bore. The bore should be machined with an H8 diametric tolerance as detailed in the table below.

Turcon® Varilip® PDR seals should not be pushed into bores that were previously scored by the assembly of another component, such as a bearing. In these circumstances a larger seal outer diameter should be selected.

Surface finish of the bore is required to be 32 µin/ 0.8 µm Ra maximum. A sealant or adhesive should be used if the housing bore is split and an axial joint crosses the seal outer diameter or if surface finish requirements cannot be met. Alternatively a custom solution can be supplied with a rubber covering or O-Ring for OD sealing.

Table V Housing Installation Data

Bore Diameter				Tolerance	
Over		To		H8 (in)	H8 (mm)
inch	mm	inch	mm		
0.394	10	0.787	18	0.0011 -0.000	+0.027 -0
0.787	18	1.181	30	0.0013 -0.0000	+0.033 -0
1.181	30	1.969	50	0.0015 -0.000	+0.039 -0
1.969	50	3.150	80	0.0018 -0.000	+0.046 -0
3.150	80	4.724	120	0.0021 -0.000	+0.054 -0
4.724	120	7.087	180	0.0025 -0.000	+0.063 -0
7.087	180	9.843	250	0.0028 -0.000	+0.072 -0
9.843	250	12.402	315	0.0032 -0.000	+0.081 -0
12.402	315	15.748	400	0.0035 -0.000	+0.089 -0

Table VI Housing Design Data

Seal Width	< 0.394 inch 10 mm	> 0.394 inch 10 mm
Min. bore depth (b)	b + 0.0197 b + 0.5 mm	b + 0.0394 b + 1.0
Chamfer length (c)	0.028 to 0.04 0.70 to 1.00	0.047 to 0.06 1.20 to 1.50
Max. corner radius (r)	0.0157 0.40	0.0157 0.40

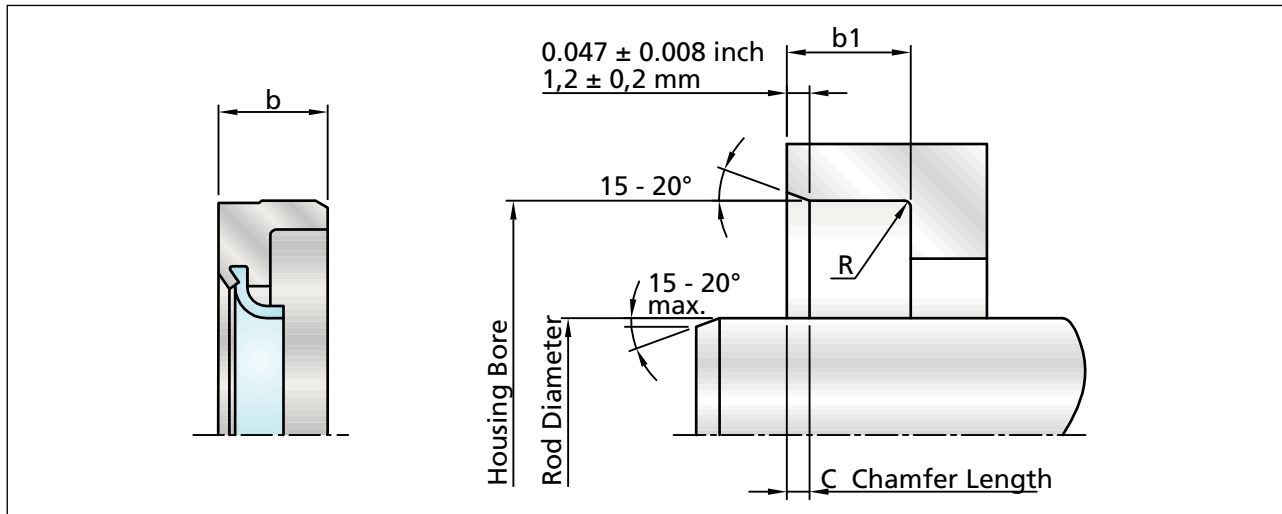


Figure 4 Housing Design Schematic

Shaft

For Turcon® Varilip® PDR the shaft should be machined to an h11 tolerance or greater, as detailed in the table below. The surface finish should be prepared by plunge grinding to avoid any machining lead that may act with the shaft rotation, potentially causing leakage.

The recommended surface finish for the shaft is 8-16 µinch/ 0.2 to 0.4 µm Ra.

Table VII Shaft Installation Data

Shaft Diameter				Tolerance	
Over		To		h11 (in)	h11 (mm)
inch	mm	inch	mm		
0.236	6	0.394	10	+0 -0.0035	+0 -0.090
0.394	10	0.787	18	+0 -0.0043	+0 -0.110
0.787	18	1.181	30	+0 -0.0051	+0 -0.130
1.181	30	1.969	50	+0 -0.0063	+0 -0.160
1.969	50	3.150	80	+0 -0.0075	+0 -0.190
3.150	80	4.724	120	+0 -0.0087	+0 -0.220
4.724	120	7.087	180	+0 -0.0098	+0 -0.250
7.087	180	9.843	250	+0 -0.0114	+0 -0.290
9.843	250	12.402	315	+0 -0.0126	+0 -0.320
12.402	315	15.748	400	+0 -0.0142	+0 -0.360

Shaft hardness in excess of 55 HRC is generally recommended for Turcon® Varilip® PDR, although softer shafts are permissible depending on pressure, speed and sealing lip material.

Titanium shafts should be avoided unless nitrided. Shafts with good chrome, nickel or zinc plating, properly finished, are acceptable depending on application. Certain ceramic coatings can also be used, although some grades can result in wear of the sealing lip due to their open structure.

In certain applications it may not be possible to provide a shaft with the necessary hardness, surface finish and corrosion resistance. Fitting a wear sleeve onto the shaft can solve this problem. If wear should occur, only the sleeve needs replacing. The surface finish of the sleeve should be as outlined above. Consideration should be given to adequate heat dissipation and effective sealing of the interface between the wear sleeve and the shaft.

Turcon® Varilip® PDR

Installation Requirements

Careful handling is important when installing Turcon® Varilip® PDR to avoid damaging the sealing lip.

Radii or lead-in chamfers must be machined on the end of the shaft if the seal is installed from the back. The end of the shaft must also be free from burrs, sharp corners or rough machining marks.

When installing the seal with the lip against the shaft end, a lead-in chamfer is required. Its smallest diameter must be smaller than the unstressed diameter of the sealing lip.

It is recommended that the angle of the shaft's lead-in chamfer is as shallow as practical within the range given in the table below.

Table VIII Shaft Lead-in Chamfer

d1 (inch)	d1 (mm)	d1-d2 (inch)	d1-d2 (mm)
< 0.4	< 10	0.06	1.5
0.4 – 0.8	10 – 20	0.08	2.0
0.8 – 1.2	20 – 30	0.10	2.5
1.2 – 1.6	30 – 40	0.12	3.0
1.6 – 2.0	40 – 50	0.14	3.5
2.0 – 2.8	50 – 70	0.16	4.0
2.8 – 3.7	70 – 95	0.18	4.5
3.7 – 5.1	95 – 130	0.22	5.5
5.1 – 9.4	130 – 240	0.28	7.0
9.4 – 11.8	240 – 300	0.43	11.0

To ensure correct orientation of the sealing lip, fitting of the seal on an installation cone before fitting is preferred.

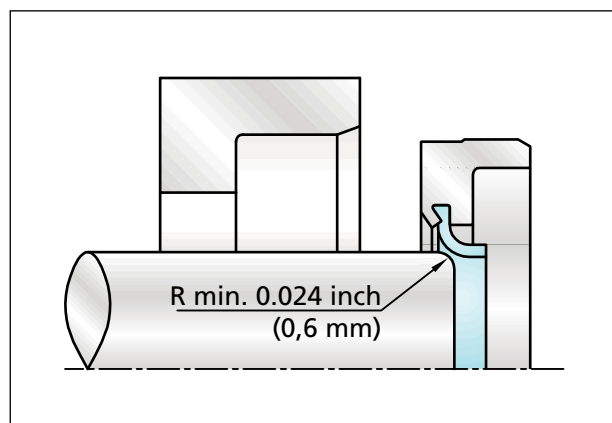


Figure 5 Installation of the sealing lip with the back to the shaft for pressurized application

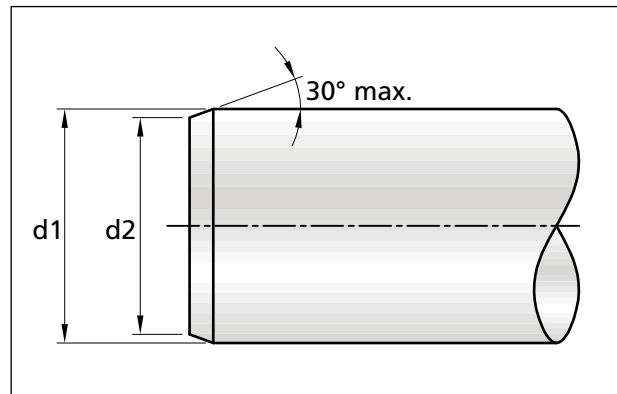


Figure 6 Shaft lead-in chamfer

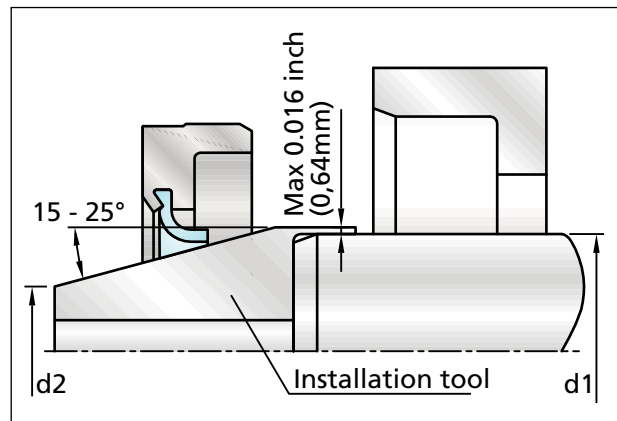


Figure 7 Fitting the sealing lip using an installation tool

Fitting should be performed in a swift movement to limit the time that the lip is formed above shaft size, reducing the amount of lip recovery needed.

Packaging

Single and small quantities of Turcon® Varilip® PDR seals will be supplied in blister packs with individual transport mandrels. These mandrels will pre-form the element to above its free diameter but below the intended shaft diameter. This assists in ease of installation while ensuring the element is not overstretched or damaged in transit.

Larger quantities of Turcon® Varilip® PDR seals will be supplied in a tube-and-end cap configuration.

Storage

Turcon® Varilip® PDR seals require no special storage conditions and do not have a limited shelf life.

Fitting Instructions

Investigations into premature failures have shown that significant numbers result from inappropriate installation techniques. By observing the following guidelines, such failures can be avoided.

- Assembly sleeves and fitting tools should be regularly checked for signs of damage.
- When supplied on mandrels the seals should not be removed from the mandrel until immediately prior to fitting. Seals supplied on cardboard mandrels should be removed in the direction so that the spiral paper overlay of the mandrel is not lifted.
- Turcon® Varilip® PDR seals should be assembled on the shaft in a non-lubricated (dry) condition to avoid contamination of the hydrodynamic feature if present.
- Care should be taken not to damage the outer diameter surface of the seal.
- Seals should be pressed squarely into the housing with the pressing-in force applied as close as possible to the outside diameter of the seal.
- If the seal contains a hydrodynamic feature on the sealing lip, ensure that it is correctly oriented in relation to the shaft's direction of rotation.
- Normal practice is to install the seal with the lip facing the medium to be sealed. The seal is reversed only when it becomes more important to exclude a medium than to retain it.

- Suitable sealants or adhesives may be used for improved sealing of the outer diameter in critical applications or for seal retention purposes.

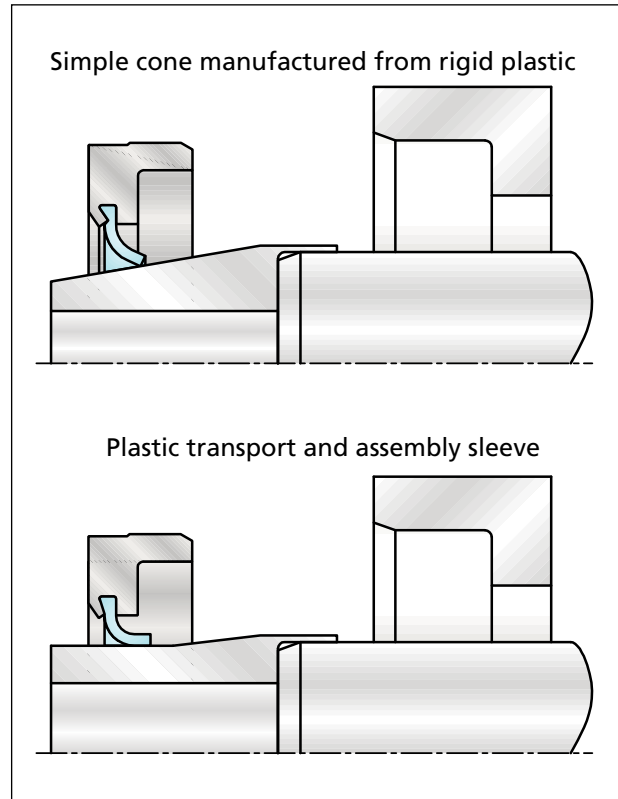


Figure 8 Assembly Techniques

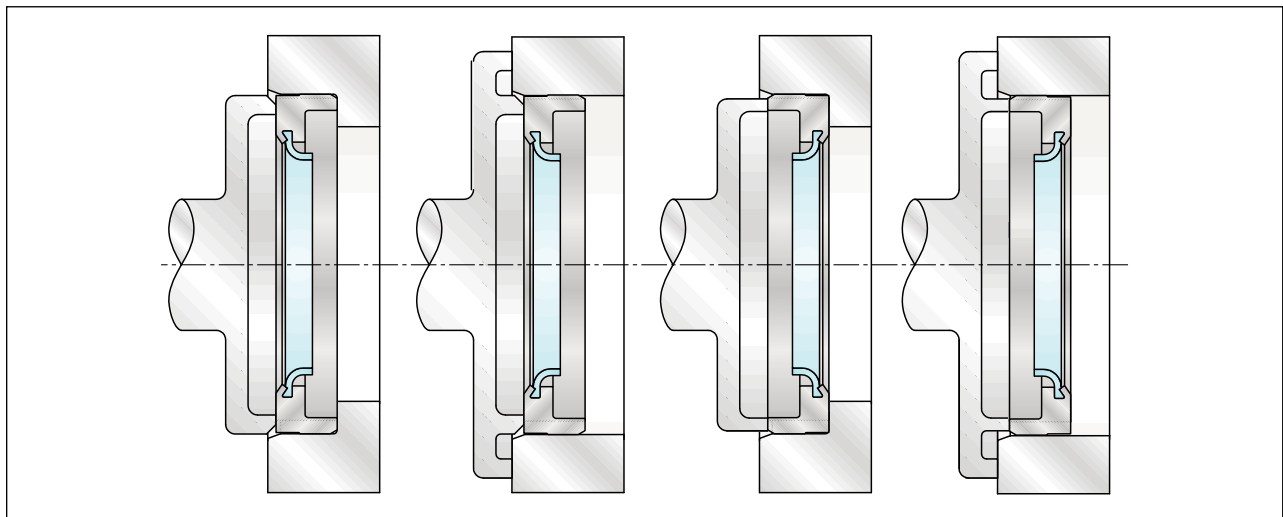


Figure 9 Assembly Techniques

Installation Recommendations

The following diagrams show installation recommendations for seal retention under conditions where there is pressure.

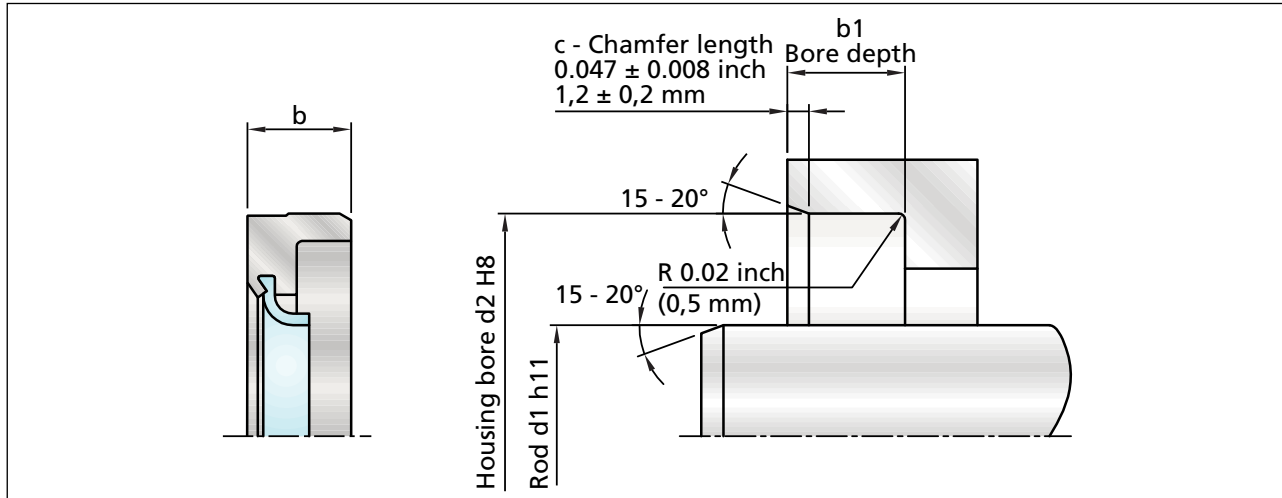


Figure 10 Installation drawing for pressure up to 73 psi/ 0.5 MPa

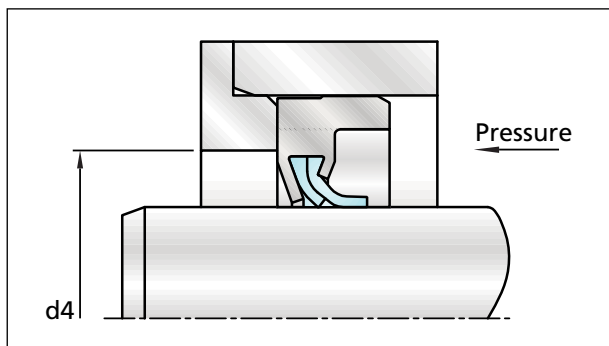


Figure 11 Installation for pressure from 73 psi/ 0.5 MPa up to 145 psi/ 1 MPa

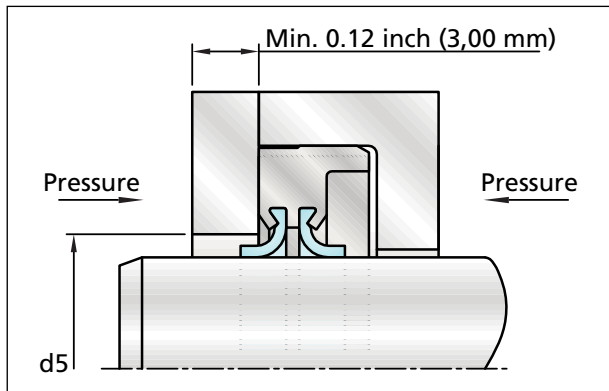


Figure 12 Installation type for fluid separation at pressures up to 73 psi/ 0.5 MPa

Post installation recommendations:

If painting the application, be sure to mask the seal. Avoid getting paint on the lip or the shaft where the lip rides. Also, mask any vents or drain holes, so they will not become clogged. Be sure to remove masks before operating unit.

If paint is to be baked or the mechanism is subjected to heat, seals should not be heated to temperatures higher than their materials can tolerate.

In cleaning or testing, do not subject seals to any fluids or pressures other than those for which the seals have been specified.

Extraction features such as tapped holes, internal threads or simple grooves can be included in custom Turcon® Varilip® PDR designs.

Turcon® Varilip® PDR

Turcon® Varilip® PDR – Special Designs

Apart from the standard range, Turcon® Varilip® PDR seals are available as special designs to satisfy the demands of specific applications. These can

accommodate non-standard housing and shaft sizes. The figures below show some of the special designs available.

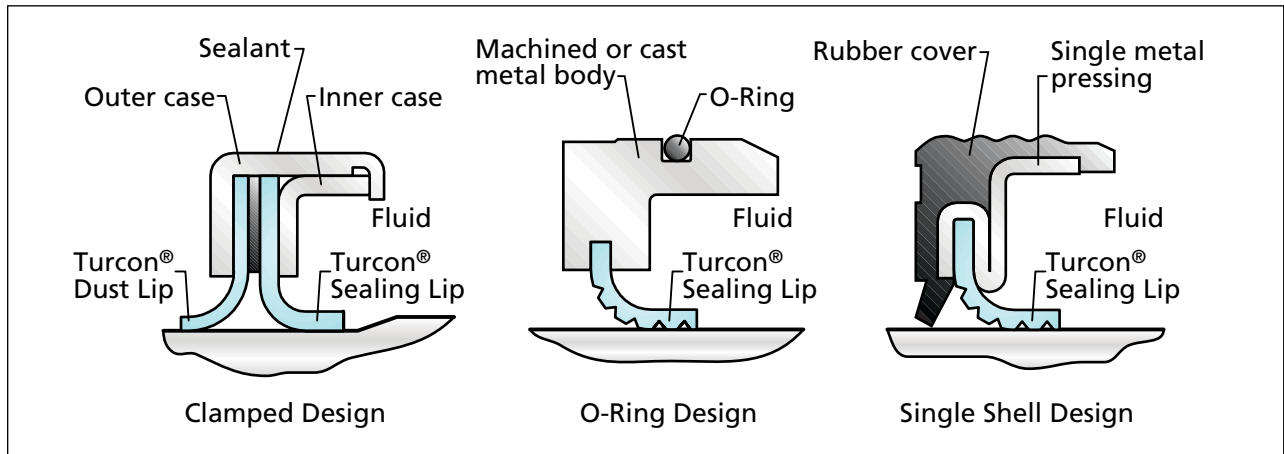


Figure 13 Turcon® Varilip® PDR – Special Designs

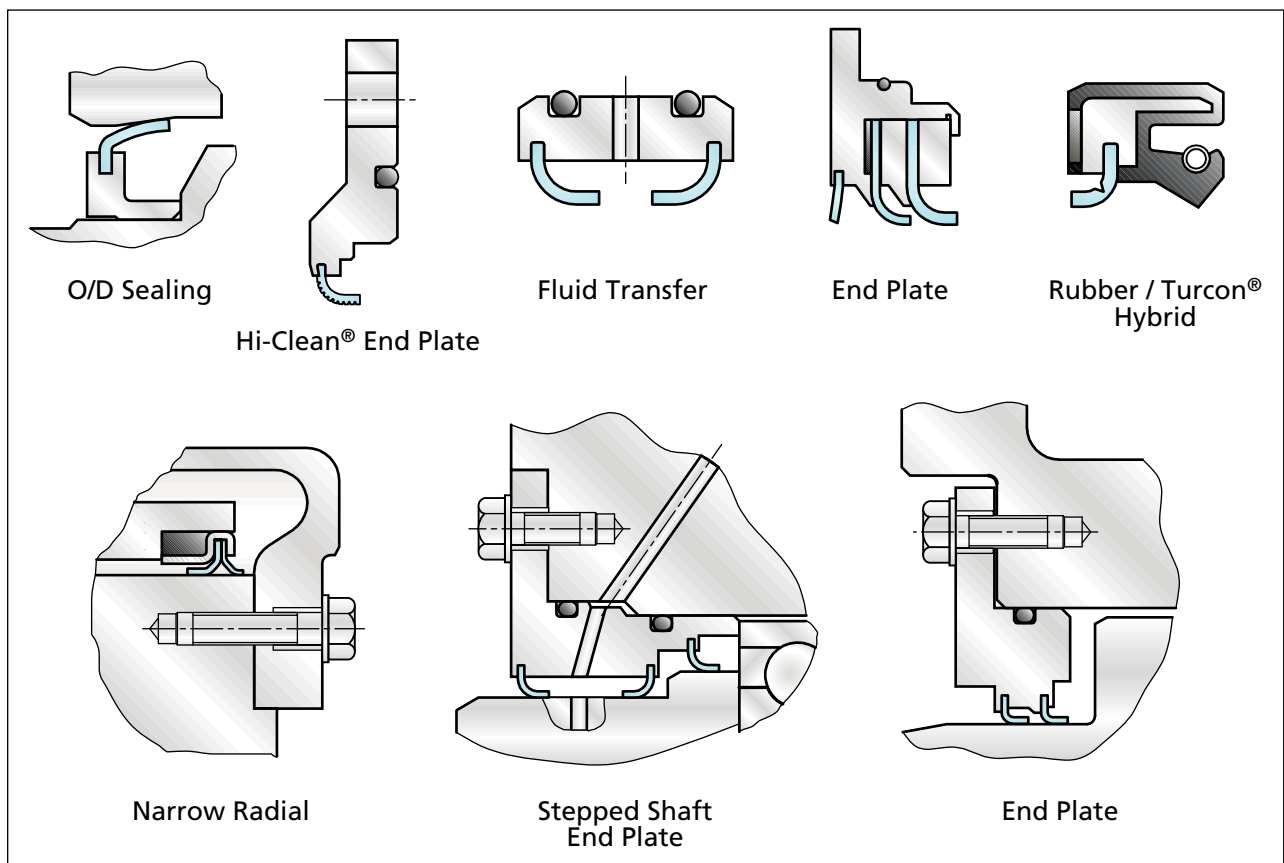
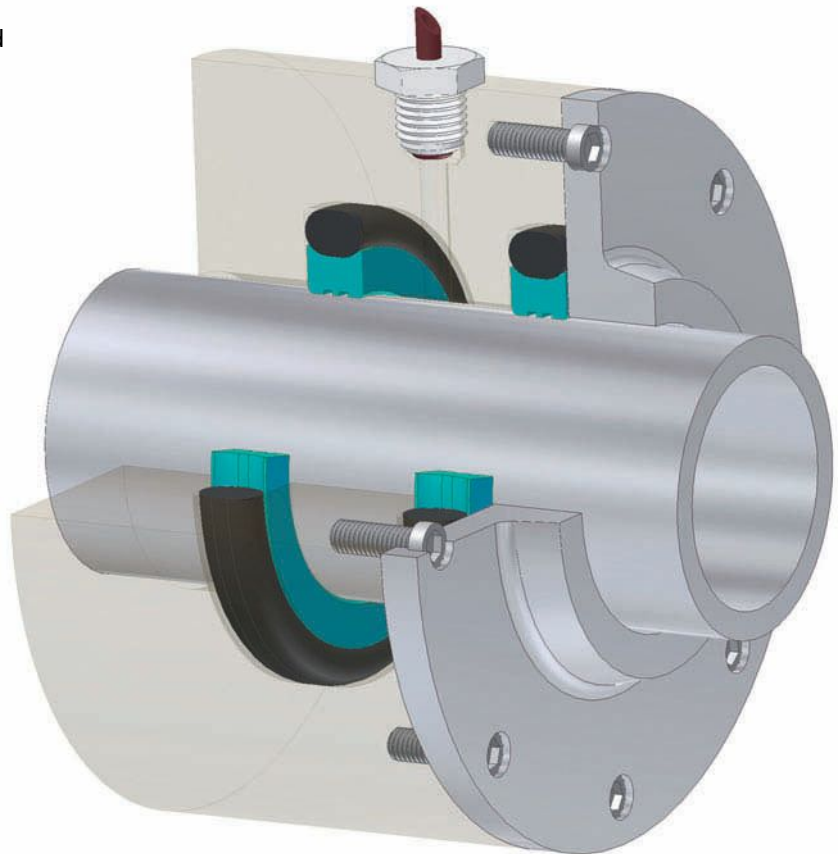


Figure 14 Turcon® Varilip® PDR – Special Designs

Turcon® Roto Glyd Ring®

Features and benefits

- Available for internal and external sealing applications
- For use at high-pressure and low sliding speeds
- Low friction
- Stick-slip-free starting
- High abrasion resistance and dimensional stability
- Simple groove design, narrow space-saving groove dimensions
- Lubricant reservoir
- Available in a wide range of standard and custom sizes
- Unidirectional or bidirectional seal



Turcon® Roto Glyd Ring® is well suited for sealing swivel joints for movable actuators.

Turcon® Roto Glyd Ring®

Description

The double-acting Turcon® Roto Glyd Ring® is used to seal rods, shafts, axles, bores, rotary transmission leadthroughs, journals and swivels with rotary, helical or oscillating movement. It consists of a seal ring in high-grade Turcon® material activated by an elastomer O-Ring.

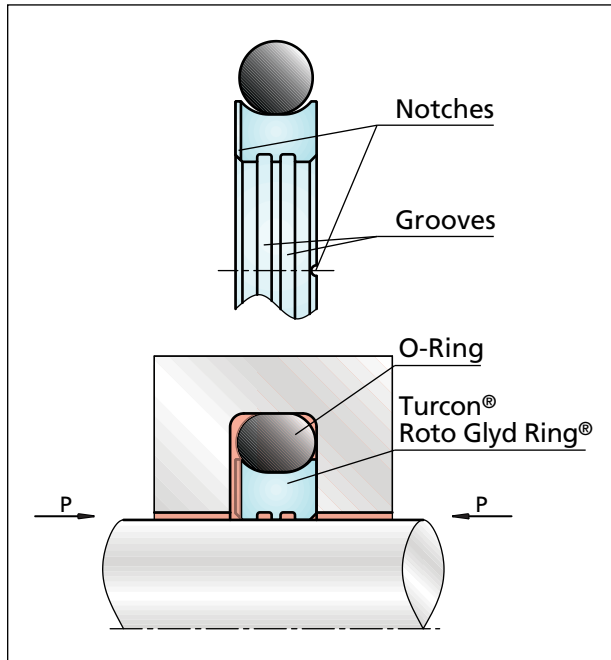


Figure 1 Turcon® Roto Glyd Ring®

The contact surface profile of the seal ring is specially designed for use at high-pressure and low sliding speeds.

Method of Operation

Depending on the cross section profile of the seal, the contact surface has one or two continuous machined grooves. These improve seal efficiency by increasing the specific surface load pressure against the sealed surface. They also form a lubricant reservoir and reduce friction.

In order to improve the pressure activation of the O-Ring, the Roto Glyd Ring® has notched end faces as standard.

The rear face which holds the O-Ring has a concave form. This increases the surface and prevents the seal from turning with the rotating surface.

Technical Data

Operation pressure: Up to 4,000 psi/ 30 MPa

Speed: Up to 6.5 ft/s/ 2.0 m/s

Temperature range: -49°F to +428°F/ -45°C to +220°C depending on elastomer
For applications at temperatures below -22°F/ -30°C contact your local Trelleborg Sealing Solutions marketing company.

Media: 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
For continuous operation at temperatures over +140°F/ +60°C, pressure and speed must be limited

Avoid combining extreme limits.

Mating Surface Materials

Sealing of applications with rotating movements requires very good mating surfaces. A minimum hardness of 55 HRC is recommended to a hardening depth of at least .012 in/ 0.3 mm.

Coated surfaces must be finished with particular care:

- Chrome-plating must not peel off in service.
- Good heat dissipation must be assured by the coating.

Unhardened mating surfaces should have a Brinell hardness of at least 1,700 N/mm².

Turcon® Roto Glyd Ring®

Frictional Power

Guide values for frictional power can be determined from the graph below. They are shown as a function of the sliding speed and operating pressure for a shaft diameter of 1.968 in/ 50 mm with an oil temperature of +140°F/ +60°C. At higher temperatures, these application limits must be reduced.

Formula for other diameters: $p \approx p_{50} \times \left(\frac{d}{50 \text{ mm}}\right) [\text{W}]$

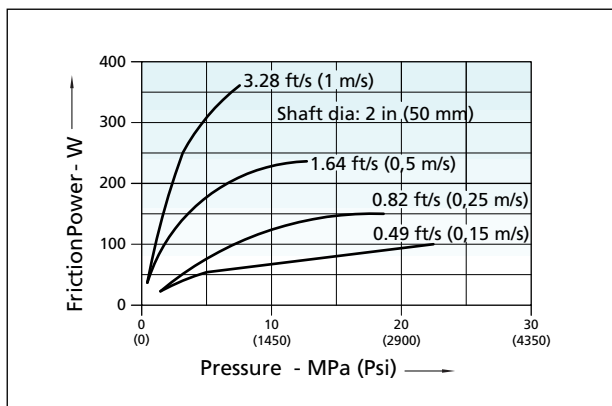




Figure 2 Friction for Turcon® Roto Glyd Ring®

Table I Turcon® Roto Glyd Ring®

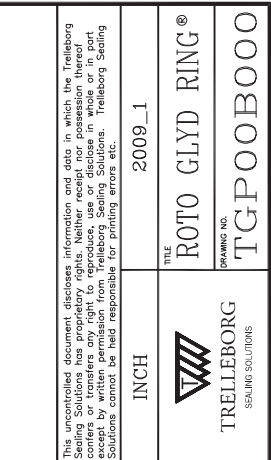
Cross Section	Description	Part Number	Gland Standard
	Turcon® Roto Glyd Ring® Rod	TGR_0B	TSS Gland Rod per AS4716
	Turcon® Roto Glyd Ring® Bore	TGP_0B	TSS Gland Bore per AS4716

Turcon® Roto Glyd Ring®

DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	B DIA.	E DIA.	O-RING NO.	DASH NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
010	.248	.441	011	210	.748	1.181	212	435	.087/.095	.005/.020	.004
011	.310	.503	012	211	.810	1.243	213	436			.005
012	.373	.566	013	212	.873	1.306	214	437			.005
				213	.935	1.368	215	438			.005
				214	.998	1.431	216	439	.126/.134	.005/.020	.006
013	.435	.628	014	215	1.060	1.493	217	440			.007
014	.498	.691	015	216	1.123	1.556	218	441			.007
015	.560	.753	016	217	1.185	1.618	219	442			.005
016	.623	.816	017	218	1.248	1.681	220	443			.005
017	.685	.878	018	219	1.310	1.743	221	444	.165/.173	.010/.025	.005
				220	1.373	1.806	222	445			.007
018	.748	.941	019	220	1.435	1.868	223	446			.008
019	.810	1.003	020	221	1.498	1.931	224	447			.006
020	.873	1.066	021	222	1.561	2.000	225	448	.248/.256	.015/.030	.007
021	.935	1.128	022	223	1.623	2.056	226	449			.007
022	.998	1.191	023	224	1.685	2.119	227	450			.007
				225	1.748	2.181	228	451	.319/.327	.020/.035	.010
023	1.060	1.253	024	226	1.810	2.243	229	452			.010
024	1.123	1.316	025	227	1.873	2.306	230	453			.010
025	1.185	1.378	026	228	1.935	2.368	231	454			.010
026	1.248	1.441	027	229	2.000	2.431	232	455			.010
027	1.310	1.503	028	230	2.062	2.493	233	456			.010
028	1.373	1.566	029	231	2.125	2.555	234	457			.010
				232	2.187	2.618	235	458			.010
				233	2.250	2.681	236	459			.010
				234	2.312	2.743	237	460			.010
				235	2.375	2.806	238	461			.010
				236	2.437	2.868	239	462			.010
				237	2.500	2.931	240	463			.010
				238	2.562	2.993	241	464			.010
				239	2.625	3.055	242	465			.010
				240	2.687	3.118	243	466			.010
				241	2.750	3.180	244	467			.010
				242	2.812	3.243	245	468			.010
				243	2.875	3.306	246	469			.010
				244	2.937	3.368	247	470			.010
				245	3.000	3.431	248	471			.010
				246	3.062	3.493	249	472			.010
				247	3.125	3.555	250	473			.010
				248	3.187	3.618	251	474			.010
				249	3.250	3.680	252	475			.010
				250	3.312	3.743	253	476			.010
				251	3.375	3.806	254	477			.010
				252	3.437	3.868	255	478			.010
				253	3.500	3.931	256	479			.010
				254	3.562	3.993	257	480			.010
				255	3.625	4.055	258	481			.010
				256	3.687	4.118	259	482			.010
				257	3.750	4.180	260	483			.010
				258	3.812	4.243	261	484			.010
				259	3.875	4.306	262	485			.010
				260	3.937	4.368	263	486			.010
				261	4.000	4.431	264	487			.010
				262	4.062	4.493	265	488			.010
				263	4.125	4.555	266	489			.010
				264	4.187	4.618	267	490			.010
				265	4.250	4.680	268	491			.010
				266	4.312	4.743	269	492			.010
				267	4.375	4.806	270	493			.010
				268	4.437	4.868	271	494			.010
				269	4.500	4.931	272	495			.010
				270	4.562	4.993	273	496			.010
				271	4.625	5.055	274	497			.010
				272	4.687	5.118	275	498			.010
				273	4.750	5.180	276	499			.010
				274	4.812	5.243	277	500			.010
				275	4.875	5.306	278	501			.010
				276	4.937	5.368	279	502			.010
				277	5.000	5.431	280	503			.010
				278	5.062	5.493	281	504			.010
				279	5.125	5.555	282	505			.010
				280	5.187	5.618	283	506			.010
				281	5.250	5.680	284	507			.010
				282	5.312	5.743	285	508			.010
				283	5.375	5.806	286	509			.010
				284	5.437	5.868	287	510			.010
				285	5.500	5.931	288	511			.010
				286	5.562	5.993	289	512			.010
				287	5.625	6.055	290	513			.010
				288	5.687	6.118	291	514			.010
				289	5.750	6.180	292	515			.010
				290	5.812	6.243	293	516			.010
				291	5.875	6.306	294	517			.010
				292	5.937	6.368	295	518			.010
				293	6.000	6.431	296	519			.010
				294	6.062	6.493	297	520			.010
				295	6.125	6.555	298	521			.010
				296	6.187	6.618	299	522			.010
				297	6.250	6.680	300	523			.010
				298	6.312	6.743	301	524			.010
				299	6.375	6.806	302	525			.010
				300	6.437	6.868	303	526			.010
				301	6.500	6.931	304	527			.010
				302	6.562	6.993	305	528			.010
				303	6.625	7.055	306	529			.010
				304	6.687	7.118	307	530			.010
				305	6.750	7.180	308	531			.010
				306	6.812	7.243	309	532			.010
				307	6.875	7.306	310	533			.010
				308	6.937	7.368	311	534			.010
				309	7.000	7.431	312	535			.010
				310	7.062	7.493	313	536			.010
				311	7.125	7.555	314	537			.010
				312	7.187	7.618	315	538			.010
				313	7.250	7.680	316	539			.010
				314	7.312	7.743	317	540			.010
				315	7.375	7.806	318	541			.010
				316	7.437	7.868	319	542			.010
				317	7.500	7.931	320	543			.010
				318	7.562	7.993	321	544			.010
				319	7.625	8.055	322	545			.010
				320	7.687	8.118	323	546			.010
				321	7.750	8.180	324	547			.010
				322	7.812	8.243	325	548			.010
				323	7.875	8.306	326	549			.010
				324	7.937	8.368	327	550			.010
				325	8.000	8.431	328	551			.010
				326	8.062	8.493	329	552			.010
				327	8.125	8.555	330	553			.010
				328	8.187	8.618	331	554			.010
				329	8.250	8.680	332	555			.010
				330	8.312	8.743	333	556			.010
				331	8.375	8.806	334	557			.010
				332	8.437	8.868	335	558			.010
				333	8.500	8.931	336	559			.010
				334	8.562	8.993	337	560			.010
				335	8.625	9.055	338	561			.010
				336	8.687	9.118	339	562			.010
				337	8.750	9.180	340	563			.010
				338	8.812	9.243	341	564			.010
				339	8.875	9.306	342	565			.010
				340	8.937	9.368	343	566			.010
				341	9.000	9.431	344	567			.010
				342	9.062	9.493	345	568			.010
				343	9.125	9.555	346	569			.010
				344	9.187	9.618	347	570			.010
				345	9.250	9.680	348	571			.010
				346	9.312	9.743	349	572			.010
				347	9.375	9.806	350	573			.010
				348	9.437	9.868	351	574			.010
				349	9.500	9.931	352	575			.010
				350	9.562	9.993	353	576			.010
				351	9.625	10.055	354	577			.010
				352	9.687	10.118	355	578			.010
				353	9.750	10.180	356	579			.010

Turcon[®] Roto Glyd Ring[®]

DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	DASH NO.	A DIA.	F DIA.	O-RING NO.	G GROOVE WIDTH	R RADIUS	D DIAMETRAL CLEARANCE MAX.
	+0.001 -0.002	+0.001 -0.001			+0.002 -0.001	+0.001 -0.003			+0.002 -0.001	+0.001 -0.003				
011	422	229	009	210	991	558	206	435	6224	5.397	431	.087/.095	.005/.020	.004
012	485	252	010	211	1053	583	208	437	6.219	5.392	432	.110-122	.005/.020	.005
013	550	357	011	213	1178	745	209	438	6.724	5.897	435	.127-129	.005/.020	.005
014	613	420	012	214	1241	808	210	439	6.974	6.147	437	.130-132	.005/.020	.006
015	675	482	013	215	1303	870	211	440	7.224	6.397	438	.133-140	.005/.020	.007
016	738	545	014	216	1366	933	212	441	7.474	6.647	439	.141-149	.005/.020	.007
017	800	607	015	217	1428	985	213	442	7.724	6.897	440	.210-222	.005/.020	.005
018	863	670	016	219	1553	1129	215	443	7.974	7.147	441	.223-254	.005/.020	.005
019	925	732	017	220	1616	1183	216	444	8.224	7.397	442	.228-243	.010/.025	.007
020	991	798	018	221	1678	1245	217	446	8.474	7.647	443	.244-245	.010/.025	.007
021	1053	860	019	222	1741	1308	218	446	8.724	7.897	444	.248-256	.015/.030	.008
022	1116	923	020	223	1867	1434	220	447	9.274	8.147	445	.323-327	.015/.030	.007
023	1178	985	021	224	1992	1559	222	448	9.724	8.397	446	.342-349	.015/.030	.007
024	1241	1048	022	225	2118	1685	223	449	10.474	9.647	448	.423-438	.009	.009
025	1303	1110	023	226	2243	1810	224	450	10.974	10.147	449	.439-445	.010	.010
026	1366	1173	024	227	2368	1935	225	451	11.474	10.647	450	.446	.010	.010
027	1428	1235	025	228	2493	2060	226	452	11.974	11.147	451			
028	1491	1298	026	229	2618	2185	227	453	12.474	11.647	452			
				230	2743	2310	228	454	12.974	12.147	453			
110	550	255	107	231	2868	2435	229	455	13.474	12.647	454			
111	613	318	109	232	2993	2560	230	456	13.974	13.147	455			
112	675	381	110	233	3118	2685	231	457	14.474	13.647	456			
113	738	443	112	234	3243	2810	232	458	14.974	14.147	457			
114	800	505	113	235	3368	2935	233	459	15.474	14.647	458			
115	863	568	114	236	3493	3060	234	460	15.974	15.147	459			
116	925	630	115	237	3618	3185	235	460	16.474	15.647	459			
117	991	693	116	238	3743	3310	236	460	16.974	16.147	459			
118	1053	755	117	239	3868	3435	237	460	17.474	16.647	459			
119	1116	818	117	240	3993	3560	238	460	17.974	17.147	459			
120	1178	883	118	241	4118	3685	239	460	18.474	17.647	459			
121	1241	946	119	242	4243	3810	240	460	18.974	18.147	459			
122	1303	1008	120	243	4368	3935	241	460	19.474	18.647	459			
123	1366	1071	121	244	4493	4060	242	460	19.974	19.147	459			
124	1428	1133	122	245	4618	4185	243	460	20.474	19.647	459			
125	1491	1196	123	246	4743	4310	244	460	20.974	20.147	459			
126	1553	1258	124	247	4868	4435	245	460	21.474	20.647	459			
127	1616	1321	125	248	4993	4560	246	460	21.974	21.147	459			
128	1678	1383	126	249	5118	4685	247	460	22.474	21.647	459			
129	1741	1446	127	250	5243	4810	248	460	22.974	22.147	459			
130	1805	1510	128	251	5368	4935	249	460	23.474	22.647	459			
131	1867	1572	129	252	5493	5060	250	460	23.974	23.147	459			
132	1930	1635	129	253	5618	5185	251	460	24.474	23.647	459			
133	1992	1697	130	254	5743	5310	252	460	24.974	24.147	459			
134	2055	1760	131	255	5868	5435	253	460	25.474	24.647	459			
135	2118	1823	132	256	5993	5560	254	460	25.974	25.147	459			
136	2181	1885	133	257	6118	5685	255	460	26.474	25.647	459			
137	2243	1948	133	258	6243	5810	256	460	26.974	26.147	459			
138	2305	2010	135	259	6368	5935	257	460	27.474	26.647	459			
139	2368	2073	136	260	6493	6060	258	460	27.974	27.147	459			
140	2430	2135	137	261	6618	6185	259	460	28.474	27.647	459			
141	2493	2198	138	262	6743	6310	260	460	28.974	28.147	459			
142	2555	2260	139	263	6868	6435	261	460	29.474	28.647	459			
143	2618	2323	140	264	6993	6560	262	460	30.474	29.647	459			
144	2680	2385	141	265	7118	6685	263	460	31.474	30.647	459			
145	2743	2448	142	266	7243	6810	264	460	31.974	31.147	459			
146	2805	2510	143	267	7368	6935	265	460	32.474	31.647	459			
147	2868	2573	144	268	7493	7060	266	460	32.974	32.147	459			
148	2930	2635	145	269	7618	7185	267	460	33.474	32.647	459			
149	2993	2698	146	270	7743	7310	268	460	33.974	33.147	459			



NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR ROTO GLYD RING[®]
 IN TRELLEBORG SEALING SOLUTIONS ROTO GLYD RING[®] PISTON GLANDS.
 2. ORDERING EXAMPLE:
 TGP2.0 B.214 A.119 NG
 ROTO GLYD RING[®] PISTON DESIGNATOR
 SEAL CROSS SECTION
 0 = -0XX SERIES
 1 = -1XX SERIES
 2 = -2XX SERIES
 3 = -3XX SERIES
 4 = -4XX SERIES
 5 = -5XX SERIES
 DESIGN CHARACTERISTICS
 0 = WITHOUT NOTCHES & WITH ROTLOK
 GLAND STANDARD
 B = TRELLEBORG SEALING SOLUTIONS
 DASH GLAND STANDARD
 ACCORDING TO TRELLEBORG SEALING SOLUTIONS
 GLAND INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON[®] ROTO GLYD RING[®] MAT'L. CODE
 TURELL[®] O-RING MAT'L. CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE
 DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

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INCH	2009_11
 TRELLEBORG SEALING SOLUTIONS	
THE ROTO GLYD RING[®] DRAWING NO. TGPOOB00	

WORLD AEROSPACE TITLE BLOCK REV.



Turcon[®] Roto Glyd Ring[®]

Other elements used in sealing configurations

Polymer bearings.....	235
Turcon® Excluder® and Scrapers	249
Turcon® Face Seals	267
O-Rings.....	281



Polymer Bearings

Features and benefits

- Prevent metal-to-metal contact
- Low friction
- Resist side loading
- Weight savings potential of 4:1 compared to metal bearings, depending on material and configuration selection
- Cost-effective
- High load bearing capacity, both static and dynamic operation
- Eliminate local stress concentrations
- Eliminate hydrodynamic problems in the guide system
- Very wear-resistant, providing long service life
- Eliminate galling between components
- Good friction characteristics
- Damp mechanical vibrations
- Protect against diesel effect
- Low maintenance costs
- Easy installation

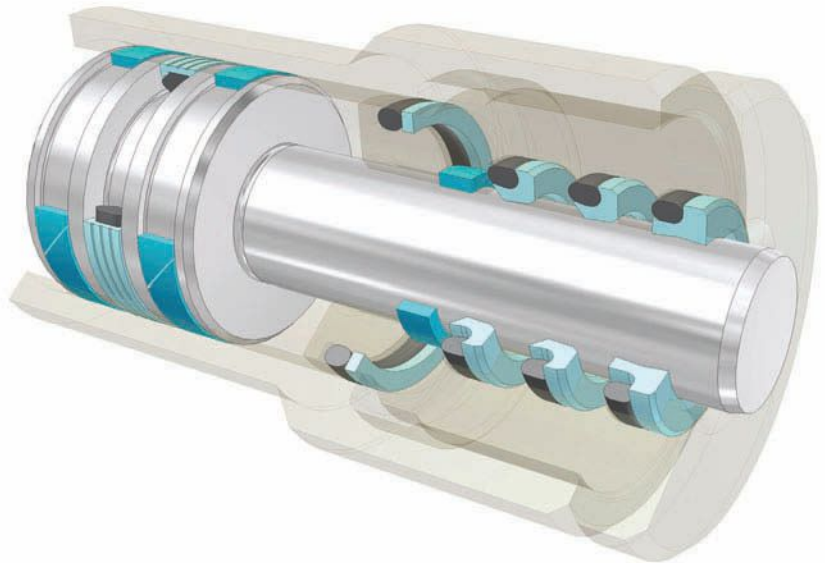


Illustration shows hydraulic cylinder fitted with Turcon® Slydring® and Wear Rings.

Polymer Bearings

Description

The purpose of polymer bearings is to guide the piston and rod of a working cylinder, absorbing any transverse forces which may occur. They prevent metal-to-metal contact, optimizing the performance of the sealing system.

In the past the use of bearings was limited in aerospace applications. This was due to limitations imposed by gland standard AS4716 and the minimum required clearance gaps necessary to minimize seal extrusion. To fit polymer bearings, hardware clearance gaps need to be larger than specified in the standard.

However, due to the trend towards higher hydraulic pressures in aerospace systems and the resulting increased side loads, the use of bearings has become necessary in an increasing number of applications. They are needed to protect primary seal components and hardware so optimum sealing performance and service life can be achieved.

Polymer bearings offer major benefits over traditional metal bearings, in particular to help meet the weight reduction goals of today's aerospace designers. On average, depending on material and configuration, a polymer bearing is a quarter of the weight of a metal one.

Cost-effective, polymer bearings are very wear-resistant, providing long service life. They offer high load bearing capacity in static and dynamic operation, have good friction characteristics and damp mechanical vibrations. They also eliminate local stress concentrations, galling between components and hydrodynamic problems in the guide system. In addition, they protect against the diesel effect where combustion of pockets of oil vapor caused by rapid changes of pressure can damage seals.

Designs

Four different types of bearing materials are available depending on application demands:

- Highly wear-resistant, low-friction, specially modified **Turcon**® PTFE based materials. For low to medium loads. Supplied as the Trelleborg Sealing Solutions proprietary **Slydring**®.
- **Orkot**® fabric composite materials for high loads and transverse forces. Supplied as Wear Ring.
- **Zurcon**® high-modulus thermoplastic provides long service life in high loads and temperatures. Supplied as Wear Ring.
- **HiMod**® high-modulus thermoplastic for use in extreme working conditions. Supplied as **Slydring**®.

Bearing Features

Though bearings appear to be simple in design, their function of preventing metal-to-metal contact within a sealing system is complex. Selection of the correct material and configuration is critical to ensure optimized performance and service life.

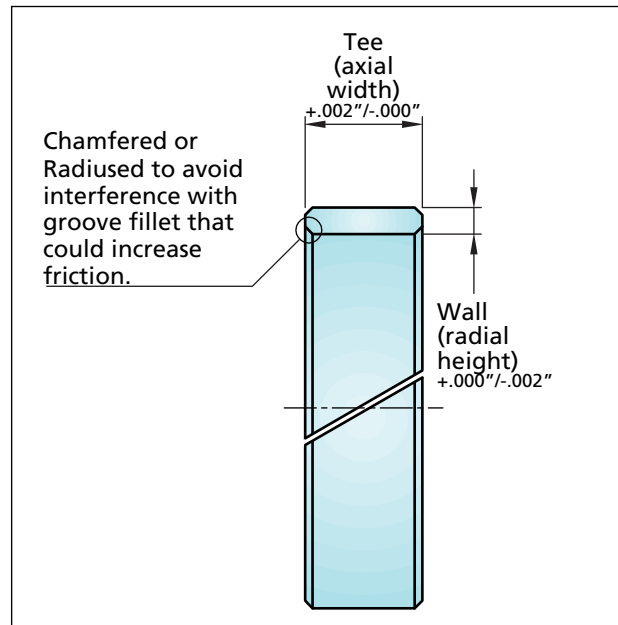








Figure 1 Bearing Features. Tolerance is for reference only.

Polymer Bearings

Table I Turcon® Slydring®

Piston and Rod Bearing				
Cross Section		Description	Part Number	Available AS4716 Dash Sizes (1)
	Piston	Turcon® Slydring® 1/32 Thick, Maximum .032" / 0.79 mm Wall	GP0_X (S34545)	006-012, 110-116, 137, 210-219, 222, 328, 339, 347
		Turcon® Slydring® 1/16 Thick, Maximum .063" / 1.59 mm Wall	GP0_W (S34546)	110-116, 210-222, 325-349
		Turcon® Slydring® 3/32 Thick, Maximum .094" / 2.38 mm Wall	GP0_Y (S34547)	328, 334-339, 425-449, 455
	Rod	Turcon® Slydring® 1/32 Thick, Maximum .032" / 0.79 mm Wall	GR0_X (S34548)	006-011, 110-115, 210-222
		Turcon® Slydring® 1/16 Thick, Maximum .063" / 1.59 mm Wall	GR0_W (S34549)	110-115, 210-221, 325-349
		Turcon® Slydring® 3/32 Thick, Maximum .094" / 2.38 mm Wall	GR0_Y (S34550)	337-348, 425-449









Notes:

1) Available dash numbers are limited by Turcon® Slydring® nominal wall thickness and AS4716 bore or rod diameter - where common rod or bore sizes are covered by different cross sections numbers but are the same dimensionally, i.e. AS4716-223 and AS4716-325 are both for a bore diameter of 1.867 inches / 47.42 mm.

Wear Ring in bearing material Orkot® and Zurcon® and Slydring® in bearing material HiMod® use special part numbers due to tolerance and temperature variations. For other sizes, bearing widths and depths not in the catalog consult your local Trelleborg Sealing Solutions marketing company.

Polymer Bearings

Table II Selection Criteria for bearings

Material	Filler	Technical Data		Application
		Temperature	Velocity	
Turcon® T10 	Carbon and graphite-filled PTFE	-320 to +500°F -196 to +260°C	49 ft/s 15 m/s	Good wear resistance and low friction. A bearing material used in poorly lubricated applications. In the Americas use Turcon® T11 in the part number.
Turcon® T19 	Mineral fibers and Molydenum Disulfide (MoS ₂)	-320 to +500°F -196 to +260°C	49 ft/s 15 m/s	Good deformation resistance and low friction. Well suited for use in flight controls and utility actuators.
Turcon® T46 	Bronze-filled medium PTFE	-320 to +500°F -196 to +260°C	49 ft/s 15 m/s	Excellent deformation resistance and stability. Used for applications above 5,800 psi/ 40 MPa. Not recommended for non-lubricated applications.
Orkot® C380* 	Polyester resin, polyester fine mesh and PTFE	-328 to +266°F -200 to +130°C	3.3 ft/s 1 m/s	High wear resistance with good sliding properties. For use in red oil only.
Orkot® C324* 	Vinylester resin and Nomex® fine mesh	-328 to +482°F -200 to +250°C	3.3 ft/s 1 m/s	Developed for high-temperature applications. For use in phosphate ester. Test Report R1081 available on request.
Zurcon® Z43* 	PEEK™, PTFE and carbon	-65 to +500°F -54 to +260°C	16 ft/s 5 m/s	For high-temperature and pressure service. Good chemical compatibility. Can be used for structural parts, such as piston heads.
HiMod® 914* 	PEEK™, thermoplastic, carbon and PTFE	-65 to +500°F -54 to +250°C	16 ft/s 5 m/s	Self-lubricating, chemical-resistant bearing developed for the most severe and critical applications.
HiMod® 924* 	PEEK and carbon fiber	-65 to +500°F -54 to +250°C	8 ft/s 2.4 m/s	High-temperature, high-modulus material with low thermal expansion, high strength and high compressive properties.

* Require a special part number

Polymer Bearings

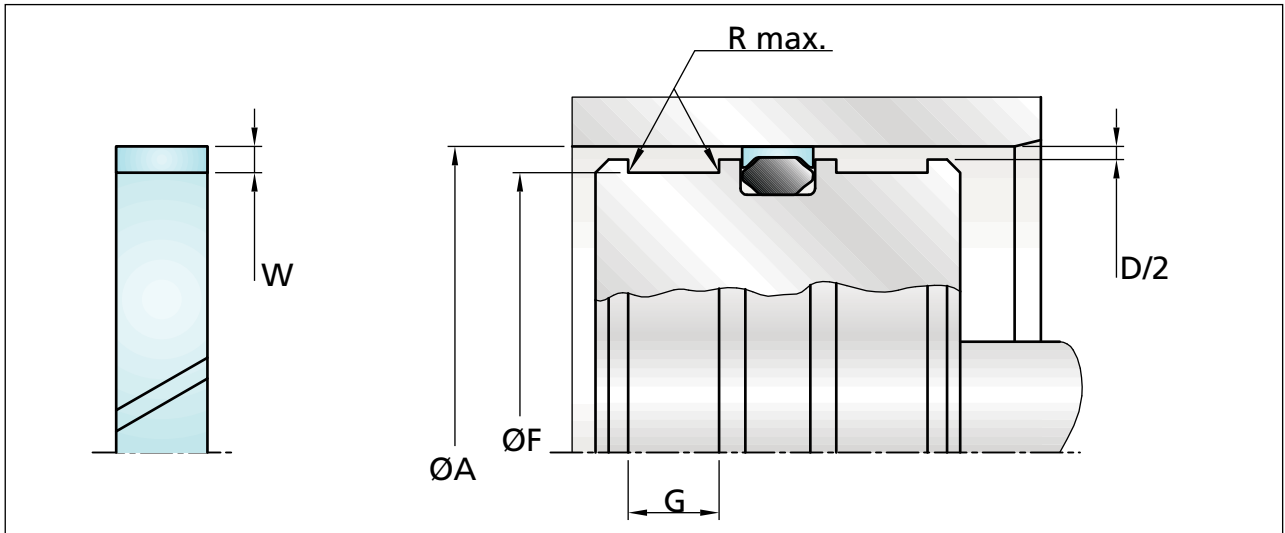


Figure 2 Sealing system with bearings - piston

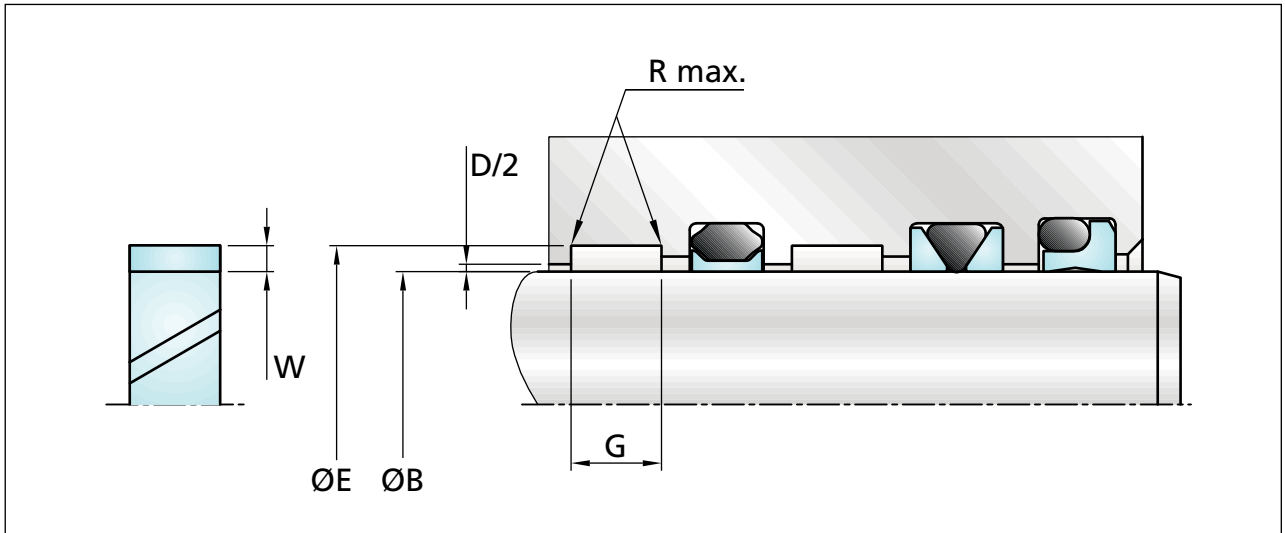


Figure 3 Sealing system with bearings - rod

Note: Wear Ring in Orkot® and Zurcon® require special part numbers due to tolerance and temperature variations.

Other elements

Polymer Bearings

Calculating the Proper Bearing Exposure

The bearing running clearance, or bearing exposure, is the least understood and the most frequently encountered problem in the design of polymer bearings. Due to the difference in thermal behavior during operation of polymer materials, they require larger running clearances than those recommended for metal bearings. Insufficient running clearances are often the cause of polymer bearing failures, so care should be taken in specifying these.

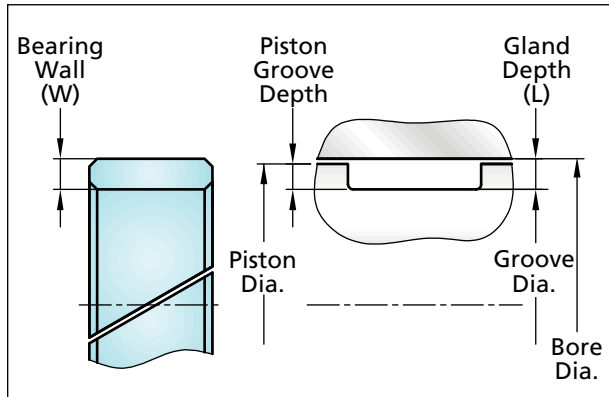


Figure 4 Bearing Exposure Variables

It is recommended that unless side load is extremely low, start with a bearing exposure of .005 inch/ 0.127 mm minimum.

As a guide:

Piston groove depth maximum equals piston diameter maximum minus groove diameter minimum.

Piston groove depth minimum equals piston diameter minimum minus groove diameter maximum.

Bearing exposure minimum equals bearing wall minimum minus piston groove depth maximum.

Bearing exposure maximum equals bearing wall maximum minus piston groove depth minimum.

To ensure that bearing exposure is correctly specified consult your local Trelleborg Sealing Solutions marketing company.

Calculate Bearing Length

A rough estimate of the number and width of the bearings required within an application can be calculated from the formula in the figure below.

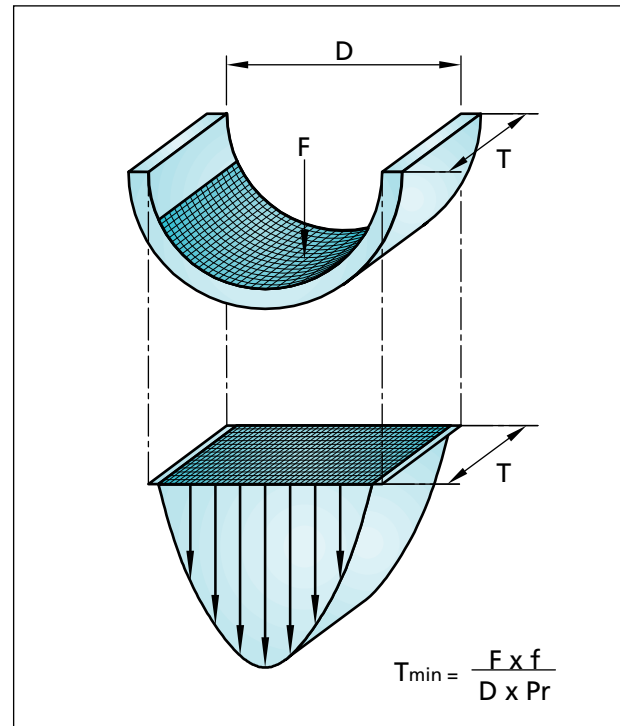


Figure 5 Bearing T

Where:

- F = Maximum radial load
- f = Safety factor
- D = Rod/Bore diameter
- Pr = Permissible dynamic load

Running Velocity

Bearing surface speed is calculated as follows:

For rotary applications:

$$- V = (D \times \pi \times \text{RPM})/12$$

For reciprocating applications:

$$- V = (LS \times C \times 2)/12$$

Where:

- V = Velocity
- D = Dynamic diameter
- LS = Length of stroke
- C = Cycles per minute

Multiply V by the system pressure to get PV.

Polymer Bearings

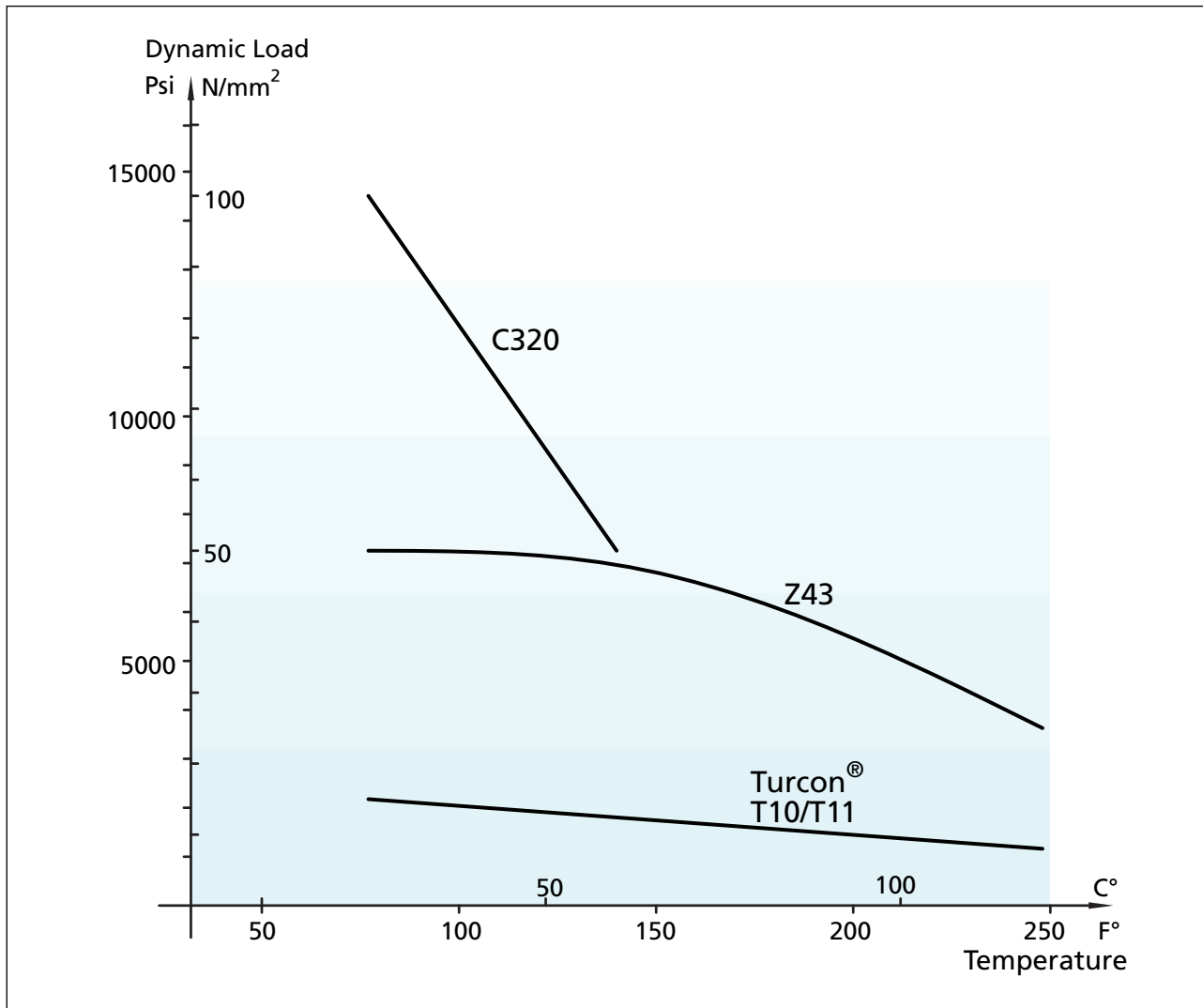
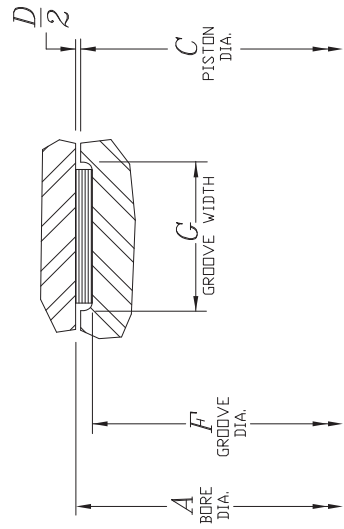


Figure 6 Permissible dynamic load bearing materials

Other elements

Polymer Bearings

DASH NO.	A DIA.	F DIA.	C DIA.	D DIA. CLEARANCE		Y SLYDRING EXPOSURE
				MIN.	MAX.	
110	.590	.424	.536	.016	.010/.016	
111	.615	.459	.571			
112	.640	.494	.606			
113	.738	.612	.724			
114	.800	.674	.786			
115	.863	.737	.849			
116	.925	.799	.911	.016	.010/.016	
	+0.02	+0.00	+0.00			
	-0.00	-0.01	-0.01			
130	1.805	1.679	1.791	.016	.010/.016	
132	1.930	1.804	1.916			
134	2.055	1.929	2.041			
136	2.180	2.054	2.166			
138	2.305	2.179	2.291			
140	2.430	2.304	2.416			
142	2.555	2.429	2.541			
144	2.680	2.554	2.666			
146	2.805	2.679	2.791			
148	2.930	2.804	2.916	.016	.010/.016	
	+0.02	+0.00	+0.00			
	-0.00	-0.01	-0.01			
210	.991	.865	.977	.016	.010/.016	
211	1.053	.927	1.039			
212	1.115	.990	1.102			
213	1.178	1.052	1.164			
214	1.241	1.115	1.227			
215	1.303	1.177	1.289			
216	1.366	1.240	1.352			
217	1.428	1.302	1.414			
218	1.491	1.365	1.477			
219	1.553	1.427	1.539			
220	1.616	1.490	1.602			
221	1.678	1.552	1.664			
222	1.741	1.615	1.727	.016	.010/.016	
	+0.02	+0.00	+0.00			
	-0.00	-0.01	-0.01			
325	1.867	1.741	1.853	.016	.010/.016	
326	1.992	1.866	1.978			
327	2.118	1.992	2.104			
328	2.243	2.117	2.229	.016	.010/.016	
	+0.02	+0.00	+0.00			
	-0.00	-0.02	-0.02			
329	2.368	2.242	2.354	.018	.010/.018	
330	2.493	2.367	2.479			
331	2.618	2.492	2.604			
332	2.743	2.617	2.729			
333	2.868	2.742	2.854			
334	2.993	2.867	2.979			
335	3.118	2.992	3.104			
336	3.243	3.117	3.229			
337	3.368	3.242	3.354			
338	3.493	3.367	3.479			
339	3.618	3.492	3.604			
340	3.743	3.617	3.729			
341	3.868	3.742	3.854			
342	3.993	3.867	3.979			
343	4.118	3.992	4.104			
344	4.243	4.117	4.229			
345	4.368	4.242	4.354			
346	4.493	4.367	4.479			
347	4.618	4.492	4.604			
348	4.743	4.617	4.729			
349	4.868	4.742	4.854	.018	.010/.018	



FOR TRELLEBORG SEALING SOLUTIONS 1/16" SLYDRING® GLANDS

- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SLYDRING® IN PISTON GLANDS.
 - ORDERING EXAMPLE:
 GP 04 V B 214 A T46
 PISTON SLYDRING® DESIGNATOR
 GROOVE WIDTH DESIGNATOR
 A SEE GROOVE WIDTH TABLE
 GROOVE DEPTH DESIGNATOR
 W = 1/16" WALL (.063")
 GL = TRELLEBORG SEALING SOLUTIONS
 B = TRELLEBORG SEALING SOLUTIONS
 SIZE DESIGNATOR
 A ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 TURETTIT® SLYDRING® MAT'L CODE
 QUALITY INDEX AND CERTIFICATE OF CONFORMANCE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - GROOVE WIDTH DESIGNATOR LISTED IN ABOVE TABLE. MINIMUM GROOVE WIDTH INCREASE IN 1/16" INCREMENTS WITH MAXIMUM OF 1000 INCHES.
 - DASH SIZES CORRESPOND TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD WHICH REPRESENT BORE DIAMETERS 0.0550" THROUGH 4.868" OF AS4716.
 - THE USE OF A SLYDRING® RESULTS IN DIAMETRAL CLEARANCES, D, WHICH EXCEED THOSE SPECIFIED IN AS4716.
 - THIS PART NUMBER REPRESENTS TURCOT® SLYDRING® BEARINGS ONLY FOR BEARINGS IN ZIRCONIUM DRYKIT® MATERIALS, PLEASE CONTACT TRELLEBORG SEALING SOLUTIONS.

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TRELLEBORG SEALING SOLUTIONS

THE SLYDRING® PISTON DRAWING NO. GPOOWB00

WORLD AEROSPACE TITLE BLOCK REV.

Polymer Bearings

DASH NO.	A DIA.	F DIA.	C DIA.	D DIA. MAX.	Y SLYDRING EXPOSURE
006	.235	.171	.221	.016	.010/.016
007	.266	.202	.232		
008	.297	.233	.263		
009	.329	.265	.315		
010	.360	.296	.346		
011	.422	.358	.408		
012	.485	.421	.471	.016	.010/.016
	+0.002	+0.000	+0.000		
	-0.000	-0.001	-0.001		
110	.550	.486	.536	.017	.010/.016
111	.613	.549	.599		
112	.675	.611	.661		
113	.738	.674	.724		
114	.800	.736	.786		
115	.863	.799	.849		
116	.925	.861	.911	.017	.010/.016
	+0.002	+0.000	+0.000		
	-0.000	-0.001	-0.001		
137	2.243	2.179	2.229	.017	.010/.016
	+0.002	+0.000	+0.000		
	-0.000	-0.001	-0.001		
210	.991	.927	.977	.017	.010/.016
211	1.053	.989	1.039		
212	1.116	1.052	1.102		
213	1.178	1.114	1.164		
214	1.241	1.177	1.227		
215	1.303	1.239	1.289		
216	1.366	1.302	1.352		
217	1.428	1.364	1.414		
218	1.491	1.427	1.477		
219	1.553	1.489	1.539		
220	1.616	1.552	1.602		
221	1.678	1.614	1.664		
222	1.741	1.677	1.727	.017	.010/.016
	+0.002	+0.000	+0.000		
	-0.000	-0.001	-0.001		
325	1.867	1.803	1.853	.017	.010/.016
326	1.929	1.865	1.915		
327	2.012	2.053	2.104		
328	2.243	2.179	2.229		
329	2.368	2.304	2.354		
330	2.493	2.429	2.479		
331	2.618	2.554	2.604		
332	2.743	2.679	2.729		
333	2.868	2.804	2.854		
334	2.993	2.929	2.979		
335	3.118	3.054	3.104		
336	3.243	3.179	3.229		
337	3.368	3.304	3.354		
338	3.493	3.429	3.479		
339	3.618	3.554	3.604		
340	3.743	3.679	3.729		
341	3.868	3.804	3.854		
342	3.993	3.929	3.979		
343	4.118	4.054	4.104		
344	4.243	4.179	4.229		
345	4.368	4.304	4.354		
346	4.493	4.429	4.479		
347	4.618	4.554	4.604		
348	4.743	4.679	4.729		
349	4.868	4.804	4.854	.017	.010/.016

GROOVE WIDTH DESIGNATOR	G GROOVE WIDTH	R RADIUS
01	.073/.083	
02	.135/.145	
03	.197/.207	
04	.260/.270	
05	.323/.333	
06	.385/.395	
07	.448/.458	
08	.510/.520	.010/.020
09	.573/.583	
10	.635/.645	
11	.698/.708	
12	.760/.770	
13	.823/.833	
14	.885/.895	
15	.948/.958	
16	1.010/1.020	

1/32" SLYDRING® WALL RADIAL THICKNESS

PISTON SEALING SOLUTIONS 1/32" SLYDRING® GLANDS

PISTON BEARING INSTALLATION

FOR TRELLEBORG SEALING SOLUTIONS 1/32" SLYDRING® GLANDS

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SLYDRING® IN PISTON GLANDS.
- ORDERING EXAMPLE:
 PISTON SLYDRING® DESIGNATOR
 GROOVE WIDTH DESIGNATOR
 GROOVE WIDTH TABLE
 GROOVE DEPTH DESIGNATOR
 X = 1/32" WALL (.032")
 GLAND TRELLEBORG SEALING SOLUTION
 B = GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO TRELLEBORG SEALING SOLUTIONS QUALITY INDEX
 TURETTOUR SPACE CENTER
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- GROOVE WIDTH DESIGNATOR LISTED IN ABOVE TABLE. MINIMUM GROOVE WIDTH INCREASE IN 1/16" INCREMENTS WITH MAXIMUM OF 1.000 INCHES.
- DASH SIZES CORRESPOND TO TRELLEBORG SEALING SOLUTIONS GLAND CLEARANCES; D, WHICH REPRESENT BORE DIAMETERS 0.25" THROUGH 4.868" OF AS4716.
- THE USE OF A SLYDRING® RESULTS IN DIAMETRAL CLEARANCES; D, WHICH EXCEED THOSE SPECIFIED IN AS4716.
- THIS PART NUMBER REPRESENTS TURCO® SLYDRING® BEARINGS ONLY FOR BEARINGS IN ZURICH® AND DRKOT® MATERIALS, PLEASE CONTACT TRELLEBORG SEALING SOLUTIONS.

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TITLE
SLYDRING® PISTON

DRAWING NO.
GPOXBOO

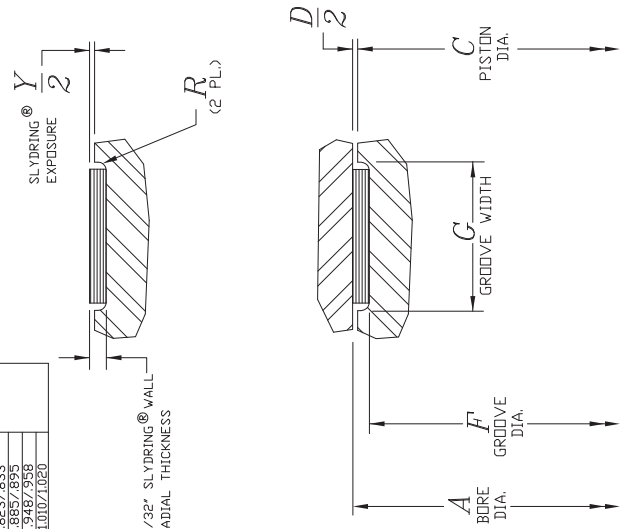
TRELLEBORG
 SEALING SOLUTIONS

Other elements

WORLD AEROSPACE TITLE BLOCK REV.

Polymer Bearings

DASH NO.	A DIA.	F DIA.	C DIA.	D DIA. CLEARANCE MAX.	Y SLYDRING EXPOSURE	GROOVE WIDTH DESIGNATOR	G GROOVE WIDTH	R RADIUS
325	+0.02 -0.00	+0.00 -0.02	+0.00 -0.02	.018	.010/.018	01	.073/.083	
326	1.867 1.992	1.679 1.804	1.853 1.978	.018	.010/.018	02	.158/.208	
327	+0.02 -0.00	+0.00 -0.02	+0.00 -0.02	.018	.010/.018	03	.260/.270	.010/.020
328	2.118	1.930	2.104	.018	.010/.018	04	.323/.333	
329	2.243	2.055	2.229	.018	.010/.018	05	.385/.395	
330	2.366	2.180	2.354	.018	.010/.018	06	.448/.458	
331	2.493	2.305	2.479	.018	.010/.018	07	.510/.520	
332	2.618	2.430	2.604	.018	.010/.018	08	.572/.583	
333	2.743	2.555	2.729	.018	.010/.018	09	.634/.645	
334	2.868	2.680	2.854	.018	.010/.018	10	.696/.707	
335	2.993	2.805	2.979	.018	.010/.018	11	.758/.769	
336	3.118	2.930	3.104	.018	.010/.018	12	.820/.831	
337	3.243	3.055	3.229	.018	.010/.018	13	.882/.893	
338	3.368	3.180	3.354	.018	.010/.018	14	.944/.955	
339	3.493	3.305	3.479	.018	.010/.018	15	1.006/.1017	
340	3.618	3.430	3.604	.018	.010/.018	16		
341	3.743	3.555	3.729	.018	.010/.018			
342	3.868	3.680	3.854	.018	.010/.018			
343	3.993	3.805	3.979	.018	.010/.018			
344	+0.03 -0.00	+0.00 -0.02	+0.00 -0.02	.019	.010/.018			
345	4.243	4.055	4.229	.019	.010/.018			
346	4.368	4.180	4.354	.019	.010/.018			
347	4.493	4.305	4.479	.019	.010/.018			
348	4.618	4.430	4.604	.019	.010/.018			
349	4.743	4.555	4.729	.019	.010/.018			
425	+0.03 -0.00	+0.00 -0.02	+0.00 -0.02	.019	.010/.018			
426	4.974	4.786	4.960	.019	.010/.018			
427	5.099	4.911	5.085	.019	.010/.018			
428	5.224	5.036	5.210	.019	.010/.018			
429	5.349	5.161	5.335	.019	.010/.018			
430	5.474	5.286	5.460	.019	.010/.018			
431	5.599	5.411	5.585	.019	.010/.018			
432	5.724	5.536	5.710	.019	.010/.018			
433	5.849	5.661	5.835	.019	.010/.018			
434	5.974	5.786	5.960	.019	.010/.018			
435	6.099	5.911	6.085	.019	.010/.018			
436	6.224	6.036	6.210	.019	.010/.018			
437	6.349	6.161	6.335	.019	.010/.018			
438	6.474	6.286	6.460	.019	.010/.018			
439	6.599	6.411	6.536	.019	.010/.018			
440	6.724	6.536	6.710	.019	.010/.018			
441	6.849	6.661	6.835	.019	.010/.018			
442	6.974	6.786	6.960	.019	.010/.018			
443	7.099	6.911	7.085	.019	.010/.018			
444	7.224	7.036	7.210	.019	.010/.018			
445	7.349	7.161	7.335	.019	.010/.018			
446	7.474	7.286	7.460	.019	.010/.018			
447	7.599	7.411	7.536	.019	.010/.018			
448	7.724	7.536	7.710	.019	.010/.018			
449	7.849	7.661	7.835	.019	.010/.018			
450	7.974	7.786	7.960	.019	.010/.018			
451	8.099	7.911	8.085	.019	.010/.018			
452	8.224	8.036	8.210	.019	.010/.018			
453	8.349	8.161	8.335	.019	.010/.018			
454	8.474	8.286	8.460	.019	.010/.018			
455	8.599	8.411	8.536	.019	.010/.018			



- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SLYDRING® IN PISTON GLANDS.
 - ORDERING EXAMPLE:
 GP 04 Y B 214 A 146
 PISTON SLYDRING® DESIGNATOR
 GROOVE WIDTH DESIGNATOR
 SEE GROOVE WIDTH TABLE
 GROOVE DEPTH DESIGNATOR
 GLAND SIZE WALL (.094")
 G = TRELLEBORG SEALING SOLUTIONS
 B = GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 QUALITY INDEX
 ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 TURCITT® SLYDRING® MAT'L CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - GROOVE WIDTH DESIGNATOR LISTED IN ABOVE TABLE. MINIMUM GROOVE WIDTH INCREASE IN 1/16" INCREMENTS WITH MAXIMUM OF 1000 INCHES IN AS4716.
 - DASH SIZES CORRESPOND TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD, WHICH REPRESENTS BORE DIAMETERS 1.867" THROUGH 13.474" OF AS4716.
 - THE USE OF A SLYDRING® RESULTS IN DIAMETRAL CLEARANCES, D, WHICH EXCEED THOSE SPECIFIED IN AS4716.
 - FOR BEARINGS IN ZIRCONIUM OXIDE MATERIALS, PLEASE CONTACT TRELLEBORG SEALING SOLUTIONS.

PISTON BEARING INSTALLATION
 FOR TRELLEBORG SEALING SOLUTIONS 3/32" SLYDRING® GLANDS

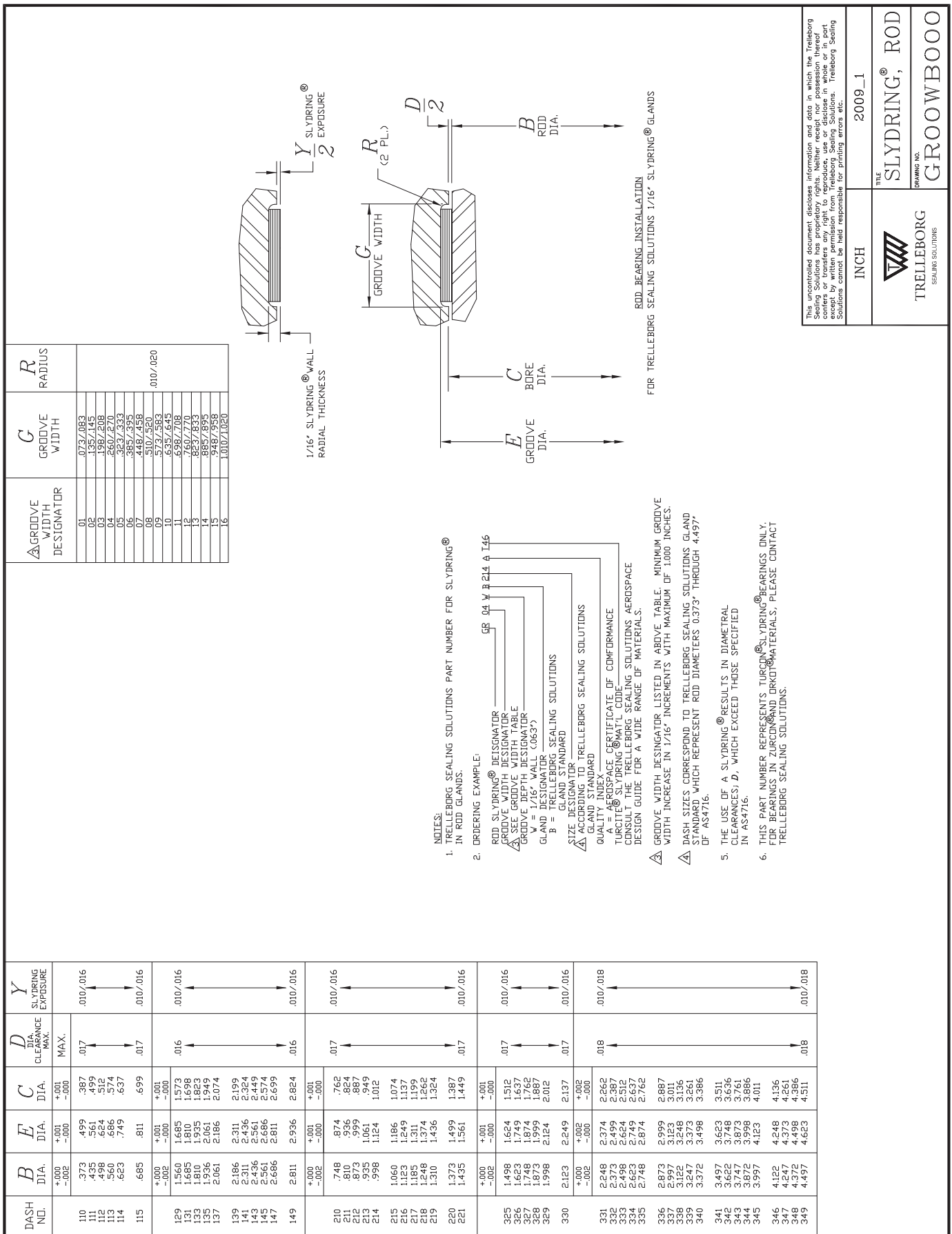
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TRELLEBORG SEALING SOLUTIONS

THE SLYDRING®, PISTON DRAWING NO. GPOYBOOO

Polymer Bearings



Polymer Bearings

DASH NO.	B DIA.	E DIA.	C DIA.	D DIA. CLEARANCE MAX.	Y SLYDRING® EXPOSURE
006	.123	.187	.137	.016	.010/.016
007	.154	.218	.166	↑	↑
008	.187	.249	.197	↑	↑
009	.217	.281	.231	↑	↑
010	.248	.312	.262	↑	↑
011	.310	.374	.324	.016	.010/.016
110	.373	.437	.387	.017	.010/.016
111	.435	.499	.449	↑	↑
112	.498	.562	.512	↑	↑
113	.560	.624	.574	↑	↑
114	.623	.687	.637	↑	↑
115	.685	.749	.699	.017	.010/.016
210	.748	.812	.762	.017	.010/.016
211	.810	.874	.824	↑	↑
212	.873	.937	.887	↑	↑
213	.935	.999	.949	↑	↑
214	.998	1.062	1.012	↑	↑
215	1.060	1.124	1.074	↑	↑
216	1.123	1.187	1.137	↑	↑
217	1.185	1.249	1.199	↑	↑
218	1.248	1.312	1.262	↑	↑
219	1.310	1.374	1.324	↑	↑
220	1.373	1.437	1.387	↑	↑
221	1.435	1.499	1.449	↑	↑
222	1.498	1.562	1.512	↑	↑

△ GROOVE WIDTH DESIGNATOR	G GROOVE WIDTH	R RADIUS
01	.073/.083	
02	.135/.145	
03	.197/.207	
04	.260/.270	
05	.323/.333	
06	.385/.395	
07	.448/.458	
08	.510/.520	.010/.020
09	.573/.583	
10	.636/.646	
11	.699/.709	
12	.760/.770	
13	.823/.833	
14	.885/.895	
15	.948/.958	
16	1.010/1.020	

1/32" SLYDRING® WALL RADIAL THICKNESS

Y SLYDRING® EXPOSURE

G GROOVE WIDTH

R (2 PL.)

D ROD DIA.

B

C BORE DIA.

E GROOVE DIA.

FOR TRELLEBORG SEALING SOLUTIONS 1/32" SLYDRING® GLANDS

FOR TRELLEBORG SEALING SOLUTIONS 1/32" SLYDRING® GLANDS

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SLYDRING® IN ROD GLANDS.
- ORDERING EXAMPLE:
 GR 04 X B 214 A 146
 ROD SLYDRING® DESIGNATOR
 GROOVE WIDTH DESIGNATOR
 △ SEE GROOVE WIDTH TABLE
 GROOVE DEPTH DESIGNATOR
 X IS 1/32" WALL (.032")
 GND TRELLEBORG SEALING SOLUTIONS
 B = TRELLEBORG SEALING SOLUTIONS
 SIZE DESIGNATOR
 △ ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 QUALITY INDEX
 △ SEE CERTIFICATE OF CONFORMANCE
 TURECIT@SLYDRING.COM CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- GROOVE WIDTH DESIGNATOR LISTED IN ABOVE TABLE. MINIMUM GROOVE WIDTH INCREASE IN 1/16" INCREMENTS WITH MAXIMUM OF 1.000 INCHES.
- DASH SIZES CORRESPOND TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD WHICH REPRESENTS ROD DIAMETERS .0123" THROUGH 1.498" OF AS4716.
- THE USE OF A SLYDRING® RESULTS IN DIAMETRAL CLEARANCES: D, WHICH EXCEED THOSE SPECIFIED IN AS4716.
- THIS PART NUMBER REPRESENTS TURCO@SLYDRING.COM BEARINGS ONLY FOR BEARINGS IN ZURCO@AND ORKOT@ MATERIALS, PLEASE CONTACT TRELLEBORG SEALING SOLUTIONS.

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 TRELLEBORG SEALING SOLUTIONS	TITLE SLYDRING®, ROD DRAWING NO. GROOXBOO

Polymer Bearings

DASH NO.	B DIA.	E DIA.	C DIA.	D DIA. CLEARANCE MAX.	Y SLYDRING® EXPOSURE
337	2.997	3.185	3.011	.018	.010/.018
338	3.122	3.310	3.136		
339	3.257	3.435	3.261		
340	3.392	3.560	3.396		
341	3.497	3.685	3.511		
342	3.622	3.810	3.636		
343	3.747	3.935	3.761		
344	3.872	4.060	3.886		
345	3.997	4.185	4.011		
346	4.122	4.310	4.136		
347	4.247	4.435	4.261		
348	4.372	4.560	4.386	.018	.010/.018
349	4.497	4.685	4.511		
350	4.622	4.810	4.636		
351	4.747	4.935	4.761		
352	4.872	5.060	4.886		
353	4.997	5.185	5.011		
354	5.122	5.310	5.136		
355	5.247	5.435	5.261		
356	5.372	5.560	5.386		
357	5.497	5.685	5.511		
358	5.622	5.810	5.636		
359	5.747	5.935	5.761		
360	5.872	6.060	5.886		
361	5.997	6.185	6.011		
362	6.122	6.310	6.136		
363	6.247	6.435	6.261		
364	6.372	6.560	6.386		
365	6.497	6.685	6.511		
366	6.622	6.810	6.636		
367	6.747	6.935	6.761		
368	6.872	7.060	6.886		
369	6.997	7.185	7.011		
370	7.122	7.310	7.136		
371	7.247	7.435	7.261		
372	7.372	7.560	7.386		
373	7.497	7.685	7.511		
374	7.622	7.810	7.636		
375	7.747	7.935	7.761		
376	7.872	8.060	7.886		
377	7.997	8.185	8.011		
378	8.122	8.310	8.136		
379	8.247	8.435	8.261		
380	8.372	8.560	8.386		
381	8.497	8.685	8.511		
382	8.622	8.810	8.636		
383	8.747	8.935	8.761		
384	8.872	9.060	8.886		
385	8.997	9.185	9.011		
386	9.122	9.310	9.136		
387	9.247	9.435	9.261		
388	9.372	9.560	9.386		
389	9.497	9.685	9.511		
390	9.622	9.810	9.636		
391	9.747	9.935	9.761		
392	9.872	10.060	9.886		
393	10.000	10.200	10.000		

Δ GROOVE WIDTH DESIGNATOR	G GROOVE WIDTH	R RADIUS
01	.073/.083	
02	.135/.145	
03	.197/.207	
04	.260/.270	
05	.323/.333	
06	.385/.395	
07	.448/.458	
08	.510/.520	
09	.573/.583	
10	.635/.645	
11	.698/.708	
12	.760/.770	
13	.823/.833	.010/.020
14	.885/.895	
15	.948/.958	
16	1.010/1.020	

3/32" SLYDRING® WALL RADIAL THICKNESS

Y SLYDRING® WALL RADIAL THICKNESS

G GROOVE WIDTH

R (2 PL.)

D

B ROD DIA.

C BORE DIA.

E GROOVE DIA.

FOR TRELLEBORG SEALING SOLUTIONS 3/32" SLYDRING® GLANDS

- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR SLYDRING® IN ROD GLANDS.
 - ORDERING EXAMPLE:
 ROD SLYDRING® DESIGNATOR: GR 04 Y B 214 A 145
 GROOVE WIDTH DESIGNATOR: Δ
 SEE GROOVE WIDTH TABLE
 GROOVE DEPTH DESIGNATOR: A
 Y = 3/32" WALL (.094")
 B = TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 SIZE DESIGNATOR: 214
 ACCORDING TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD
 QUALITY INDEX: A
 PLEASE CERTIFICATE OF CONFORMANCE TUREBORG SEALING SOLUTIONS AEROSPACE CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
- Δ GROOVE WIDTH DESIGNATOR LISTED IN ABOVE TABLE. MINIMUM GROOVE WIDTH INCREASE IN 1/16" INCREMENTS WITH MAXIMUM OF 1.000 INCHES
- Δ DASH SIZES CORRESPOND TO TRELLEBORG SEALING SOLUTIONS GLAND STANDARD WHICH REPRESENT ROD DIAMETERS E.997 THROUGH 9.997 OF AS4716.
5. THE USE OF A SLYDRING® RESULTS IN DIAMETRAL CLEARANCES, D, WHICH EXCEED THOSE SPECIFIED IN AS4716.
6. THIS PART NUMBER REPRESENTS TUREBORG SEALING SOLUTIONS BEARINGS ONLY FOR BEARINGS IN ZIRCONIUM AND ORKOT MATERIALS, PLEASE CONTACT TRELLEBORG SEALING SOLUTIONS.

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INCH	2009_1
 TRELLEBORG SEALING SOLUTIONS	TITLE SLYDRING®, ROD DRAWING NO. GROOYBOO

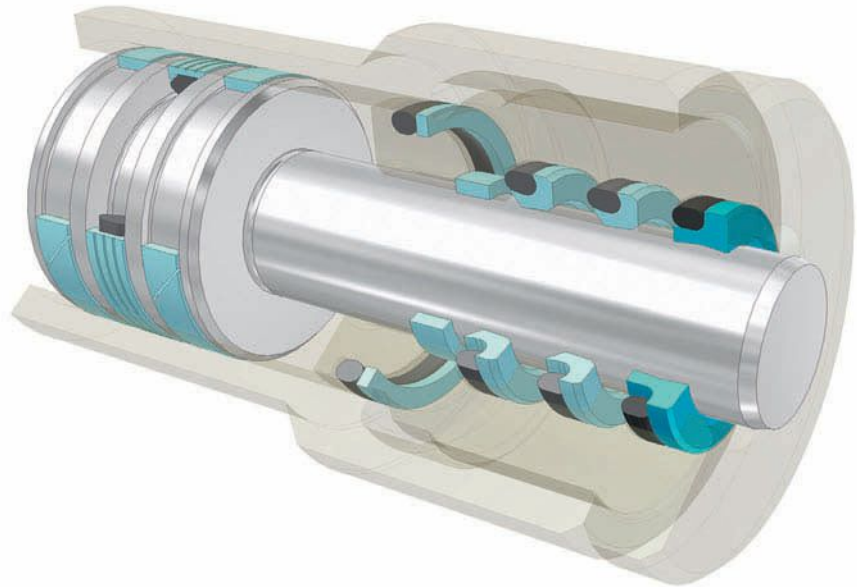


Polymer Bearings

Turcon® Excluder® and Scrapers

Features and benefits

- Prevent ingress of contaminants into sealing systems
- Protect sealing systems from damage by contaminants
- Can act as secondary sealing elements
- Can be designed to vent interstage pressure
- Scrapers can be matched to specific applications and gland sizes
- Eliminate rod scoring
- Low-friction
- Long service life
- Replace metallic scrapers



The Turcon® Excluder® DC shown here is a well proven scraping device that protects the sealing system from ingress of dirt and sand.

Turcon® Excluder® and Scrapers

Description

Scrapers are elements used in sealing configurations, usually consisting of a Turcon® PTFE based ring and elastomer O-Ring. Installed in hydraulic cylinders, they are designed to scrape dirt, foreign particles, chips or moisture from the piston rods as they retract into the system. This prevents contamination of the hydraulic medium that could damage wear rings, seals and other components.

Single-acting scrapers keep contamination from the outside. Double-acting scrapers also scrape off residual fluid film. They minimize the ingress of small particles into the system and act as a secondary seal, avoiding external leakage.

Trelleborg Sealing Solutions offers a wide range of scrapers. Specifically recommended for aerospace applications is Turcon® Excluder®, the Trelleborg Sealing Solutions proprietary design of double-acting scraper.

In addition, for systems with extreme working conditions, spring-energized scraper Turcon® Variseal® M2S can be specified. As its operating performance is not limited by an elastomer element, it offers a wide temperature range and optimal chemical resistance.

Method of Operation

The Turcon® PTFE based element within the scraper or Turcon® Excluder® configuration performs the scraping function. The elastomer O-Ring (or spring in Turcon® Variseal® M2S) maintains the pressure of the scraper lips against the sliding surface and can compensate any deflections of the piston rod.

The scraper should be considered an integral part of a sealing system within hydraulic systems. Incorrect selection can result in the migration of contamination into a system, potentially causing damage to wear rings, seals and hardware components.

An axial notch can be added to the inner scraping lip of a double-acting scraper. This provides a path to vent any interstage pressure to the outside while still retaining the double-acting scraper effect. See Turcon® Excluder® DC section.

Note on Ordering

Any standard scraper configuration in this catalog containing an elastomer O-Ring part can be supplied as a complete seal set.

Older designs no longer contained in this catalog continue to be available. For all new applications we recommend use of the types shown in this catalog.

Other combinations of Turcon® materials and special designs can be developed and supplied for specific applications in sizes up to 10 feet/three meter diameter, provided there is sufficient volume demand. Sizes above this are available for specific scraper types.

Design Recommendations

When installing scrapers in applications where interstage pressure may occur the distance between seal groove and scraper groove L should exceed groove depth x . See figure below. There should also be provision for an oil reservoir to collect the oil returned to the hydraulic system by the seal.

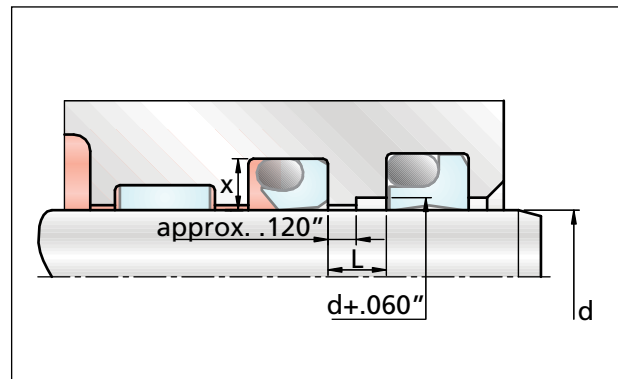



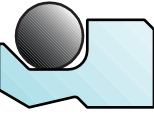
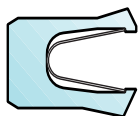


Figure 1 Recommendation for hardware design in applications when there may be interstage pressure

Turcon® Excluder® and Scrapers

Table I Turcon® Scrapers and Excluders® with Aerospace Gland Specification

Gland Standard	Standard Type	TSS Trade name	Profile	Configuration	Part Number	Primary Application Area
MS33675	-	DC Scraper Ring		Scarf-cut, garter-spring-energized	WM65	Not recommended for new designs
		Turcon® Excluder® DC Series E		Continuous, energized with an elastomer O-Ring	WE65	Light duty, space saving design
TSS Groove	-	Turcon® Excluder® DC		Continuous, energized with an elastomer O-Ring	WE25_B	Flight controls and utility actuators
AS4716					0 BU width Glands ¹⁾	
	AS4088	-	Turcon® Excluder® AS			Continuous, energized with an elastomer O-Ring
AS4052					I	
	Rev. B	II	Turcon® Variseal® M2S			Spring-energized

Profiles in color are recommended configurations

¹⁾ Scrapers are designed to fit in AS4716 zero back-up width grooves. Certain dimensions such as the downstream sidewall are modified to allow optimum operating performance for scrapers.

Turcon® Excluder® and Scrapers

■ Turcon® Excluder® DC

Description

In Turcon® Excluder® DC the gland has been altered to accommodate a larger cross section O-Ring for better activation of the scraping lips. It optimizes the configuration's ability to exclude contamination without the restrictions and limitations of the MS 33675 gland dimensions.

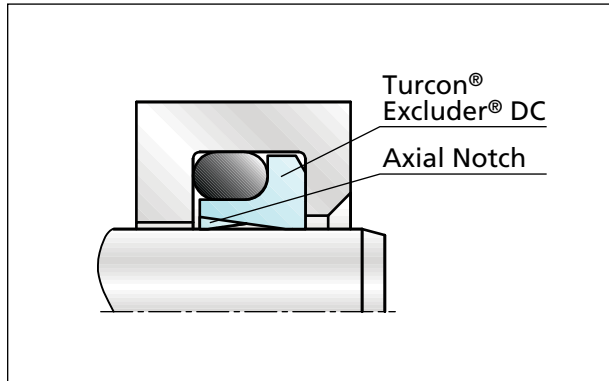


Figure 2 Turcon® Excluder® DC with axial notch

Due to the heavy cross section of the Turcon® element on the downstream side, Turcon® Excluder® DC will accept a significant back-pressure without being extruded out of the groove.

If high back-pressure is expected, we recommend use of Turcon® Excluder® DC with an axial notch.

Groove specification

AS4716 zero backup width gland. Open/split grooves are recommended for diameters smaller than 1.4 inch/ 35 mm (see page 257, 258).

Technical Data

Speed:	49.2 ft/s/ 15 m/s
Temperature range:	-65°F to +500°F/ -54°C to +260°C depending on elastomer material
Media:	All commonly used aerospace fluids depending on elastomer

■ Turcon® Excluder® DC Series E

Description

Turcon® Excluder® DC Series E is optimized for MS 33675 gland dimensions. The configuration is for relatively light duty and it is not recommended for new designs. The original virgin PTFE split Ring spring-energized scraper is not recommended.

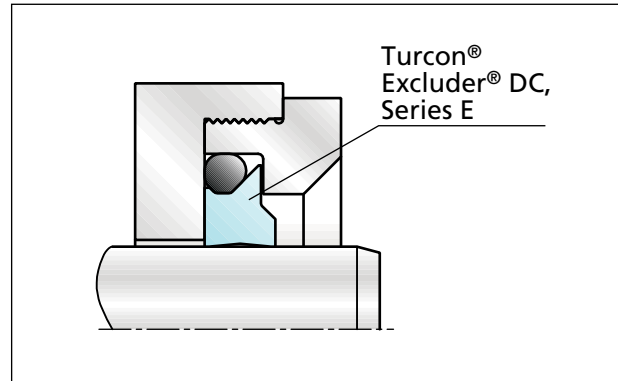


Figure 3 Turcon® Excluder® DC Series E

If back-pressure is expected, we recommend use of Turcon® Excluder® DC with an axial notch.

Groove specification

MS 33675. Open/split grooves are recommended for diameters smaller than 1.4 inch/ 35 mm (see page 263).

Technical Data

Speed:	49.2 ft/s/ 15 m/s
Temperature range:	-65°F to +500°F/ -54°C to +260°C depending on elastomer material
Media:	All commonly used aerospace fluids depending on elastomer

Turcon® Excluder® and Scrapers

■ Turcon® Excluder® AS

Description

The three versions of Turcon® Excluder® AS are designed for AS4088 and AS4052 Type I glands. The O-Ring is located over the inside sealing lip, providing an excellent secondary sealing function. The outside wall of Turcon® Excluder® AS is the full depth of the groove, meaning it can effectively scrape dust, sand and ice.

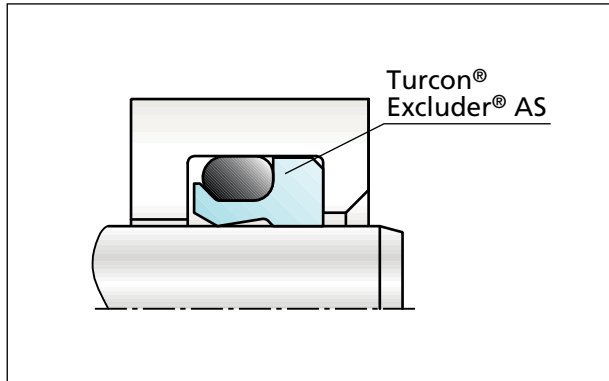


Figure 4 Turcon® Excluder® AS

Turcon® Excluder® AS per AS4088 standard, is a heavy duty scraper for general use (see page 259). A design for AS4052 Rev. B Type I for use in landing gear applications is shown on page 260 and page 262.

Groove specification

AS4716 zero backup width gland. Open/split grooves are recommended for diameters smaller than 1.4 inch/ 35 mm.

Technical Data

Speed: 49.2 ft/s/ 15 m/s
Temperature range: -65°F to +500°F/ -54°C to +260°C depending on elastomer material

Media: All commonly used aerospace fluids depending on elastomer

■ Turcon® Variseal® M2S Scraper

Description

Turcon® Variseal® M2S is a single-acting seal/scraper with an asymmetric seal profile. The dynamic lip has an optimized heavy profile. This offers long service life and a good scraping effect, even in highly viscous media. The U-shaped corrosion resistant spring provides consistent loading of the scraping lip.

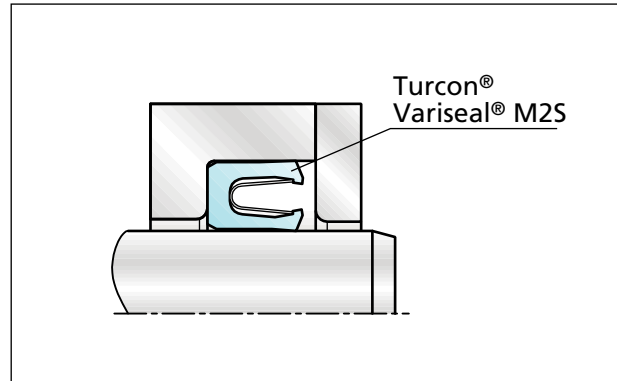


Figure 5 Turcon® Variseal® M2S

Turcon® Variseal® M2S has unlimited shelf-life and a very wide temperature range

A Hi-Clean version is available where the spring cavity is filled with silicone. This prevents contaminant lodging in the spring cavity.

Groove specification

MIL-G-5514F/AS4716 and ISO 3771 (see page 255, 256). The seal can only be installed to a limited extent in closed grooves. Refer to the Installation & Hardware Guidelines (page 293).

A version for AS4052 Rev. B Type II is shown on page 261.

Technical Data

Speed: Reciprocating up to 49.2 ft/s/ 15 m/s
Turning up to 1.65 ft/s/ 0.5 m/s

Temperature: -94°F to +500°F/ -70°C to +260°C

Media: Typically all fluids with medium to high viscosity and media containing hard particles

Turcon® Excluder® and Scrapers

Relative Sizes of Cross Sections

Turcon® Excluder® DC

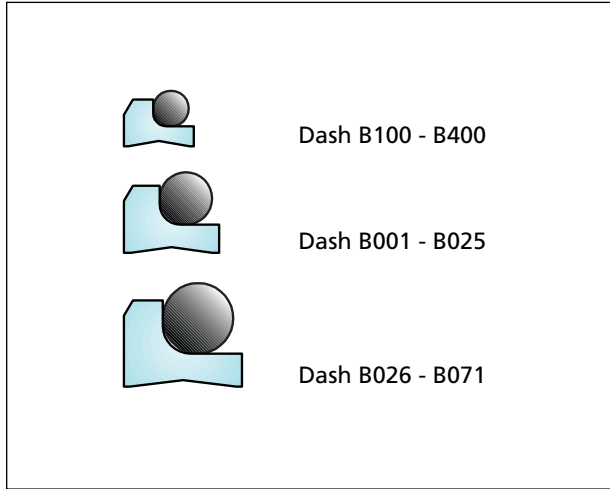


Figure 6 Turcon® Excluder® DC

Turcon® Excluder® DC, Series E

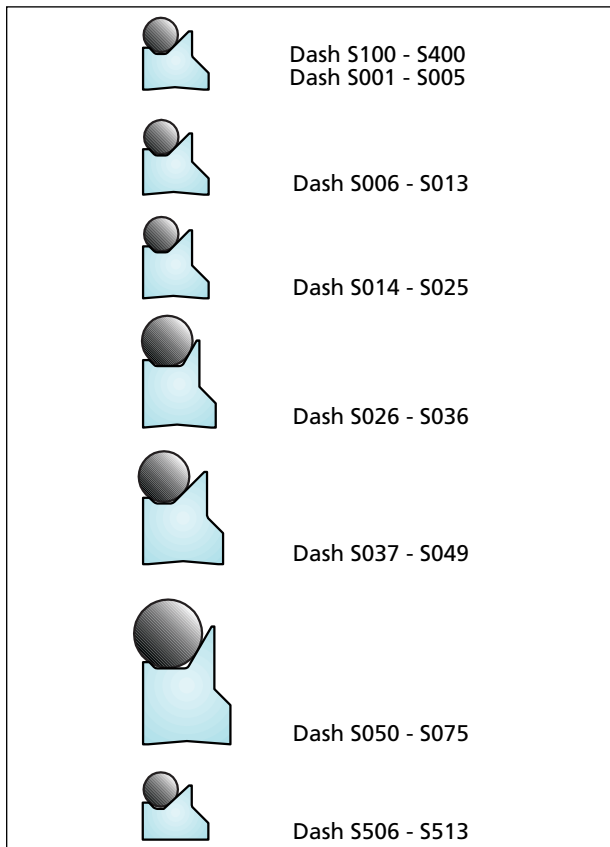


Figure 7 Turcon® Excluder® DC, Series E

Turcon® Excluder® AS

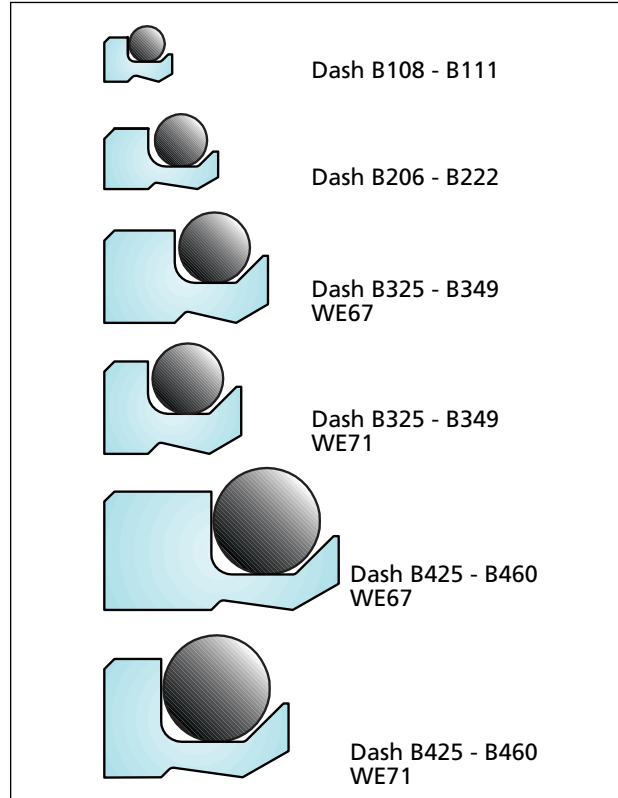


Figure 8 Turcon® Excluder® AS

Turcon® Variseal® M2S Scraper

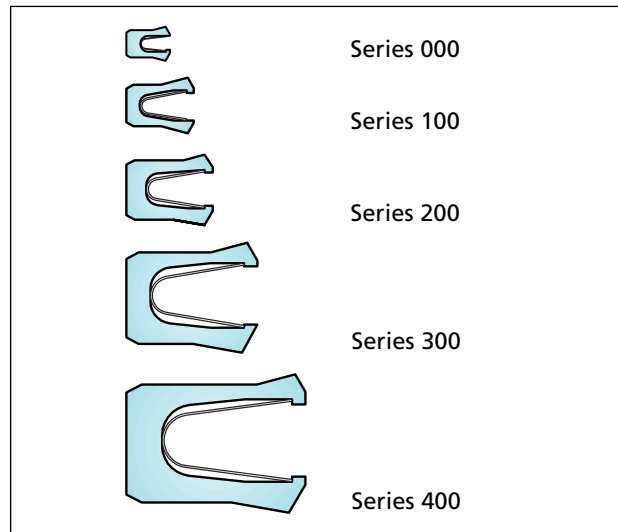
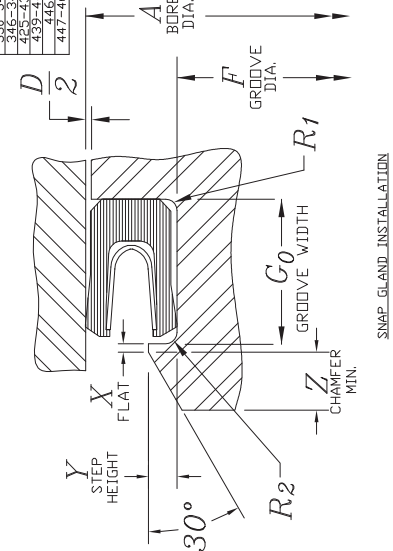


Figure 9 Turcon® Variseal® M2S Scraper

Turcon® Excluder® and Scrapers

TSS EXCLUDER GLAND DIMENSIONS - TABLE 1					SNAP GLAND DIMENSIONS - TABLE 2											
DASH NO.	A DIA.	F DIA.	A DIA.	F DIA.	DASH NO.	G ₀ GROOVE WIDTH	R RADIUS	F DIAMETRAL CLEARANCE MAX.	Y STEP HEIGHT	Z CHAMFER MIN.	R ₁ RADIUS MAX.	R ₂ RADIUS MAX.	X FLAT MIN.	SEAL ID MIN.	DASH NO.	D DIAMETRAL CLEARANCE MAX.
106	+0.01	+0.00	+0.02	+0.01	1210	0.991	0.750	0.003	0.002	0.025	0.015	0.005	0.015	0.375	004-009	0.004
107	+0.05	+0.02	0.103	0.082	1211	0.973	0.732	0.003	0.002	0.025	0.015	0.005	0.015	0.375	010-012	0.004
108	+0.08	+0.05	0.141	0.110	1212	0.955	0.714	0.003	0.002	0.025	0.015	0.005	0.015	0.375	013-016	0.004
109	+0.12	+0.08	0.179	0.148	1213	0.937	0.696	0.003	0.002	0.025	0.015	0.005	0.015	0.375	017-018	0.004
110	+0.16	+0.11	0.217	0.186	1214	0.919	0.678	0.003	0.002	0.025	0.015	0.005	0.015	0.375	019-020	0.004
111	+0.20	+0.15	0.255	0.224	1215	0.901	0.660	0.003	0.002	0.025	0.015	0.005	0.015	0.375	021-022	0.004
112	+0.24	+0.19	0.293	0.262	1216	0.883	0.642	0.003	0.002	0.025	0.015	0.005	0.015	0.375	023-024	0.004
113	+0.28	+0.23	0.331	0.300	1217	0.865	0.624	0.003	0.002	0.025	0.015	0.005	0.015	0.375	025-026	0.004
114	+0.32	+0.27	0.369	0.338	1218	0.847	0.606	0.003	0.002	0.025	0.015	0.005	0.015	0.375	027-028	0.004
115	+0.36	+0.31	0.407	0.376	1219	0.829	0.588	0.003	0.002	0.025	0.015	0.005	0.015	0.375	029-030	0.004
116	+0.40	+0.35	0.445	0.414	1220	0.811	0.570	0.003	0.002	0.025	0.015	0.005	0.015	0.375	031-032	0.004
117	+0.44	+0.39	0.483	0.452	1221	0.793	0.552	0.003	0.002	0.025	0.015	0.005	0.015	0.375	033-034	0.004
118	+0.48	+0.43	0.521	0.490	1222	0.775	0.534	0.003	0.002	0.025	0.015	0.005	0.015	0.375	035-036	0.004
119	+0.52	+0.47	0.559	0.528	1223	0.757	0.516	0.003	0.002	0.025	0.015	0.005	0.015	0.375	037-038	0.004
120	+0.56	+0.51	0.597	0.566	1224	0.739	0.498	0.003	0.002	0.025	0.015	0.005	0.015	0.375	039-040	0.004
121	+0.60	+0.55	0.635	0.604	1225	0.721	0.480	0.003	0.002	0.025	0.015	0.005	0.015	0.375	041-042	0.004
122	+0.64	+0.59	0.673	0.642	1226	0.703	0.462	0.003	0.002	0.025	0.015	0.005	0.015	0.375	043-044	0.004
123	+0.68	+0.63	0.711	0.680	1227	0.685	0.444	0.003	0.002	0.025	0.015	0.005	0.015	0.375	045-046	0.004
124	+0.72	+0.67	0.749	0.718	1228	0.667	0.426	0.003	0.002	0.025	0.015	0.005	0.015	0.375	047-048	0.004
125	+0.76	+0.71	0.787	0.756	1229	0.649	0.408	0.003	0.002	0.025	0.015	0.005	0.015	0.375	049-050	0.004
126	+0.80	+0.75	0.825	0.794	1230	0.631	0.390	0.003	0.002	0.025	0.015	0.005	0.015	0.375	051-052	0.004
127	+0.84	+0.79	0.863	0.832	1231	0.613	0.372	0.003	0.002	0.025	0.015	0.005	0.015	0.375	053-054	0.004
128	+0.88	+0.83	0.901	0.870	1232	0.595	0.354	0.003	0.002	0.025	0.015	0.005	0.015	0.375	055-056	0.004
129	+0.92	+0.87	0.939	0.908	1233	0.577	0.336	0.003	0.002	0.025	0.015	0.005	0.015	0.375	057-058	0.004
130	+0.96	+0.91	0.977	0.946	1234	0.559	0.318	0.003	0.002	0.025	0.015	0.005	0.015	0.375	059-060	0.004
131	+1.00	+0.95	1.015	0.984	1235	0.541	0.300	0.003	0.002	0.025	0.015	0.005	0.015	0.375	061-062	0.004
132	+1.04	+0.99	1.053	1.022	1236	0.523	0.282	0.003	0.002	0.025	0.015	0.005	0.015	0.375	063-064	0.004
133	+1.08	+1.03	1.091	1.060	1237	0.505	0.264	0.003	0.002	0.025	0.015	0.005	0.015	0.375	065-066	0.004
134	+1.12	+1.07	1.129	1.098	1238	0.487	0.246	0.003	0.002	0.025	0.015	0.005	0.015	0.375	067-068	0.004
135	+1.16	+1.11	1.167	1.136	1239	0.469	0.228	0.003	0.002	0.025	0.015	0.005	0.015	0.375	069-070	0.004
136	+1.20	+1.15	1.205	1.174	1240	0.451	0.210	0.003	0.002	0.025	0.015	0.005	0.015	0.375	071-072	0.004
137	+1.24	+1.19	1.243	1.212	1241	0.433	0.192	0.003	0.002	0.025	0.015	0.005	0.015	0.375	073-074	0.004
138	+1.28	+1.23	1.281	1.250	1242	0.415	0.174	0.003	0.002	0.025	0.015	0.005	0.015	0.375	075-076	0.004
139	+1.32	+1.27	1.319	1.288	1243	0.397	0.156	0.003	0.002	0.025	0.015	0.005	0.015	0.375	077-078	0.004
140	+1.36	+1.31	1.357	1.326	1244	0.379	0.138	0.003	0.002	0.025	0.015	0.005	0.015	0.375	079-080	0.004
141	+1.40	+1.35	1.395	1.364	1245	0.361	0.120	0.003	0.002	0.025	0.015	0.005	0.015	0.375	081-082	0.004
142	+1.44	+1.39	1.433	1.402	1246	0.343	0.102	0.003	0.002	0.025	0.015	0.005	0.015	0.375	083-084	0.004
143	+1.48	+1.43	1.471	1.440	1247	0.325	0.084	0.003	0.002	0.025	0.015	0.005	0.015	0.375	085-086	0.004
144	+1.52	+1.47	1.509	1.478	1248	0.307	0.066	0.003	0.002	0.025	0.015	0.005	0.015	0.375	087-088	0.004
145	+1.56	+1.51	1.547	1.516	1249	0.289	0.048	0.003	0.002	0.025	0.015	0.005	0.015	0.375	089-090	0.004
146	+1.60	+1.55	1.585	1.554	1250	0.271	0.030	0.003	0.002	0.025	0.015	0.005	0.015	0.375	091-092	0.004
147	+1.64	+1.59	1.623	1.592	1251	0.253	0.012	0.003	0.002	0.025	0.015	0.005	0.015	0.375	093-094	0.004
148	+1.68	+1.63	1.661	1.630	1252	0.235	0.000	0.003	0.002	0.025	0.015	0.005	0.015	0.375	095-096	0.004
149	+1.72	+1.67	1.699	1.668	1253	0.217	0.000	0.003	0.002	0.025	0.015	0.005	0.015	0.375	097-098	0.004



TSS EXCLUDER SEALING SOLUTIONS GLAND STANDARD
 FOR ZERO BACKUP WIDTH GLAND PER AS4716 REVISION A

SNAP GLAND INSTALLATION
 FOR ZERO BACKUP WIDTH GLAND PER AS4716 REVISION A

NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR VARISEAL® M2S SCRAPER IN AS4716 REVISION A PISTON GLANDS WITH THE EXCEPTION OF THE TSS RECOMMENDED STEP HEIGHT (Y).
 2. ORDERING EXAMPLE: VARISEAL® M2S, PISTON DESIGNATOR PVC 2 0 G 214 A 105 XM
 CROSS SECTION:
 0 = 100 SERIES
 1 = 100 SERIES
 2 = 200 SERIES
 3 = 300 SERIES
 4 = 300 SERIES
 DESIGN CHARACTERISTICS GLAND STANDARD
 G = AS4716
 SIZE DESIGNATION ACCORDING TO AS4716 REVISION A
 QUALITY INDEX:
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON®VARISEAL®M2S MAT'L CODE
 SPRING MAT'L CODE - MEDIUM SPRING LOAD AS STANDARD
 FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE.
 SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL
 CODE MEDIUM DUTY AS STANDARD
 S 301 STAINLESS STEEL
 H HASTELLOY
 E ELGILOY

4. DASH SIZES -006 TO -028, -106 TO -128, AND -210 TO -221 REQUIRE SPLIT OR SNAP FITTING GLAND CONFIGURATION, PLEASE CONSULT YOUR TRELLEBORG SEALING SOLUTIONS SALES ENGINEER FOR DETAILED INFORMATION.

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INCH

TRELLEBORG SEALING SOLUTIONS

VARISEAL® M2S, PISTON, SCRAPER

DRAWING NO. PVC20G000

2011_5

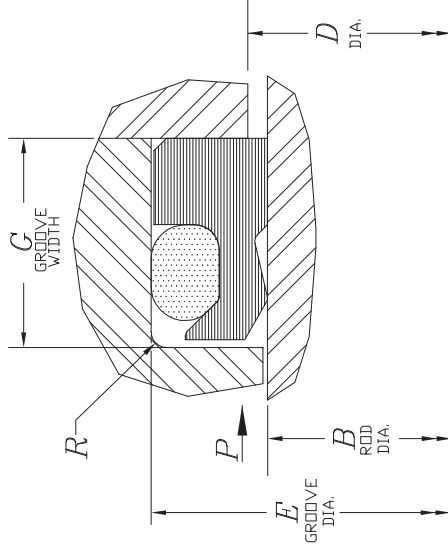
WORLD AEROSPACE TITLE BLOCK REV.

Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D-RING NO.	DASH NO.	B DIA.	E DIA.	D-RING NO.	DASH NO.	B DIA.	E DIA.	D-RING NO.	DASH NO.	G	R	F	
	+0.001 -0.001	+0.002 -0.002			+0.002 -0.002	+0.002 -0.002			+0.002 -0.002	+0.002 -0.002			±.005 +.005 -0.005			
1/4	248	436	011	501	498	686	015	705	748	1096	212	1/4-7/16				
3/8	310	498	012	502	560	748	016	706	810	1158	213	501-525	.144	.005/.015	.042	
1/2	373	561	013	503	623	811	017	707	873	1221	214	1-25			.042	
5/8	435	623	014	504	685	873	018	708	935	1283	215	626-665	.195	.005/.015		
1	435	623	014	505	748	936	019	709	998	1346	216	26-71	.240	.005/.015		
101	498	766	113	506	810	998	020	710	1060	1408	217	705-725				
102	560	828	114	507	873	1061	021	711	1123	1471	218					
103	623	891	115	508	935	1123	022	712	1185	1533	219					
104	685	953	116	509	998	1186	023	713	1248	1596	220					
105	748	1016	117	511	1123	1311	025	715	1373	1721	222					
106	810	1078	118	512	1185	1373	026	716	1435	1783	222					
107	873	1141	119	513	1248	1436	027	717	1498	1846	223					
108	935	1203	120	514	1312	1498	028	718	1561	1910	224					
109	998	1263	121	515	1373	1561	029	719	1623	2006	225					
110	1060	1323	122	516	1435	1623	030	720	1685	2096	226					
111	1123	1391	123	517	1498	1685	031	721	1748	2185	227					
112	1185	1453	124	518	1561	1748	032	722	1810	2275	228					
113	1248	1516	125	519	1623	1810	033	723	1873	2365	229					
114	1310	1578	126	520	1685	1873	034	724	1936	2445	230					
115	1373	1641	127	521	1748	1936	035	725	2000	2525	231					
116	1435	1703	128	522	1810	2000	036	726	2063	2605	232					
117	1498	1766	129	523	1873	2063	037	727	2126	2685	233					
118	1561	1829	130	524	1936	2126		728	2189	2765						
119	1623	1891	131	525	2000	2189		729	2252	2845						
120	1685	1954	132	526	2063	2252		730	2315	2925						
121	1748	2017	133	527	2126	2315		731	2378	3005						
122	1810	2080	134	528	2189	2378		732	2441	3085						
123	1873	2143	135	529	2252	2441		733	2504	3165						
124	1936	2206	136	530	2315	2504		734	2567	3245						
125	1998	2269	137	531	2378	2567		735	2630	3325						
126	2061	2332	138	532	2441	2630		736	2693	3405						
127	2124	2395	139	533	2504	2693		737	2756	3485						
128	2187	2458	140	534	2567	2756		738	2819	3565						
129	2250	2521	141	535	2630	2819		739	2882	3645						
130	2313	2584	142	536	2693	2882		740	2945	3725						
131	2376	2647	143	537	2756	2945		741	3008	3805						
132	2439	2710	144	538	2819	3008		742	3071	3885						
133	2502	2773	145	539	2882	3071		743	3134	3965						
134	2565	2836	146	540	2945	3134		744	3197	4045						
135	2628	2899	147	541	3008	3197		745	3260	4125						
136	2691	2962	148	542	3071	3260		746	3323	4205						
137	2754	3025	149	543	3134	3323		747	3386	4285						
138	2817	3088	150	544	3197	3386		748	3449	4365						
139	2880	3151	151	545	3260	3449		749	3512	4445						
140	2943	3214	152	546	3323	3512		750	3575	4525						
141	3006	3277	153	547	3386	3575		751	3638	4605						
142	3069	3340	154	548	3449	3638		752	3701	4685						
143	3132	3403	155	549	3512	3701		753	3764	4765						
144	3195	3466	156	550	3575	3764		754	3827	4845						
145	3258	3529	157	551	3638	3827		755	3890	4925						
146	3321	3592	158	552	3701	3890		756	3953	5005						
147	3384	3655	159	553	3764	3953		757	4016	5085						
148	3447	3718	160	554	3827	4016		758	4079	5165						
149	3510	3781	161	555	3890	4079		759	4142	5245						
150	3573	3844	162	556	3953	4142		760	4205	5325						
151	3636	3907	163	557	4016	4205		761	4268	5405						
152	3699	3970	164	558	4079	4268		762	4331	5485						
153	3762	4033	165	559	4142	4331		763	4394	5565						
154	3825	4096	166	560	4205	4394		764	4457	5645						
155	3888	4159	167	561	4268	4457		765	4520	5725						
156	3951	4222	168	562	4331	4520		766	4583	5805						
157	4014	4285	169	563	4394	4583		767	4646	5885						
158	4077	4348	170	564	4457	4646		768	4709	5965						
159	4140	4411	171	565	4520	4709		769	4772	6045						
160	4203	4474	172	566	4583	4772		770	4835	6125						
161	4266	4537	173	567	4646	4835		771	4898	6205						
162	4329	4600	174	568	4709	4898		772	4961	6285						
163	4392	4663	175	569	4772	4961		773	5024	6365						
164	4455	4726	176	570	4835	5024		774	5087	6445						
165	4518	4789	177	571	4898	5087		775	5150	6525						
166	4581	4852	178	572	4961	5150		776	5213	6605						
167	4644	4915	179	573	5024	5213		777	5276	6685						
168	4707	4978	180	574	5087	5276		778	5339	6765						
169	4770	5041	181	575	5150	5339		779	5402	6845						
170	4833	5104	182	576	5213	5402		780	5465	6925						
171	4896	5167	183	577	5276	5465		781	5528	7005						
172	4959	5230	184	578	5339	5528		782	5591	7085						
173	5022	5293	185	579	5402	5591		783	5654	7165						
174	5085	5356	186	580	5465	5654		784	5717	7245						
175	5148	5419	187	581	5528	5717		785	5780	7325						
176	5211	5482	188	582	5591	5780		786	5843	7405						
177	5274	5545	189	583	5654	5843		787	5906	7485						
178	5337	5608	190	584	5717	5906		788	5969	7565						
179	5400	5671	191	585	5780	5969		789	6032	7645						
180	5463	5734	192	586	5843	6032		790	6095	7725						
181																

Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D DIA.	Q-RING SIZE	DASH NO.	B DIA.	E DIA.	D DIA.	Q-RING SIZE	DASH NO.		RADIUS
										G	R	
	DIA.	DIA.	DIA.		DIA.	DIA.	DIA.	DIA.		GLAND WIDTH	GLAND WIDTH	RADIUS
1108	248	466	278	011	447	8997	9474	9039	373	408-111	.183/193	.005/015
1109	273	518	300	013	448	9497	9974	9539	375	506-262	.235/245	.010/065
1110	373	670	400	015	449	9997	10474	10039	377	282-328	.334/344	.020/035
1111	435	813	465	014	450	10497	10974	10539	378	328-349		
1206	498	741	528		451	10997	11474	11039	379	425-438	.475/485	.020/035
1207	620	862	650		452	11497	11974	11539	380			
1208	662	904	692	114	453	11997	12474	12039	381			
1209	685	928	715	116	454	12497	12974	12539	381			
1210	748	991	778	117	455	12997	13474	13039	382			
211	810	1053	852	118	456	13497	13974	13539	382			
212	873	1116	915	119	457	13997	14474	14039	383			
213	935	1178	977	120	458	14497	14974	14539	383			
214	998	1241	1040	121	459	14997	15474	15039	384			
215	1060	1303	1102	122	460	15497	15974	15539	384			
216	1123	1366	1165	123								
217	1185	1428	1227	124								
218	1248	1491	1290	125								
219	1310	1553	1352	126								
220	1373	1616	1415	127								
221	1435	1678	1477	128								
222	1498	1741	1540	129								
325	1428	1870	1540	233								
326	1491	1933	1603	234								
327	1554	1996	1666	235								
328	1617	2059	1729	236								
329	1680	2122	1792	237								
330	1743	2185	1855	238								
331	1806	2248	1918	239								
332	1869	2311	1981	240								
333	1932	2374	2044	241								
334	1995	2437	2107	242								
335	2058	2500	2170	243								
336	2121	2563	2233	244								
337	2184	2626	2296	245								
338	2247	2689	2359	246								
339	2310	2752	2422	247								
340	2373	2815	2485									
341	2436	2878	2548									
342	2499	2941	2611									
343	2562	3004	2674									
344	2625	3067	2737									
345	3287	3729	3399									
346	3350	3792	3462									
347	3413	3855	3525									
348	3476	3918	3588									
349	3539	3981	3651									
425	4497	4974	4539	350								
426	4622	5099	4664	351								
427	4747	5224	4789	352								
428	4872	5349	4914	353								
429	4997	5474	5039	354								
430	5122	5599	5164	355								
431	5247	5724	5289	356								
432	5372	5849	5414	357								
433	5497	5974	5539	358								
434	5622	6099	5664	359								
435	5747	6224	5789	360								
436	5872	6349	5914	361								
437	5997	6474	6039	361								
438	6247	6724	6289	362								
439	6497	6974	6539	363								
440	6747	7224	6789	364								
441	6997	7474	7039	365								
442	7247	7724	7289	366								
443	7497	7974	7539	367								
444	7747	8224	7789	368								
445	7997	8474	8039	369								
446	8247	8724	8289	371								



EXCLUDER[®] AS INSTALLATION
FOR AS4088 SCRAPER GLAND STANDARD

NOTES:
1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR EXCLUDER[®] AS IN AS4088 SCRAPER GLANDS.
2. ORDERING EXAMPLE:
WE 6Z Q B 214 A 199 NE

EXCLUDER[®] DESIGNATOR
SERIES NUMBER
DESIGN CHARACTERISTICS
A 0 = STANDARD
GLAND TRELLEBERG SEALING SOLUTIONS
B = GLAND STANDARD
SIZE DESIGNATOR TO AS4088
ACCORDING TO AS4088
QUALITY INDEX
A = AEROSPACE CERTIFICATE OF CONFORMANCE
TURCON[®] EXCLUDER[®] MATERIAL CODE
TURCON[®] EXCLUDER[®] PRODUCT CODE
CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

△ NOTICES NOT AVAILABLE
4. REQUIRES SPLIT GLAND

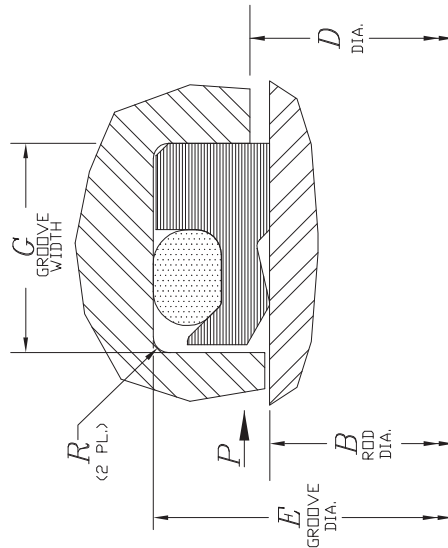
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TITLE	2011_4
EXCLUDER [®] AS	
DRAWING NO.	WE670B00
INCH	
TRELLEBERG SEALING SOLUTIONS	

Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D DIA.	O-RING SIZE
	+0.00 -0.02	+0.00 -0.00	+0.00 -0.00	
325	1.498	1.870	1.646	223
326	1.623	1.995	1.771	224
327	1.748	2.120	1.896	225
328	1.873	2.245	2.021	226
329	1.998	2.370	2.146	227
330	2.123	2.495	2.271	228
331	2.248	2.620	2.396	229
332	2.373	2.745	2.521	230
333	2.498	2.870	2.646	231
334	2.623	2.995	2.771	232
335	2.748	3.120	2.896	233
336	2.873	3.245	3.021	234
337	2.998	3.370	3.146	235
338	3.123	3.495	3.271	236
339	3.248	3.620	3.396	237
340	3.373	3.745	3.521	238
341	3.498	3.870	3.646	239
342	3.623	3.995	3.771	240
343	3.748	4.120	3.896	241
344	3.873	4.245	4.021	242
345	3.998	4.370	4.146	243
346	4.123	4.495	4.271	244
347	4.248	4.620	4.396	245
348	4.373	4.745	4.521	246
349	4.498	4.870	4.646	247
350	4.623	4.995	4.771	248
351	4.748	5.120	4.896	249
352	4.873	5.245	5.021	250
353	4.998	5.370	5.146	251
354	5.123	5.495	5.271	252
355	5.248	5.620	5.396	253
356	5.373	5.745	5.521	254
357	5.498	5.870	5.646	255
358	5.623	5.995	5.771	256
359	5.748	6.120	5.896	257
360	5.873	6.245	6.021	258
361	5.998	6.370	6.146	259
362	6.123	6.495	6.271	260
363	6.248	6.620	6.396	261
364	6.373	6.745	6.521	262
365	6.498	6.870	6.646	263
366	6.623	6.995	6.771	264
367	6.748	7.120	6.896	265
368	6.873	7.245	7.021	266
369	6.998	7.370	7.146	267
370	7.123	7.495	7.271	268
371	7.248	7.620	7.396	269
372	7.373	7.745	7.521	270
373	7.498	7.870	7.646	271
374	7.623	7.995	7.771	272
375	7.748	8.120	7.896	273
376	7.873	8.245	8.021	274
377	7.998	8.370	8.146	275
378	8.123	8.495	8.271	276
379	8.248	8.620	8.396	277
380	8.373	8.745	8.521	278
381	8.498	8.870	8.646	279
382	8.623	8.995	8.771	280
383	8.748	9.120	8.896	281
384	8.873	9.245	9.021	282
385	8.998	9.370	9.146	283
386	9.123	9.495	9.271	284
387	9.248	9.620	9.396	285
388	9.373	9.745	9.521	286
389	9.498	9.870	9.646	287
390	9.623	9.995	9.771	288
391	9.748	10.120	9.896	289
392	9.873	10.245	10.021	290
393	9.998	10.370	10.146	291
394	10.123	10.495	10.271	292
395	10.248	10.620	10.396	293
396	10.373	10.745	10.521	294
397	10.498	10.870	10.646	295
398	10.623	10.995	10.771	296
399	10.748	11.120	10.896	297
400	10.873	11.245	11.021	298
401	10.998	11.370	11.146	299
402	11.123	11.495	11.271	300
403	11.248	11.620	11.396	301
404	11.373	11.745	11.521	302
405	11.498	11.870	11.646	303
406	11.623	11.995	11.771	304
407	11.748	12.120	11.896	305
408	11.873	12.245	12.021	306
409	11.998	12.370	12.146	307
410	12.123	12.495	12.271	308
411	12.248	12.620	12.396	309
412	12.373	12.745	12.521	310
413	12.498	12.870	12.646	311
414	12.623	12.995	12.771	312
415	12.748	13.120	12.896	313
416	12.873	13.245	13.021	314
417	12.998	13.370	13.146	315
418	13.123	13.495	13.271	316
419	13.248	13.620	13.396	317
420	13.373	13.745	13.521	318
421	13.498	13.870	13.646	319
422	13.623	13.995	13.771	320
423	13.748	14.120	13.896	321
424	13.873	14.245	14.021	322
425	13.998	14.370	14.146	323
426	14.123	14.495	14.271	324
427	14.248	14.620	14.396	325
428	14.373	14.745	14.521	326
429	14.498	14.870	14.646	327
430	14.623	14.995	14.771	328
431	14.748	15.120	14.896	329
432	14.873	15.245	15.021	330
433	14.998	15.370	15.146	331
434	15.123	15.495	15.271	332
435	15.248	15.620	15.396	333
436	15.373	15.745	15.521	334
437	15.498	15.870	15.646	335
438	15.623	15.995	15.771	336
439	15.748	16.120	15.896	337
440	15.873	16.245	16.021	338
441	15.998	16.370	16.146	339
442	16.123	16.495	16.271	340
443	16.248	16.620	16.396	341
444	16.373	16.745	16.521	342
445	16.498	16.870	16.646	343
446	16.623	16.995	16.771	344
447	16.748	17.120	16.896	345
448	16.873	17.245	17.021	346
449	16.998	17.370	17.146	347
450	17.123	17.495	17.271	348
451	17.248	17.620	17.396	349
452	17.373	17.745	17.521	350
453	17.498	17.870	17.646	351
454	17.623	17.995	17.771	352
455	17.748	18.120	17.896	353
456	17.873	18.245	18.021	354
457	17.998	18.370	18.146	355
458	18.123	18.495	18.271	356
459	18.248	18.620	18.396	357
460	18.373	18.745	18.521	358

DASH NO.	G GROOVE WIDTH	R RADIUS
325-349	.3347/344	.0207/035
425-460	.4757/485	.0207/035



EXCLUDER® AS INSTALLATION
FOR AS4052 REV B TYPE I SCRAPER GLAND STANDARD

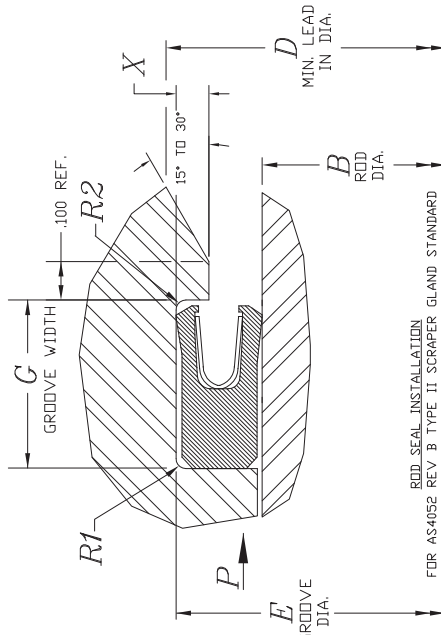
- NOTES:
- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR EXCLUDER® AS IN AS4052 REV B TYPE I SCRAPER GLANDS.
 - ORDERING EXAMPLE:
WE 71 0 B 214 A 199 NE
EXCLUDER® DESIGNATOR
SERIES NUMBER
DESIGN CHARACTERISTICS
O = STANDARD DESIGNATOR
B = TRELLEBORG SEALING SOLUTIONS
G = GLAND STANDARD
SIZE DESIGNATOR
A = CERTIFICATE OF CONFORMANCE
QUALITY INDEX
T = TRELLEBORG SEALING SOLUTIONS
TURBO-ROTOR MAT'L CODE
O-RING MAT'L CODE
CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 - NOTICES NOT AVAILABLE.
 - FOR SCRAPERS TO OLD REVISION OF AS4052 SEE TSS PART NUMBER WE720B000.

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INCH	2011_4
TITLE	EXCLUDER® AS
DRAWING NO.	WE710B00
TRELLEBORG SEALING SOLUTIONS	

Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D DIA.	GROSS WIDTH	X DIMENSION	R1 RADIUS	R2 RADIUS
325	1.498	1.870	1.868	.000	.032/.037	.020/.035	.009 MAX.
326	1.623	1.995	2.013	-.006	.034/.043	.020/.035	.012 MAX.
327	1.748	2.120	2.138				
328	1.873	2.245	2.263				
329	1.998	2.370	2.388				
330	2.123	2.495	2.513				
331	2.248	2.620	2.638				
332	2.373	2.745	2.763				
333	2.498	2.870	2.888				
334	2.623	2.995	3.013				
335	2.748	3.120	3.138				
336	2.873	3.245	3.263				
337	2.998	3.370	3.388				
338	3.123	3.495	3.513				
339	3.248	3.620	3.638				
340	3.373	3.745	3.763				
341	3.498	3.870	3.888				
342	3.623	3.995	4.013				
343	3.748	4.120	4.138				
344	3.873	4.245	4.263				
345	3.998	4.370	4.388				
346	4.123	4.495	4.513				
347	4.248	4.620	4.638				
348	4.373	4.745	4.763				
349	4.498	4.870	4.888				
425	4.497	4.974	5.017				
426	4.622	5.099	5.042				
427	4.747	5.224	5.267				
428	4.872	5.349	5.392				
429	4.997	5.474	5.517				
430	5.122	5.599	5.642				
431	5.247	5.724	5.767				
432	5.372	5.849	5.892				
433	5.497	5.974	6.017				
434	5.622	6.099	6.042				
435	5.747	6.224	6.267				
436	5.872	6.349	6.392				
437	5.997	6.474	6.517				
438	6.122	6.599	6.642				
439	6.247	6.724	6.767				
440	6.372	6.849	6.892				
441	6.497	6.974	7.017				
442	6.622	7.099	7.142				
443	6.747	7.224	7.267				
444	6.872	7.349	7.392				
445	6.997	7.474	7.517				
446	7.122	7.599	7.642				
447	7.247	7.724	7.767				
448	7.372	7.849	7.892				
449	7.497	7.974	8.017				
450	7.622	8.099	8.142				
451	7.747	8.224	8.267				
452	7.872	8.349	8.392				
453	7.997	8.474	8.517				
454	8.122	8.599	8.642				
455	8.247	8.724	8.767				
456	8.372	8.849	8.892				
457	8.497	8.974	9.017				
458	8.622	9.099	9.142				
459	8.747	9.224	9.267				
460	8.872	9.349	9.392				



NOTES:
1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR VARISEAL® M2S IN AS4052 REV B TYPE II SCRAPER GLANDS.
2. ORDERING EXAMPLE: VARISEAL® M2S, ROD DESIGNATOR RVD 3 N B 325A 199 \$M

CROSS SECTION
3 = 300 SERIES
DESIGN CHARACTERISTICS
0 = NOTCH, HEEL (NOT RECOMMENDED)
N = NO NOTCH, HEEL (RECOMMENDED)
TSS GLAND STANDARD
SIZE DESIGNATION
QUALITY INDEX
A = AIRSPACER CERTIFICATE OF CONFORMANCE
TURCON® VARISEAL® M2S MAT'L CODE
AS STANDARD

FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AIRSPACE DESIGN GUIDE.
SPRING MATERIAL OPTIONS LISTED BELOW.

CODE	MATERIAL
S	301 STAINLESS STEEL
H	HASTELLOY
E	ELGILOY

4. FOR SCRAPERS TO OLD REVISION OF AS4052 SEE TSS PART NUMBER W6720B000.

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TITLE
VARISEAL® M2S

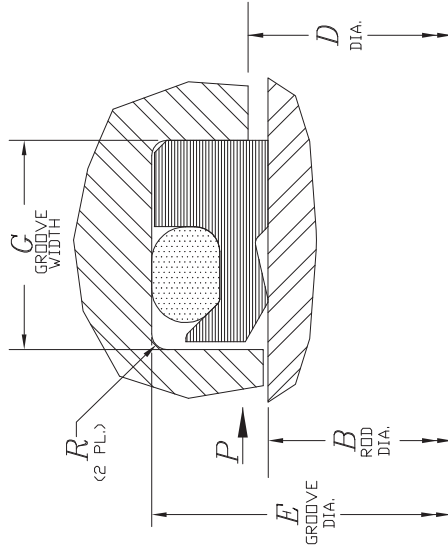
REF. NO.
RVD30B000

TRELLEBERG
SEALING SOLUTIONS

Other elements

Turcon® Excluder® and Scrapers

DASH NO.	G GLAND WIDTH	R RADIUS
325-349	.281/.291	.020/.035
425-460	.375/.385	.020/.035



EXCLUDER® AS INSTALLATION
FOR AS4052 TYPE I SCRAPER GLAND STANDARD

NOTES:
1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR EXCLUDER® AS IN AS4052 TYPE I SCRAPER GLANDS.

2. ORDERING EXAMPLE:
WE 72 0 0 214 A 199 NE
EXCLUDER® DESIGNATOR
SERIES NUMBER
DESIGN CHARACTERISTICS
0 = STANDARD
GLAND STANDARD DESIGNATOR
B = TRELLEBORG SEALING SOLUTIONS
GLAND STANDARD
SIZE DESIGNATOR
FACTORY FINISH TO AS4052 TYPE I
QUALITY
A = AEROSPACE CERTIFICATE OF CONFORMANCE
TURCON® EXCLUDER® MAT'L CODE
TUREL® D-RING MAT'L CODE
CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

NOTCHES NOT AVAILABLE

4. WE720B000 IS DESIGNED TO FIT AS4052 REVISIONS BEFORE REVISION LEVEL B. FOR AS4052 REVISION B OR LATER SCRAPERS DESIGNS SEE WE710B000 AND RVJ3NN000.

DASH NO.	B DIA.	E DIA.	D DIA.	D-RING SIZE
325	+0.002	+0.010	+0.010	223
326	-0.002	-0.010	-0.010	224
327	1.498	1.870	1.674	225
328	1.623	1.995	1.779	226
329	1.748	2.120	1.984	227
330	1.873	2.245	2.189	228
331	1.998	2.370	2.394	229
332	2.123	2.495	2.599	230
333	2.248	2.620	2.804	231
334	2.373	2.745	2.999	232
335	2.498	2.870	3.194	233
336	2.623	2.995	3.389	234
337	2.748	3.120	3.584	235
338	2.873	3.245	3.779	236
339	2.998	3.370	3.974	237
340	3.123	3.495	4.169	238
341	3.248	3.620	4.364	239
342	3.373	3.745	4.559	240
343	3.498	3.870	4.754	241
344	3.623	3.995	4.949	242
345	3.748	4.120	5.144	243
346	3.873	4.245	5.339	244
347	3.998	4.370	5.534	245
348	4.123	4.495	5.729	246
349	4.248	4.620	5.924	247
425	+0.003	+0.003	+0.010	350
426	-0.003	-0.003	-0.010	351
427	4.497	4.974	4.726	352
428	4.622	5.099	4.851	353
429	4.747	5.224	4.976	354
430	4.872	5.349	5.101	355
431	4.997	5.474	5.226	356
432	5.122	5.599	5.351	357
433	5.247	5.724	5.476	358
434	5.372	5.849	5.601	359
435	5.497	5.974	5.726	360
436	5.622	6.099	5.851	361
437	5.747	6.224	5.976	362
438	5.872	6.349	6.101	363
439	5.997	6.474	6.226	364
440	6.122	6.599	6.351	365
441	6.247	6.724	6.476	366
442	6.372	6.849	6.601	367
443	6.497	6.974	6.726	368
444	6.622	7.099	6.851	369
445	6.747	7.224	6.976	370
446	6.872	7.349	7.101	371
447	6.997	7.474	7.226	372
448	7.122	7.599	7.351	373
449	7.247	7.724	7.476	374
450	7.372	7.849	7.601	375
451	7.497	7.974	7.726	376
452	7.622	8.099	7.851	377
453	7.747	8.224	7.976	378
454	7.872	8.349	8.101	379
455	7.997	8.474	8.226	380
456	8.122	8.599	8.351	381
457	8.247	8.724	8.476	382
458	8.372	8.849	8.601	383
459	8.497	8.974	8.726	384
460	8.622	9.099	8.851	384

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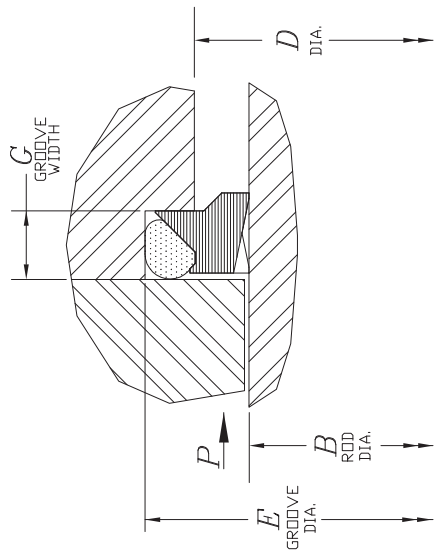
TITLE EXCLUDER® AS

DRAWING NO. WE720B000

TRELLEBORG SEALING SOLUTIONS

Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D DIA.	C WIDTH	D-RING SIZE	DASH NO.	B DIA.	E DIA.	D DIA.	C WIDTH	D-RING SIZE
11/4	.248	.510	.398	.104	012	066	10.497	10.989	10.772	.151	066
15/16	.310	.572	.327	.104	013	067	10.997	11.489	11.272	.151	067
13/8	.373	.636	.460	.104	014	068	11.497	11.989	11.772	.166	068
17/16	.435	.697	.585	.104	015	070	12.497	12.989	12.772	.166	070
1001	.498	.760	.647	.104	016	071	12.997	13.489	13.272	.166	071
1002	.560	.823	.710	.104	017	072	13.497	13.989	13.772	.166	072
1003	.623	.885	.772	.104	018	073	13.997	14.489	14.272	.166	073
1004	.685	.948	.834	.104	019	074	14.497	14.989	14.772	.166	074
1005	.748	1.010	.897	.104	020	075	14.997	15.489	15.272	.166	075
006	.810	1.086	.949	.104	021	076	15.497	15.989	15.772	.166	076
007	.873	1.148	1.012	.104	022						
008	.935	1.210	1.074	.104	023						
009	.998	1.273	1.136	.104	024						
010	1.060	1.335	1.199	.104	025						
011	1.123	1.398	1.262	.104	026	506	.810	1.052	.954	.104	021
012	1.185	1.461	1.324	.104	027	507	.873	1.114	1.017	.104	022
013	1.248	1.523	1.386	.104	028	508	.935	1.177	1.079	.104	023
014	1.310	1.614	1.480	.104	029	509	.997	1.239	1.141	.104	024
015	1.373	1.677	1.542	.104	030	510	1.060	1.302	1.204	.104	025
016	1.435	1.739	1.605	.104	031	511	1.123	1.364	1.267	.104	026
017	1.498	1.802	1.668	.104	032	512	1.185	1.427	1.329	.104	027
018	1.560	1.864	1.730	.104	033	513	1.248	1.489	1.391	.104	028
019	1.623	1.927	1.793	.104	034						
020	1.685	2.052	1.918	.104	035						
021	1.748	2.177	2.043	.104	036						
022	1.810	2.302	2.168	.104	037						
023	1.873	2.427	2.303	.104	038						
024	1.935	2.552	2.448	.104	039						
025	2.000	2.677	2.593	.104	040						
026	2.062	2.802	2.738	.104							
027	2.125	2.927	2.883	.104							
028	2.187	3.052	3.028	.104							
029	2.250	3.177	3.173	.104							
030	2.312	3.302	3.334	.104							
031	2.375	3.427	3.469	.104							
032	2.437	3.552	3.584	.104							
033	2.500	3.677	3.709	.104							
034	2.562	3.802	3.834	.104							
035	2.625	3.927	3.959	.104							
036	2.687	4.052	4.084	.104							
037	2.750	4.177	4.240	.104							
038	2.812	4.302	4.365	.104							
039	2.875	4.427	4.490	.104							
040	2.937	4.552	4.615	.104							
041	3.000	4.677	4.740	.104							
042	3.062	4.802	4.865	.104							
043	3.125	4.927	5.000	.104							
044	3.187	5.052	5.115	.104							
045	3.250	5.177	5.240	.104							
046	3.312	5.302	5.365	.104							
047	3.375	5.427	5.490	.104							
048	3.437	5.552	5.615	.104							
049	3.500	5.677	5.740	.104							
050	3.562	5.802	5.865	.104							
051	3.625	5.927	6.000	.104							
052	3.687	6.052	6.115	.104							
053	3.750	6.177	6.240	.104							
054	3.812	6.302	6.365	.104							
055	3.875	6.427	6.490	.104							
056	3.937	6.552	6.615	.104							
057	4.000	6.677	6.740	.104							
058	4.062	6.802	6.865	.104							
059	4.125	6.927	7.000	.104							
060	4.187	7.052	7.115	.104							
061	4.250	7.177	7.240	.104							
062	4.312	7.302	7.365	.104							
063	4.375	7.427	7.490	.104							
064	4.437	7.552	7.615	.104							
065	4.500	7.677	7.740	.104							



EXCLUDER® D.C. SERIES E - INSTALLATION
FOR MSS3675 GLAND STANDARD

NOTES:
 1. TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR EXCLUDER® DC SERIES E IN MSS3675 GLANDS.
 2. ORDERING EXAMPLE:
 WE 65 0 0.025 A 199 NE
 EXCLUDER® DESIGNATOR
 SERIES NUMBER
 DESIGN CHARACTERISTICS
 O = NOTCHED (SHOWN)
 N = STANDARD
 S = MSS3675 SCRAPER GLAND STANDARD
 SIZE DESIGNATOR MSS3675
 QUALITY INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TUREL® EXCLUDER® MAT'L CODE
 CONSULT THE TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.
 Δ THE FOLLOWING TABLE APPLIES TO THOSE FRACTIONAL INCHES SIZES PER MSS3675

MSS3675 DASH SIZE	TSS P/N SIZE
5/16	200
3/8	300
7/16	400

- 4. TRELLEBORG SPLIT GLAND
- Δ STANDARD O-RINGS NOT AVAILABLE - SPECIAL O-RINGS FROM TRELLEBORG SEALING SOLUTIONS ARE REQUIRED.
- 6. EXCLUDER D.C. SERIES E SIZES -506 THRU -513 ARE DIMENSIONALLY INTERCHANGEABLE WITH MS28776 SIZEZ -6 THRU -13 GLANDS.

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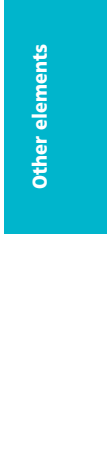
TRELLEBORG SEALING SOLUTIONS

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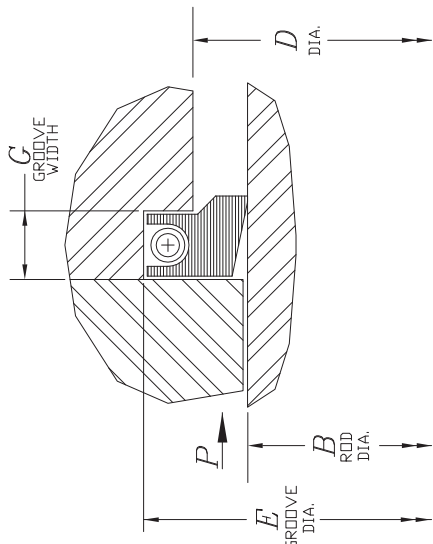
TITLE EXCLUDER® D.C. SERIES E

DRAWING NO. WE650S000



Turcon® Excluder® and Scrapers

DASH NO.	B DIA.	E DIA.	D DIA.	G WIDTH	DASH NO.	B DIA.	E DIA.	D DIA.	G WIDTH
1	1.4	1.4	1.4	1.4	66	10.497	10.989	10.772	1.51
2	1.6	1.6	1.6	1.6	67	11.497	11.989	11.772	1.52
3	1.8	1.8	1.8	1.8	68	11.997	12.489	12.272	1.56
4	2.0	2.0	2.0	2.0	69	12.497	12.989	12.772	1.56
5	2.2	2.2	2.2	2.2	70	12.997	13.489	13.272	1.56
6	2.4	2.4	2.4	2.4	71	13.497	13.989	13.772	1.56
7	2.6	2.6	2.6	2.6	72	13.997	14.489	14.272	1.56
8	2.8	2.8	2.8	2.8	73	14.497	14.989	14.772	1.56
9	3.0	3.0	3.0	3.0	74	14.997	15.489	15.272	1.56
10	3.2	3.2	3.2	3.2	75	15.497	15.989	15.772	1.56
11	3.4	3.4	3.4	3.4	76	15.997	16.489	16.272	1.56
12	3.6	3.6	3.6	3.6					
13	3.8	3.8	3.8	3.8					
14	4.0	4.0	4.0	4.0					
15	4.2	4.2	4.2	4.2					
16	4.4	4.4	4.4	4.4					
17	4.6	4.6	4.6	4.6					
18	4.8	4.8	4.8	4.8					
19	5.0	5.0	5.0	5.0					
20	5.2	5.2	5.2	5.2					
21	5.4	5.4	5.4	5.4					
22	5.6	5.6	5.6	5.6					
23	5.8	5.8	5.8	5.8					
24	6.0	6.0	6.0	6.0					
25	6.2	6.2	6.2	6.2					
26	6.4	6.4	6.4	6.4					
27	6.6	6.6	6.6	6.6					
28	6.8	6.8	6.8	6.8					
29	7.0	7.0	7.0	7.0					
30	7.2	7.2	7.2	7.2					
31	7.4	7.4	7.4	7.4					
32	7.6	7.6	7.6	7.6					
33	7.8	7.8	7.8	7.8					
34	8.0	8.0	8.0	8.0					
35	8.2	8.2	8.2	8.2					
36	8.4	8.4	8.4	8.4					
37	8.6	8.6	8.6	8.6					
38	8.8	8.8	8.8	8.8					
39	9.0	9.0	9.0	9.0					
40	9.2	9.2	9.2	9.2					
41	9.4	9.4	9.4	9.4					
42	9.6	9.6	9.6	9.6					
43	9.8	9.8	9.8	9.8					
44	10.0	10.0	10.0	10.0					
45	10.2	10.2	10.2	10.2					
46	10.4	10.4	10.4	10.4					
47	10.6	10.6	10.6	10.6					
48	10.8	10.8	10.8	10.8					
49	11.0	11.0	11.0	11.0					
50	11.2	11.2	11.2	11.2					
51	11.4	11.4	11.4	11.4					
52	11.6	11.6	11.6	11.6					
53	11.8	11.8	11.8	11.8					
54	12.0	12.0	12.0	12.0					
55	12.2	12.2	12.2	12.2					
56	12.4	12.4	12.4	12.4					
57	12.6	12.6	12.6	12.6					
58	12.8	12.8	12.8	12.8					
59	13.0	13.0	13.0	13.0					
60	13.2	13.2	13.2	13.2					
61	13.4	13.4	13.4	13.4					
62	13.6	13.6	13.6	13.6					
63	13.8	13.8	13.8	13.8					
64	14.0	14.0	14.0	14.0					
65	14.2	14.2	14.2	14.2					



SCRAPER RING INSTALLATION
FOR MS33675 GLAND STANDARD

NOTES:
 1. TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR SCRAPER RING IN MS33675 SCRAPER GLANDS.
 2. ORDERING EXAMPLE:
 WM 65 0 0.025 A 105 S
 SCRAPER DESIGNATOR
 SERIES NUMBER
 DESIGN CHARACTERISTICS
 OIL STANDARD
 GLAND DESIGNATOR
 GLAND SIZE
 S = MS33675 SCRAPER GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO MS33675
 QUALITY INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON® SCRAPER MAT'L CODE
 CONFINED OIL PAPER MATERIAL
 CONFINED OIL PAPER MATERIAL
 DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

MS33675	TSS	P/N SIZE
1/4	100	
5/16	200	
3/8	300	
7/16	400	

- THE FOLLOWING TABLE APPLIES TO FRACTIONAL INCH SIZES PER MS33675.
- TREQUIRES SPLIT GLAND
 - EXCLUDER I.C. SERIES E SIZES -506 THRU -513 ARE DIMENSIONALLY INTERCHANGEABLE WITH MS28776 SIZE -6 THRU -13 GLANDS.

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TRELLEBERG SEALING SOLUTIONS

THE SCRAPER RING ASSEMBLY DRAWING NO. WM650S000

Turcon® Excluder® and Scrapers

DC SCRAPER RING INSTALLATION
FOR MSS3675 GLAND STANDARD

INCH

TRELLBERG SEALING SOLUTIONS

DC SCRAPER RING

DRAWING NO. WM820S000

DC SCRAPER RING INSTALLATION
FOR MSS3675 GLAND STANDARD

INCH

TRELLBERG SEALING SOLUTIONS

DC SCRAPER RING

DRAWING NO. WM820S000

NOTES:

- TRELLBERG SEALING SOLUTIONS PART NUMBER FOR DC SCRAPER RING IN MSS3675 GLANDS.
- ORDERING EXAMPLE:
 WE 82 0 5 .025 A 10S
 DC SCRAPER RING DESIGNATOR
 SERIES NUMBER
 DESIGN CHARACTERISTICS
 0 = NO NOTCH (STANDARD)
 GLAND STANDARD DESIGNATOR
 S = MSS3675 SCRAPER GLAND STANDARD
 SIZE DESIGNATOR
 QUALITY INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON® DC SCRAPER RING MAT'L CODE

CONSULT THE TRELLBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

△ THE FOLLOWING TABLE APPLIES TO THOSE FRACTIONAL INCH SIZES PER MSS3675

MSS3675 DASH SIZE	TSS P/N SIZE
1/4	100
3/8	500
7/16	400

DASH NO.	B DIA.	E DIA.	D DIA.	G WIDTH
001	+.000	-.004	+.005	-.000
002	-.002	-.002	-.000	-.000
003	248	510	398	.104
004	310	572	327	
005	373	636	460	
006	435	697	585	
007	498	760	647	
008	560	823	710	
009	623	885	772	
010	685	948	834	
011	748	1010	897	
012	810	1086	949	
013	873	1148	1012	
014	935	1210	1074	
015	998	1273	1136	
016	1060	1335	1199	
017	1123	1398	1262	
018	1185	1461	1324	
019	1248	1523	1386	
020	1310	1586	1448	
021	1373	1648	1510	
022	1435	1739	1605	
023	1498	1802	1668	
024	1560	1864	1730	
025	1623	1926	1793	
026	1685	2017	2043	
027	1748	2108	2178	
028	1810	2200	2303	
029	1873	2291	2427	
030	1935	2382	2552	
031	2000	2473	2677	
032	2062	2564	2802	
033	2125	2655	2927	
034	2187	2746	3052	
035	2250	2837	3177	
036	2312	2928	3302	
037	2375	3019	3427	
038	2437	3110	3552	
039	2500	3201	3677	
040	2562	3292	3802	
041	2625	3383	3927	
042	2687	3474	4052	
043	2750	3565	4177	
044	2812	3656	4302	
045	2875	3747	4427	
046	2937	3838	4552	
047	3000	3929	4677	
048	3062	4020	4802	
049	3125	4111	4927	
050	3187	4202	5052	
051	3250	4293	5177	
052	3312	4384	5302	
053	3375	4475	5427	
054	3437	4566	5552	
055	3500	4657	5677	
056	3562	4748	5802	
057	3625	4839	5927	
058	3687	4930	6052	
059	3750	5021	6177	
060	3812	5112	6302	
061	3875	5203	6427	
062	3937	5294	6552	
063	4000	5385	6677	
064	4062	5476	6802	
065	4125	5567	6927	
066	4187	5658	7052	
067	4250	5749	7177	
068	4312	5840	7302	
069	4375	5931	7427	
070	4437	6022	7552	
071	4500	6113	7677	
072	4562	6204	7802	
073	4625	6295	7927	
074	4687	6386	8052	
075	4750	6477	8177	
076	4812	6568	8302	
077	4875	6659	8427	
078	4937	6750	8552	
079	5000	6841	8677	
080	5062	6932	8802	
081	5125	7023	8927	
082	5187	7114	9052	
083	5250	7205	9177	
084	5312	7296	9302	
085	5375	7387	9427	
086	5437	7478	9552	
087	5500	7569	9677	
088	5562	7660	9802	
089	5625	7751	9927	
090	5687	7842	10052	
091	5750	7933	10177	
092	5812	8024	10302	
093	5875	8115	10427	
094	5937	8206	10552	
095	6000	8297	10677	
096	6062	8388	10802	
097	6125	8479	10927	
098	6187	8570	11052	
099	6250	8661	11177	
100	6312	8752	11302	

WORLD AEROSPACE TITLE BLOCK REV.

Other elements

Turcon[®] Excluder[®] and Scrapers

Turcon® Face Seals

Features and benefits

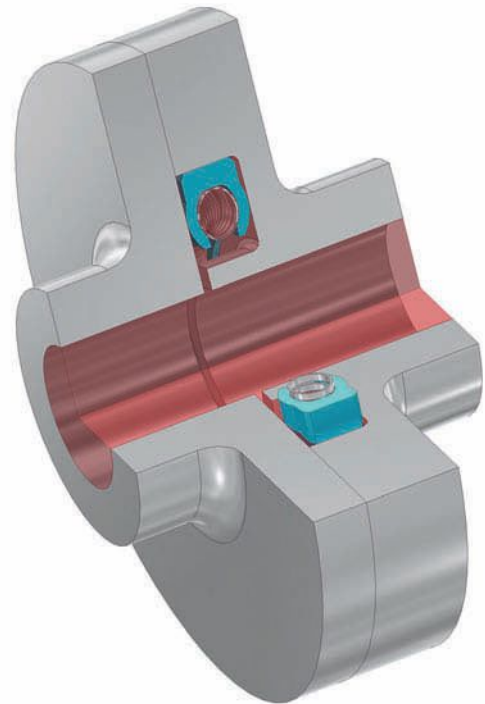
- For demanding applications
- Internal and external designs
- High performance materials
- Superior low friction
- Very wide temperature range
- Available for AS4716 and non-standard sizes

Turcon® Variseal® Face Seal

- Pressure actuated
- Large hardware deflection capable
- Corrosion resistant metal spring energizer
- Unidirectional seal

Turcon® HST Face Seal and Turcon® Wedgpak® Face Seal

- Back-up Ring extrusion resistant for zero-leakage
- Elastomer profile gives optimum performance and loading profile
- Provides unidirectional sealing



Turcon® Variseal® Face Seal HF has unparalleled temperature and chemical resistance and can be used to seal hot or aggressive fluids effectively.

Turcon® Face Seals

■ Turcon® Variseal® Face Seal

Description

Turcon® Variseal® Face Seal is an adaptation of the traditional Turcon® Variseal® design that maximizes performance in face seal applications. Turcon® Variseal® M Face Seal utilizes the cantilever or v-spring and Turcon® Variseal® H Face Seal utilizes a helical spring.

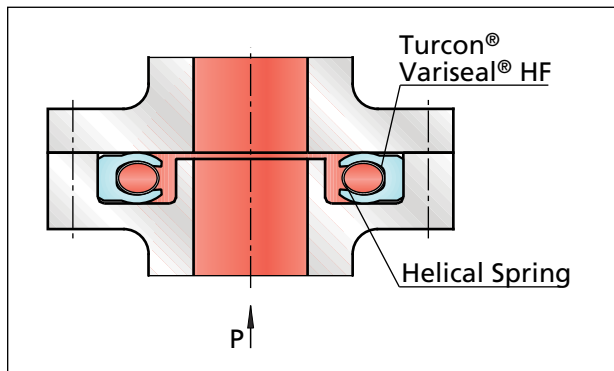


Figure 1 Turcon® Variseal® H Face Seal, Internal

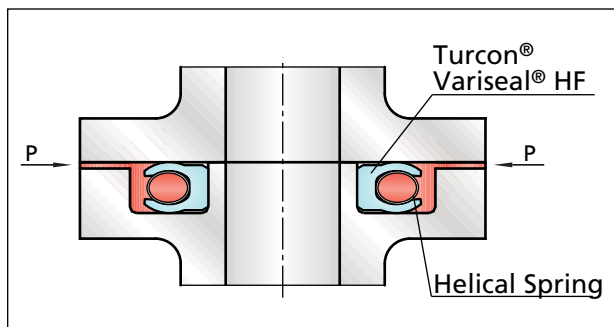


Figure 2 Turcon® Variseal® H Face Seal, External

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

Method of Operation

The spring-energizer in Turcon® Variseal® Face Seal provides tight sealing in system conditions without pressure or when pressure is very low. As the system pressure increases, this activates the seal.

Typically in face seal applications there are impulse pressures. This causes high breathing conditions between the seal and mating hardware. The large heel of Turcon® Variseal® Face Seal acts as a Back-up Ring in these situations, preventing extrusion of the seal.

The Turcon® Variseal® H is especially suitable for sealing gas and for cryogenic applications. The Turcon® Variseal® M is a good all-round seal with low friction characteristics for rotary joints and swivels. Additionally, due to the large flexibility of the sealing lips, it allows a relatively high deflection of the flanges. However it is important to note that large flange deflections must only occur at low pressure.

Spring Types

For details on v-spring and helical spring types see the main section on Turcon® Variseal®.

Technical Data

Operating pressure: 5,000 psi/ 35 MPa (greater in non-standard configurations)

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer material

Clearance: Can exceed recommendations of AS4716 depending on the combination of pressures and clearance gaps

Media: Virtually all media and gases

Series

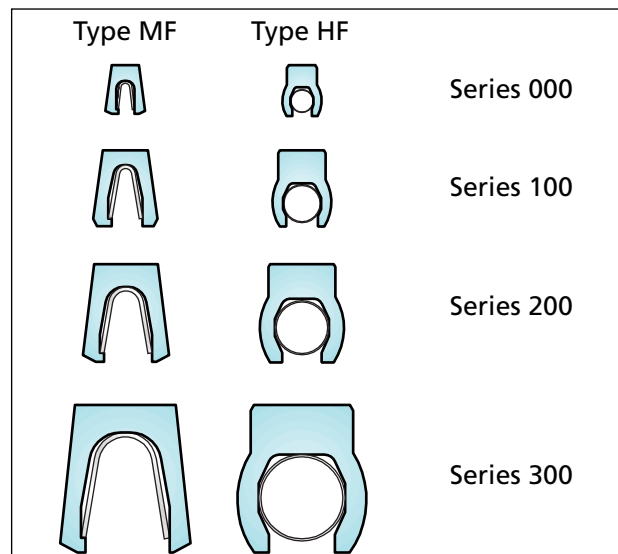


Figure 3 Relative size of Turcon® Variseal® MF and Turcon® Variseal® HF seal cross sections

Turcon® Face Seals

■ Turcon® HST Face Seal

Description

Turcon® HST Face Seal is designed to retrofit O-Rings in AS4716 glands in face seal applications. It consists of an L-shaped elastomer sealing element supported by a solid Turcon® Back-up Ring.

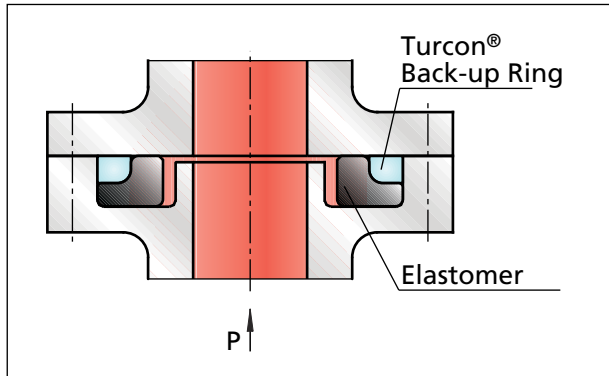


Figure 4 Turcon® HST Face Seal (internal pressure)

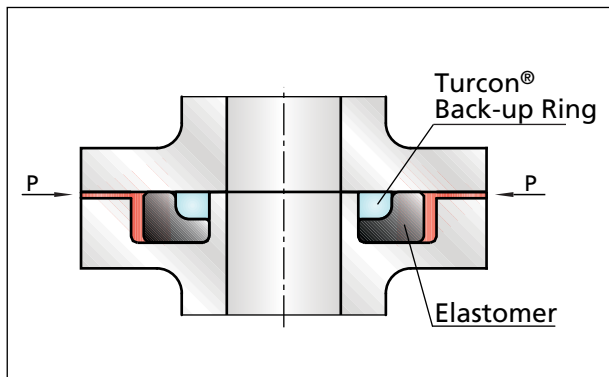


Figure 5 Turcon® HST Face Seal (external pressure)

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

Method of Operation

At zero or low pressure operation, the L-shaped elastomer element functions as a positive sealing element. As the system pressure increases, the L-shaped elastomer is deflected against the Turcon® Back-up Ring. This provides excellent extrusion protection while allowing the L-shaped elastomer to provide outstanding leakage control.

Technical Data

Operation pressure: 5,000 psi/ 35 MPa (greater in non-standard configurations)

Temperature range: Up to -65°F to +390°F/ -54°C to +200°C depending on elastomer material

Clearance: Zero clearance is recommended. Clearance can exceed the recommended clearances of AS4716 depending on the combination of pressures and clearance gaps

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Avoid combining extreme limits.

Series

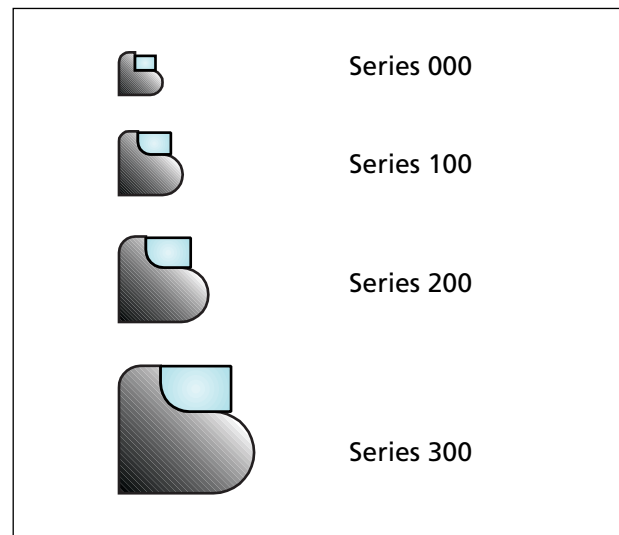


Figure 6 Relative Size of Turcon® HST Face Seal cross section

Turcon® Face Seals

■ Turcon® Wedgpak® Face Seal

Description

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

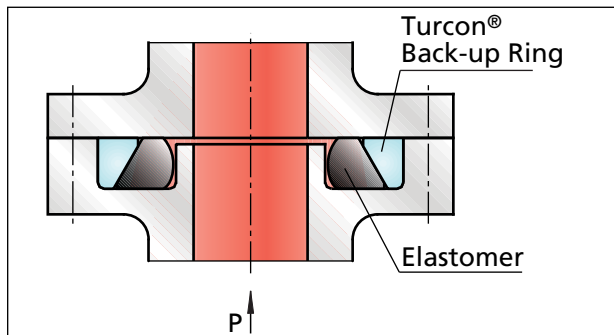


Figure 7 Turcon® Wedgpak® Face Seal (Internal pressure)

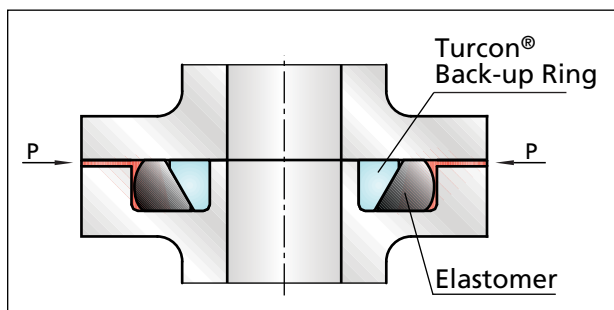


Figure 8 Turcon® Wedgpak® Face Seal (External pressure)

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

Method of Operation

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

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

Technical Data

Operating pressure: 5,000 psi/ 35 MPa (greater in non-standard configurations)

Temperature range: -65°F to +390°F/ -54°C to +200°C depending on elastomer material

Clearance: Can exceed recommendations of MIL-G-5514F/AS4716 dependent upon the combination of pressures and clearance gaps

Media: Mineral oil-based hydraulic fluids, flame-retardant hydraulic fluids, environmentally-safe hydraulic fluids (bio-oils), phosphate ester-based hydraulic oils, water and others depending on the elastomer material selected

Series

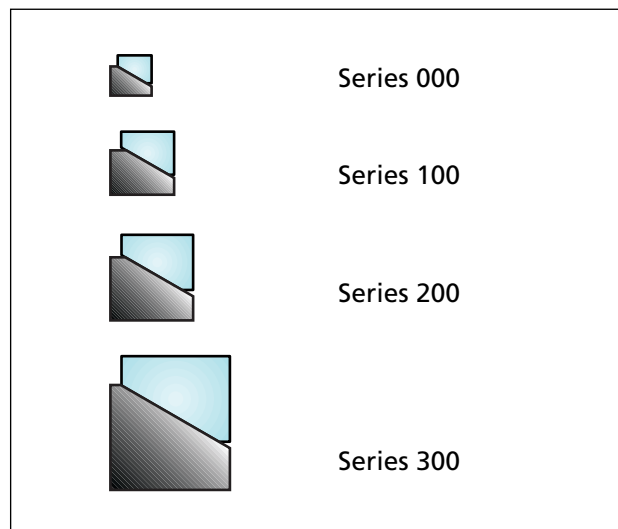









Figure 9 Relative Size of Turcon® Wedgpak® Face Seal cross section

Turcon® Face Seals

Table I Turcon® Face Seal Selection

Cross Section	Description	Available Configuration	Part Number	Gland Standard
	Turcon® Variseal® HF Face Seal	Internal Pressure	DVE	Gland design based on AS4716 dimensions
	Turcon® Variseal® MF Face Seal		DVA	
	Turcon® HST Face Seal		DYHA	
	Turcon® Wedgpak® Face Seal		DW00	
	Turcon® Variseal® HF Face Seal	External Pressure	DVL	Gland design based on AS4716 dimensions
	Turcon® Variseal® MF Face Seal		DVC	
	Turcon® HST Face Seal		DYHB	
	Turcon® Wedgpak® Face Seal		DW01	

Other elements

Turcon® Face Seals

DASH NO.	A DIA.	A DASH NO.	A DIA.	DASH NO.	L GROOVE DEPTH	G GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
010	379	210	1012	008-028	.058/.056	.094/.104	.005/.015	.005
011	441	211	1074	110-135	.091/.089	.141/.151	.005/.015	.007
012	564	212	1137	210-247	.123/.121	.188/.198	.010/.025	.008
013	644	213	1199	325-349	.188/.186	.281/.291	.020/.035	.007
014	754	214	1324					
015	816	215	1384					
016	879							
017	941							
018	1004							
019	1066							
020	1129							
021	1191							
022	1254							
023	1316							
024	1379							
025	1441							
026	1504							
027	1568							
028	1630							
110	630	231	2887	346	4520			
111	693	232	3012	347	4645			
112	755	233	3136	348	4770			
113	818	234	3262	349	4895			
114	881	235	3387					
115	943	236	3512					
116	1005	237	3637					
117	1068	238	3762					
118	1130	239	3887					
119	1193	240	4012					
120	1255	241	4137					
121	1318	242	4262					
122	1380	243	4387					
123	1443	244	4512					
124	1505	245	4637					
125	1568	246	4762					
126	1630	247	4887					
127	1693							
128	1755							
129	1818							
130	1880							
131	1943							
132	2005							
133	2068							
134	2130							
135	2193							

VARISEAL® HF INSTALLATION
FOR INTERNAL PRESSURE FACE SEAL GLANDS

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER IN VARISEAL® HF, FACE SEAL, INTERNAL PRESSURE GLANDS.
- ORDERING EXAMPLE: IVE 2 0 1 214 A 105 SH
 2. VARISEAL® HF INTERNAL DESIGNATOR IVE 2 0 1 214 A 105 SH
 CROSS SECTION
 0 = 000 SERIES
 1 = 100 SERIES
 G = 200 SERIES
 J = 300 SERIES
 DESIGN CHARACTERISTICS
 GLAND STANDARD
 M = AS4716
 SIZE DESIGNATION
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON® VARISEAL® HF MAT'L CODE
 SPRING MAT'L CODE - HEAVY SPRING LOAD
 AS STANDARD

FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE.
 SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL CODE	HEAVY DUTY AS STANDARD	MATERIAL CODE	301 STAINLESS STEEL	H HASTELLOY	E ELGILOY

INCH 2009_1

TRELLEBERG
 SEALING SOLUTIONS

THE
VARISEAL® HF, FACE SEAL, INTERNAL
 DRAWING NO.
DVE00B00

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Turcon® Face Seals

DASH NO.	A DIA.	DASH NO.	A DIA.	DASH NO.	L GROOVE DEPTH	G GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
008	*.000	210	1.012	008-028	.058/.056	.094/.104	.005/.015	.005
009	.316	211	1.017	110-135	.091/.089	.141/.151	.005/.015	.007
010	.375	212	1.127	210-247	.123/.121	.188/.198	.010/.025	.008
011	.441	213	1.199	325-349	.188/.186	.281/.291	.020/.035	.007
012	.504	214	1.262					
013	.566	215	1.324					
014	.629	216	1.387					
015	.691	217	1.449					
016	.754	218	1.511					
017	.816	219	1.574					
018	.879	220	1.637					
019	.941	221	1.699					
020	1.004	222	1.762					
021	1.066	223	1.825					
022	1.129	224	1.887					
023	1.191	225	1.950					
024	1.254	226	2.012					
025	1.316	227	2.075					
026	1.379	228	2.137					
027	1.441	229	2.200					
028	1.504	230	2.262					
		231	2.325					
		232	2.387					
		233	2.450					
		234	2.512					
110	.568	235	2.575					
111	.630	236	2.637					
112	.693	237	2.700					
113	.755	238	2.762					
114	.818	239	2.825					
115	.880	240	2.887					
116	.943	241	2.950					
117	1.005	242	3.012					
118	1.068	243	3.075					
119	1.130	244	3.137					
120	1.193	245	3.200					
121	1.255	246	3.262					
122	1.318	247	3.325					
123	1.380	248	3.387					
124	1.443	249	3.450					
125	1.505	250	3.512					
126	1.568	251	3.575					
127	1.630	252	3.637					
128	1.693	253	3.700					
129	1.755	254	3.762					
130	1.818	255	3.825					
131	1.880	256	3.887					
132	1.943	257	3.950					
133	2.005	258	4.012					
134	2.068	259	4.075					
135	2.131	260	4.137					
		261	4.200					
		262	4.262					
		263	4.325					
		264	4.387					
		265	4.450					
		266	4.512					
		267	4.575					
		268	4.637					
		269	4.700					
		270	4.762					
		271	4.825					
		272	4.887					
		273	4.950					
		274	5.012					
		275	5.075					
		276	5.137					
		277	5.200					
		278	5.262					
		279	5.325					
		280	5.387					
		281	5.450					
		282	5.512					
		283	5.575					
		284	5.637					
		285	5.700					
		286	5.762					
		287	5.825					
		288	5.887					
		289	5.950					
		290	6.012					
		291	6.075					
		292	6.137					
		293	6.200					
		294	6.262					
		295	6.325					
		296	6.387					
		297	6.450					
		298	6.512					
		299	6.575					
		300	6.637					
		301	6.700					
		302	6.762					
		303	6.825					
		304	6.887					
		305	6.950					
		306	7.012					
		307	7.075					
		308	7.137					
		309	7.200					
		310	7.262					
		311	7.325					
		312	7.387					
		313	7.450					
		314	7.512					
		315	7.575					
		316	7.637					
		317	7.700					
		318	7.762					
		319	7.825					
		320	7.887					
		321	7.950					
		322	8.012					
		323	8.075					
		324	8.137					
		325	8.200					
		326	8.262					
		327	8.325					
		328	8.387					
		329	8.450					
		330	8.512					
		331	8.575					
		332	8.637					
		333	8.700					
		334	8.762					
		335	8.825					
		336	8.887					
		337	8.950					
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		342	9.262					
		343	9.325					
		344	9.387					
		345	9.450					
		346	9.512					
		347	9.575					
		348	9.637					
		349	9.700					
		350	9.762					
		351	9.825					
		352	9.887					
		353	9.950					
		354	10.012					
		355	10.075					
		356	10.137					
		357	10.200					
		358	10.262					
		359	10.325					
		360	10.387					

FOR INTERNAL PRESSURE, ZERO BACKUP WIDTH GLANDS

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER IN HST SEAL™, FACE SEAL, INTERNAL PRESSURE GLANDS.
- ORDERING EXAMPLE:
 HST SEAL™ INTERNAL DESIGNATOR — DYHA0 R 224 A I19 ME
 BACKUP WIDTH —
 GLAND —
 B = TRELLEBERG SEALING SOLUTIONS GLAND STANDARD
 SIZE DESIGNATOR —
 ACCORDING TO TRELLEBERG SEALING SOLUTIONS GLAND STANDARD
 QUALITY INDEX —
 AEROSPACE CERTIFICATE OF PERFORMANCE —
 TUREL™ AEROSPACE BACKUP RING MAT'L. CODE —
 TUREL™ ELASTOMER MAT'L. CODE —
 CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

AVAILABLE ZURCON™ MATERIALS, ORDERING CODES

ZURCON™ DESCRIPTION	PART NUMBER CODE
ZURCON® 260	Z60
ZURCON® 240	Z40
ZURCON® 243	Z43

INCH

TITLE
HST SEAL™

DRAWING NO.
DYHA0B000

2011_4

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Turcon® Face Seals

DASH NO.	A DIA.	A DASH NO.	A DIA.	L GROOVE DEPTH	G GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
008	.316	210	+0.00	.058/.056	.094/.104	.005/.015	.005
009	.348	211	1.012	.091/.089	.141/.151	.005/.015	.007
010	.377	212	1.077	.123/.121	.188/.198	.010/.025	.008
011	.441	213	1.159	.188/.186	.281/.291	.020/.035	.007
012	.504	214	1.262				
013	.566	215	1.324				
014	.629	216	1.387				
015	.691	217	1.449				
016	.754	218	1.511				
017	.816	219	1.574				
018	.879	220	1.637				
019	.941	221	1.699				
020	1.004	222	1.762				
021	1.066	223	1.824				
022	1.129	224	1.887				
023	1.191	225	1.950				
024	1.254	226	2.012				
025	1.316	227	2.075				
026	1.379	228	2.137				
027	1.441	229	2.200				
028	1.504	230	2.262				
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		294	6.262				
		295	6.325				
		296	6.387				
		297	6.450				
		298	6.512				
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		300	6.637				
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		302	6.762				
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		305	6.950				
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		307	7.075				
		308	7.137				
		309	7.200				
		310	7.262				
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		312	7.387				
		313	7.450				
		314	7.512				
		315	7.575				
		316	7.637				
		317	7.700				
		318	7.762				
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		321	7.950				
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		329	8.450				
		330	8.512				
		331	8.575				
		332	8.637				
		333	8.700				
		334	8.762				
		335	8.825				
		336	8.887				
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		338	9.012				
		339	9.075				
		340	9.137				
		341	9.200				
		342	9.262				
		343	9.325				
		344	9.387				
		345	9.450				
		346	9.512				
		347	9.575				
		348	9.637				
		349	9.700				
		350	9.762				

WEDGPAK® FACE SEAL INSTALLATION
FOR INTERNAL PRESSURE, ZERO BACKUP WIDTH GLANDS

NOTES:

- TRELLEBORG SEALING SOLUTIONS PART NUMBER FOR WEDGPAK® FACE SEAL IN INTERNAL PRESSURE GLANDS.
- ORDERING EXAMPLE: **DW000 B 224 A I19 NE**

WEDGPAK® FACE SEAL, INTERNAL DESIGNATOR
 G = GROOVE WIDTH
 B = TRELLEBORG SEALING SOLUTIONS PART NUMBER
 A = AEROSPACE CERTIFICATE OF CONFORMANCE TUREL® ELASTOMER MAT'L. CODE
 I = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

QUALITY INDEX:
 A = AEROSPACE CERTIFICATE OF CONFORMANCE TUREL® ELASTOMER MAT'L. CODE
 I = TRELLEBORG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

AVAILABLE ZURCIN® MATERIALS, ORDERING CODES

ZURCIN® DESCRIPTION	PART NUMBER
ZURCIN® Z60	Z60
ZURCIN® Z40	Z40
ZURCIN® Z43	Z43

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INCH	2009_1
	TITLE WEDGPAK® FACE SEAL
TRELLEBORG SEALING SOLUTIONS	DRAWING NO. DW000B000

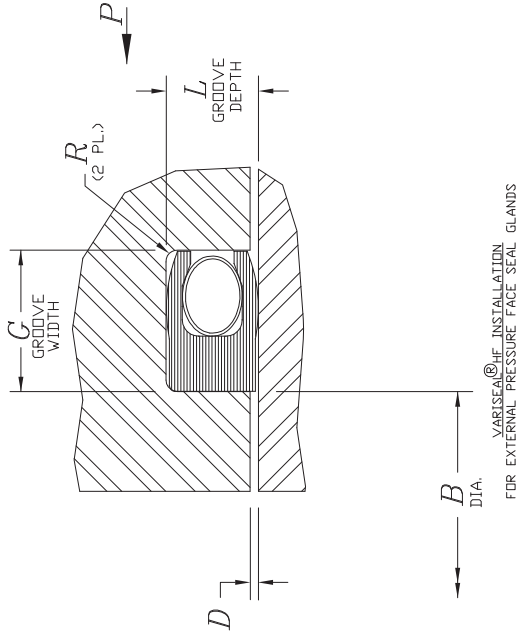
WORLD AEROSPACE TITLE BLOCK REV.

Other elements

The drawings are also available on the CD supplied with this manual or they can be downloaded from www.tss.trelleborg.com. 275

Turcon® Face Seals

DASH NO.	B DIA.	B DASH NO.	B DIA.	B DASH NO.	B DIA.	DASH NO.	L GROOVE DEPTH	C GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
008	+0.000	210	+0.000	325	+0.000	008-028	.058/.056	.084/.104	.005/.015	.005
009	-.002	211	-.002	326	-.002	110-135	.091/.089	.141/.151	.005/.015	.007
010	-.002	212	-.002	327	-.002	210-247	.123/.121	.188/.198	.010/.025	.008
011	-.002	213	-.002	328	-.002	325-349	.188/.186	.281/.291	.020/.035	.007
012	-.002	214	-.002	329	-.002					
013	-.002	215	-.002	330	-.002					
014	-.002	216	-.002	331	-.002					
015	-.002	217	-.002	332	-.002					
016	-.002	218	-.002	333	-.002					
017	-.002	219	-.002	334	-.002					
018	-.002	220	-.002	335	-.002					
019	-.002	221	-.002	336	-.002					
020	-.002	222	-.002	337	-.002					
021	-.002	223	-.002	338	-.002					
022	-.002	224	-.002	339	-.002					
023	-.002	225	-.002	340	-.002					
024	-.002	226	-.002	341	-.002					
025	-.002	227	-.002	342	-.002					
026	-.002	228	-.002	343	-.002					
027	-.002	229	-.002	344	-.002					
028	-.002	230	-.002	345	-.002					
111	-.002	231	-.002	346	-.002					
112	-.002	232	-.002	347	-.002					
113	-.002	233	-.002	348	-.002					
114	-.002	234	-.002	349	-.002					
115	-.002	235	-.002	3109	-.002					
116	-.002	236	-.002	3234	-.002					
117	-.002	237	-.002	3359	-.002					
118	-.002	238	-.002	3484	-.002					
119	-.002	239	-.002	3609	-.002					
120	-.002	240	-.002	3734	-.002					
121	-.002	241	-.002	3859	-.002					
122	-.002	242	-.002	3984	-.002					
123	-.002	243	-.002	4109	-.002					
124	-.002	244	-.002	4234	-.002					
125	-.002	245	-.002	4359	-.002					
126	-.002	246	-.002	4484	-.002					
127	-.002	247	-.002	4609	-.002					
128	-.002	248	-.002		-.002					
129	-.002	249	-.002		-.002					
130	-.002	250	-.002		-.002					
131	-.002	251	-.002		-.002					
132	-.002	252	-.002		-.002					
133	-.002	253	-.002		-.002					
134	-.002	254	-.002		-.002					
135	-.002	255	-.002		-.002					



NOTES:
 1. TRELLEBERG SEALING SOLUTIONS PART NUMBER IN VARISEAL® HF, FACE SEAL, EXTERNAL PRESSURE GLANDS.
 2. ORDERING EXAMPLE: DVL 2 0 M 214 A 105 SH
 CROSS SECTION
 0 = 000 SERIES
 1 = 100 SERIES
 2 = 200 SERIES
 3 = 300 SERIES
 4 = 400 SERIES
 5 = 500 SERIES
 6 = 600 SERIES
 7 = 700 SERIES
 8 = 800 SERIES
 9 = 900 SERIES
 DESIGN CHARACTERISTICS
 GLAND STANDARD
 M = AS4716
 SIZE DESIGNATION
 ACCORDING TO AS4716 REVISION A
 QUALITY INDEX:
 A = AEROSPACE CERTIFICATE OF CONFORMANCE
 TURCON®VARISEAL®HF MAT'L CODE
 SPRING MAT'L CODE - HEAVY SPRING LOAD
 AS STANDARD
 FOR MATERIAL OPTIONS, SEE MATERIALS SECTION OF TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE.
 SPRING MATERIAL OPTIONS LISTED BELOW.

SPRING MATERIAL CODE	HEAVY DUTY AS STANDARD	MATERIAL
S	301	STAINLESS STEEL
H		HASTELLOY
E		ELGILOY

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INCH 2009_1

TRELLEBERG SEALING SOLUTIONS

TITLE VARISEAL® HF, FACE SEAL, EXTERNAL DRAWING NO. DVLO0B00

Turcon® Face Seals

DASH NO.	B DIA.	DASH NO.	B DIA.	DASH NO.	L GROOVE DEPTH	G GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
008	.176	210	.734	008-028	.058/.056	.094/.104	.005/.015	.005
009	.176	211	.734	110-135	.091/.089	.141/.151	.005/.015	.007
010	.233	212	.859	210-247	.123/.121	.188/.198	.007/.025	.008
011	.233	213	.859	325-349	.188/.186	.281/.291	.020/.035	.007
012	.301	214	.984					
013	.426	215	1.046					
014	.489	216	1.109					
015	.551	217	1.171					
016	.614	218	1.234					
017	.676	219	1.296					
018	.739	220	1.359					
019	.801	221	1.421					
020	.864	222	1.484					
021	.926	223	1.509					
022	.989	224	1.734					
023	1.051	225	1.859					
024	1.114	226	1.984					
025	1.176	227	2.109					
026	1.239	228	2.234					
027	1.301	229	2.359					
028	1.364	230	2.484					
		231	2.609					
		232	2.734					
110	.362	233	2.859					
111	.424	234	2.984					
112	.487	235	3.109					
113	.549	236	3.234					
114	.612	237	3.359					
115	.674	238	3.484					
116	.737	239	3.609					
117	.799	240	3.734					
118	.862	241	3.859					
119	.924	242	3.984					
120	.987	243	4.109					
121	1.049	244	4.234					
122	1.112	245	4.359					
123	1.174	246	4.484					
124	1.237	247	4.609					
125	1.299	248	4.734					
126	1.362	249	4.859					
127	1.424	250	4.984					
128	1.487	251	5.109					
129	1.549	252	5.234					
130	1.612	253	5.359					
131	1.674	254	5.484					
132	1.737	255	5.609					
133	1.799	256	5.734					
134	1.862	257	5.859					
135	1.925	258	5.984					

HST SEAL™ INSTALLATION
FOR EXTERNAL PRESSURE FACE SEAL GLANDS

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER IN HST SEAL™, FACE SEAL, EXTERNAL PRESSURE GLANDS.
- ORDERING EXAMPLE: **DYHBO R 224 A I19 ME**
 HST SEAL™ EXTERNAL DESIGNATOR
 RADIUS OF GROOVE STANDARD
 B = TRELLEBERG SEALING SOLUTIONS GLAND STANDARD
 SIZE DESIGNATOR
 ACCORDING TO TRELLEBERG SEALING SOLUTIONS GLAND STANDARD
 QUALITY INDEX
 TRELLEBERG SEALING SOLUTIONS PART NUMBER
 TUREL® ELASTOMER MAT'L CODE
 CONSULT THE TRELLEBERG SEALING SOLUTIONS AEROSPACE DESIGN GUIDE FOR A WIDE RANGE OF MATERIALS.

AVAILABLE ZURCON® MATERIALS, ORDERING CODES

ZURCON® DESCRIPTION	PART NUMBER
ZURCON® Z60	Z60
ZURCON® Z40	Z40
ZURCON® Z43	Z43

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INCH

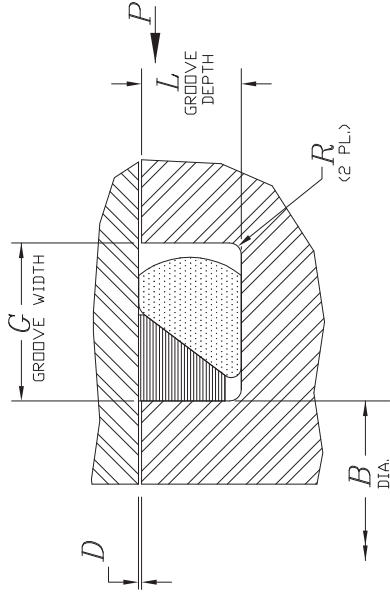
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TRELLEBERG SEALING SOLUTIONS

TITLE
HST SEAL™

DRAWING NO.
DYHBOB000

Turcon® Face Seals

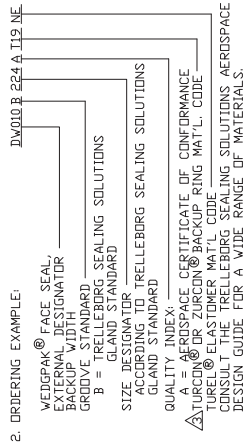


WEDGPAK® FACE SEAL INSTALLATION
FOR EXTERNAL PRESSURE FACE SEAL GLANDS

DASH NO.	B DIA.	DASH NO.	B DIA.	L GROOVE DEPTH	G GROOVE WIDTH	R RADIUS	D HARDWARE CLEARANCE MAX.
008	.176	210	.734	.058/.056	.094/.104	.005/.015	.005
009	.238	211	.899	.091/.089	.141/.151	.005/.015	.007
010	.301	212	1.064	.123/.121	.188/.198	.007/.025	.008
011	.364	213	1.229	.188/.186	.281/.291	.020/.035	.007
012	.426	214	1.394				
013	.489	215	1.559				
014	.551	216	1.724				
015	.614	217	1.889				
016	.677	218	2.054				
017	.740	219	2.219				
018	.803	220	2.384				
019	.866	221	2.549				
020	.929	222	2.714				
021	.992	223	2.879				
022	1.055	224	3.044				
023	1.118	225	3.209				
024	1.181	226	3.374				
025	1.244	227	3.539				
026	1.307	228	3.704				
027	1.370	229	3.869				
028	1.433	230	4.034				
		231	4.199				
		232	4.364				
		233	4.529				
		234	4.694				
110	.362	235	3.109				
111	.424	236	3.274				
112	.487	237	3.439				
113	.549	238	3.604				
114	.612	239	3.769				
115	.674	240	3.934				
116	.737	241	4.099				
117	.799	242	4.264				
118	.862	243	4.429				
119	.924	244	4.594				
120	.987	245	4.759				
121	1.049	246	4.924				
122	1.112	247	5.089				
123	1.174	248	5.254				
124	1.237	249	5.419				
125	1.299	250	5.584				
126	1.422	251	5.749				
127	1.484	252	5.914				
128	1.547	253	6.079				
129	1.609	254	6.244				
130	1.672	255	6.409				
131	1.734	256	6.574				
132	1.797	257	6.739				
133	1.859	258	6.904				
134	1.922	259	7.069				
135	1.984	260	7.234				

NOTES:

- TRELLEBERG SEALING SOLUTIONS PART NUMBER FOR WEDGPAK® FACE SEAL IN EXTERNAL PRESSURE GLANDS.
- ORDERING EXAMPLE:



AVAILABLE ZURCON® MATERIALS, ORDERING CODES

ZURCON® DESCRIPTION	PART NUMBER CODE
ZURCON® Z60	Z60
ZURCON® Z40	Z40
ZURCON® Z43	Z43

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INCH 2009_1

TRELLEBERG SEALING SOLUTIONS

THE WEDGPAK® FACE SEAL

DRAWING NO. DW010B000

Turcon® Face Seals

O-Rings

Features and benefits

- Versatile sealing element
- Cost-effective in a wide range of primarily static applications
- Simple one-piece gland design minimizes hardware and design costs
- Compact design allows smaller hardware
- Easy installation
- Compounds specifically engineered for aerospace applications provide broad chemical compatibility
- Many sizes available from stock worldwide

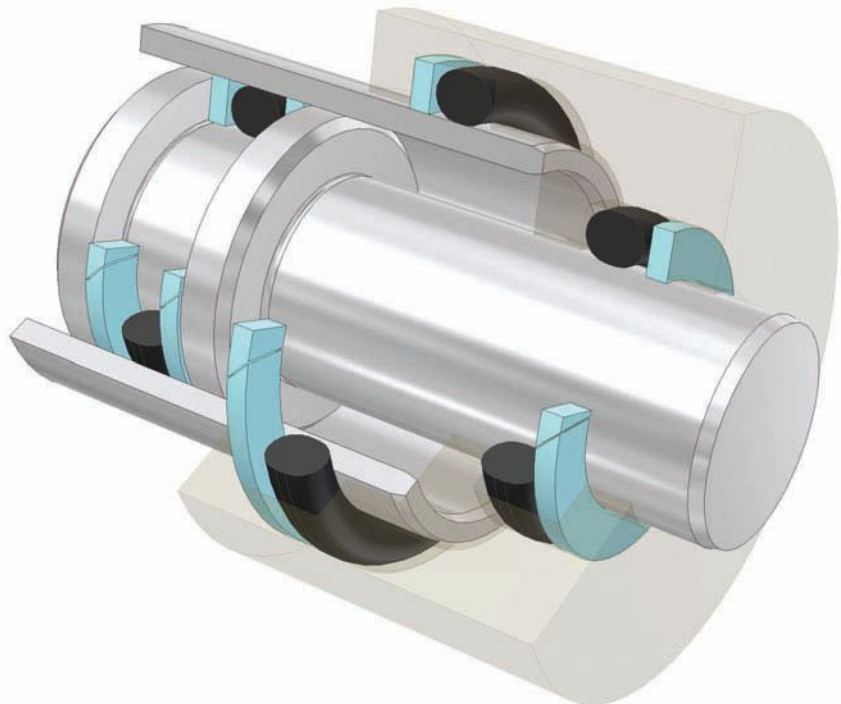


Illustration shows O-Rings in a hydraulic application.

O-Rings

Description

O-Rings are vulcanized in molds and characterized by their circular or torus form. The dimensions of O-Rings are defined by their inside diameter and cross section.

Efficient production methods and ease of use have made O-Rings the most widely used seals. They offer the designer an efficient, versatile and economical sealing element for a wide range of static and very light-duty dynamic applications.

O-Rings can be produced in a wide choice of Turel® or Isolast® elastomer materials specifically engineered for the aerospace industry. Compounds are available that are compatible with virtually all media commonly used in aircraft or spacecraft applications.

Cross sections of .013 in/ 0.35 mm up to 1.6 in/ 40 mm and inside diameters of up to 196 in/ 50 m and more are available. Giant O-Rings can be produced by Trelleborg Sealing Solutions FlexiMold™ process without the need for a dedicated tool, minimizing lead times and costs.

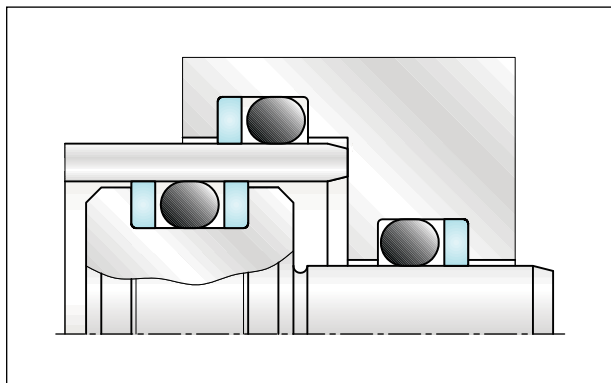


Figure 1 Typical Turel® O-Ring Application

In addition, O-Rings can be manufactured in Zurcon® polyurethane in hardness 70 to 90 Shore A. These demonstrate high wear and extrusion resistance with low friction.

O-Rings are available to meet ISO 3601, AS568 A, BS1806, BS4518 and other recognized standards.

Applications

Turel® or Isolast® O-Rings are used as sealing elements on their own or as energizing elements for hydraulic slipper seals and wipers. This means that they cover a large number of fields of application.

Typical aerospace applications include:

- Radial static seal for bushings, covers, pipes and cylinders
- Axial static seal for flanges, manifolds, plates and caps

O-Rings are not generally recommended in dynamic applications as they are limited by speed and the system pressure they are trying to seal against.

Method of Operation

O-Rings are double-acting sealing elements. The initial squeeze or compression acts in a radial or axial direction, depending on the application. This gives the O-Ring its initial sealing capability. These forces are increased by the system pressure to create the total sealing force. This increases as the system pressure increases.

Under pressure the O-Ring behaves in a similar fashion to a fluid with high surface tension. The pressure is transmitted uniformly in all directions. The net result is efficient reliable sealing performance.

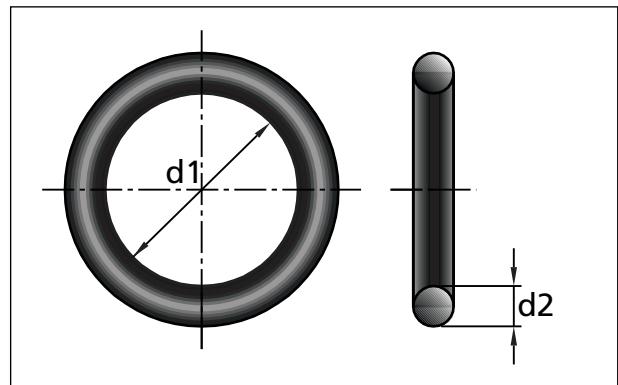


Figure 2 O-Ring Dimensioning

Trelleborg Sealing Solutions recommends O-Rings be used with Turcon® Back-up Rings at higher pressures.

O-Rings

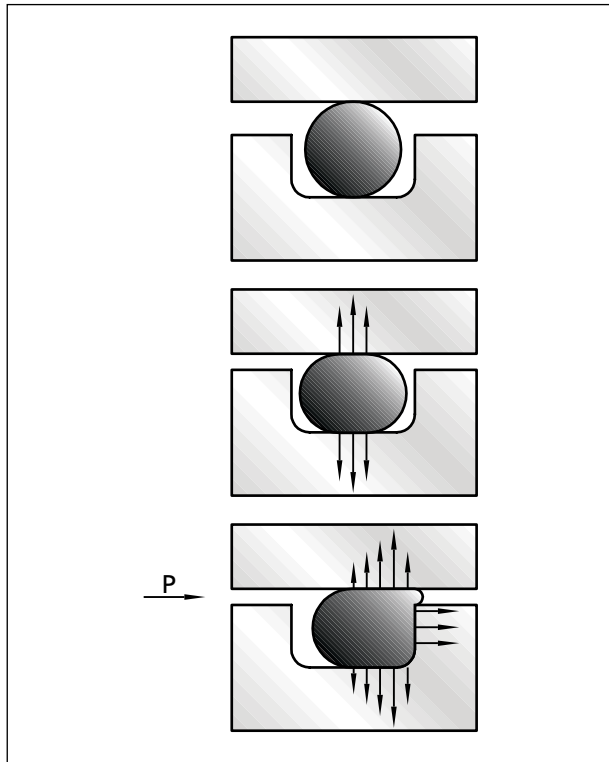


Figure 3 Turel® O-Ring Sealing Forces with and without System Pressure

Technical data

O-Rings can be used in a wide range of applications. Temperature, pressure and media determine the choice of appropriate materials. In order to assess the suitability of an O-Ring as a sealing element for a given application, the interaction of all the operating parameters have to be taken into consideration.

Working Pressure

Static applications

Up to 725 psi/ 5 MPa for O-Rings with inside diameter > 1.968 in/ 50 mm without Back-up Ring

Up to 1,500 psi/ 10 MPa for O-Rings with inside diameter > 1.968 in/ 50 mm without Back-up Ring depending on the material, the cross section and clearance

Up to 5,800 psi/ 40 MPa with Back-up Ring

Up to 36,260 psi/ 250 MPa with special Back-up Ring

Dynamic applications

Reciprocating up to 725 psi/ 5 MPa without Back-up Ring

Higher pressures with Back-up Ring

Speed: Reciprocating up to 1.64 ft/s/ 0.5 m/s
Rotating up to 1.64 ft/s/ 0.5 m/s
Depending on material and application

Temperature: From -76 to +617°F/ -60 to +325 °C
Depending on material and media resistance
Peak and continuous operating temperatures and running period should be taken into consideration when specifying material. For rotating applications the temperature increase due to frictional heat must be taken into account.

Media: Elastomer materials are available that are compatible with virtually all media and gases. To identify suitable elastomer types for a particular media use the Trelleborg Sealing Solutions online chemical compatibility check on www.tss.trelleborg.com

O-Rings

Materials

O-Rings are primarily manufactured from Turel® elastomers including Nitrile (NBR), Fluorocarbon (FKM), Ethylene Propylene Diene Monomer (EPDM), Fluorosilicone (FVMQ) and Silicone Rubber (Q). In addition, for high-temperature applications, an Isolast® perfluoroelastomer (FFKM) is recommended. These materials are extremely flexible in their use and are suitable for a large number of applications. For further details on these go to the Material Technology section.

Characteristics and Inspection of Elastomers for use in O-Rings

Hardness

Hardness is an important characteristic of an O-Ring. It is defined as the resistance of a body against penetration of an even harder body of a standard shape and defined pressure.

There are two procedures for hardness testing:

1. Shore A/D according to ISO 868 /ISO 7619 / DIN 53 505 / ASTM D 2240
Measurement of test samples
2. Durometer IRHD (International Rubber Hardness Degree) according to ISO 48 / ASTM 1414 and 1415
Measurement of test samples and finished parts

The hardness scale has a range from zero (softest) to 100 (hardest). The measured values depend on the elastic qualities of the elastomers, especially the tensile strength.

The test should be carried out at temperatures of $73 \pm 2^\circ\text{F}$ / $23 \pm 2^\circ\text{C}$ - not earlier than 16 hours after the last vulcanization process. If the test is carried out at other temperatures, this should be mentioned in the test report.

Tests should only be carried out with samples which have not previously been stressed mechanically.

Hardness tests according to Shore A / D

The hardness test device for Shore A is an indenter with a pyramid base. It is suitable for use in the hardness range of shore 10 up to 90. Samples with a greater hardness than this should be tested with a Shore D device, an indenter with spike.

Test specimen:

Diameter minimum 1.181 in/ 30 mm

Thickness minimum 0.236 in /6 mm

Upper and lower sides smooth and flat

When thin material is being tested it can be layered, providing minimal sample thickness is achieved by a maximum of three layers. All layers must be a minimum 0.079 in / 2 mm thick.

The measurement is done at three different places at a defined distance and time.

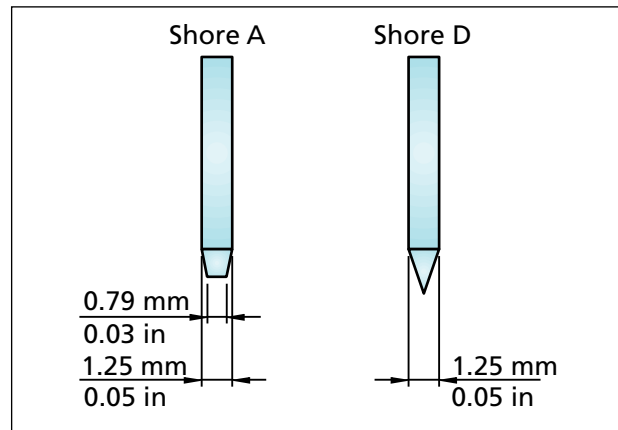


Figure 4 Indenter according to Shore A/D

Hardness test according to IRHD

The durometer test according to IRHD is used with test samples and with finished goods.

The thickness of the test material has to be adjusted according to the range of hardness. According to ISO 48, there are two hardness ranges.

Soft: 10 to 35 IRHD → Sample thicknesses
0.394 to 0.591 in/
10 to 15 mm - procedure L

Normal: over 35 IRHD → Sample thicknesses
0.315 to 0.394 in/8 to 10 mm
- procedure N
Sample thicknesses
0.059 to 0.098 in/ 1.5 to
2.5 mm - procedure M

The hardness of finished parts or product samples usually varies from that of specimen samples, especially those with a curved surface.

O-Rings

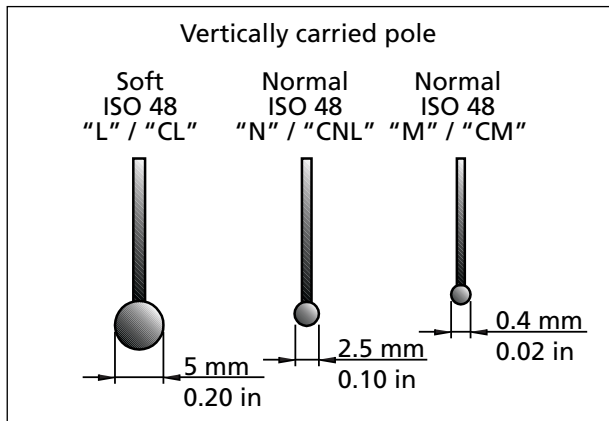


Figure 5 Indenter according to IRHD

Compression Set

An important parameter affecting the sealing capability of an O-Ring is the compression set (CS) of its material. Elastomers, when under compression, demonstrate elasticity and also permanent plastic deformation.

The compression set is determined in accordance with ISO 815 as follows:

Standard test piece: Cylindrical disc, diameter 0.512 in / 13 mm and height 0.236 in / 6 mm

Deformation: 25%

Tension release time: 30 minutes

$$CS = \frac{H_0 - h_2}{H_0 - h_1} \times 100$$

Where h_0 = Original height (cross section d_2)

h_1 = Height in the compressed state

h_2 = Height after tension release

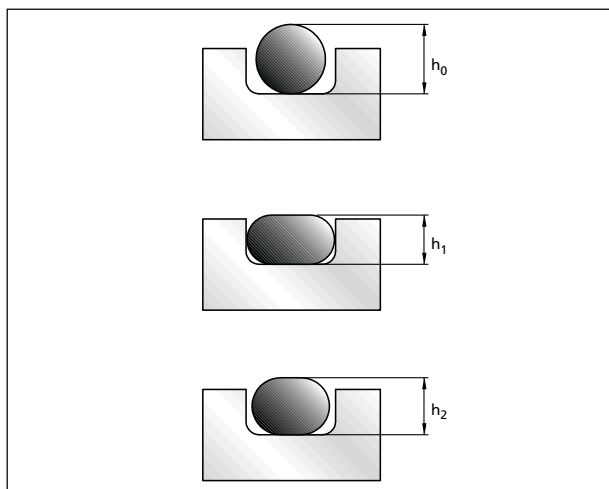


Figure 6 Illustration of compression set

Design Recommendations

The following design recommendations do not apply to Isolast® perfluoroelastomer materials. For these refer to our Isolast® brochure or contact your local Trelleborg Sealing Solutions marketing company for further details.

Installation Recommendations

General recommendations

Before starting installation, check that:

- Lead-in chamfers are made according to drawing
- Bores are deburred and edges rounded
- Machining residues such as chips, dirt and foreign particles are removed
- Screw thread tips are covered
- Seals and components are greased or oiled
- The elastomer is compatible application media
- Lubricants with solid additives, such as molybdenum disulfide or zinc sulfide, are not used in the application.

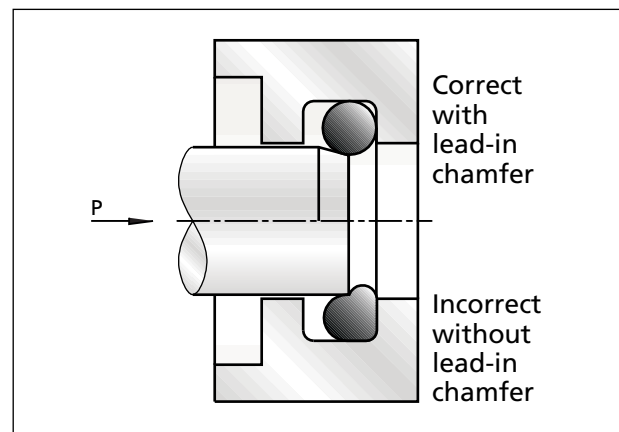


Figure 7 Rod installation with O-Ring

O-Rings

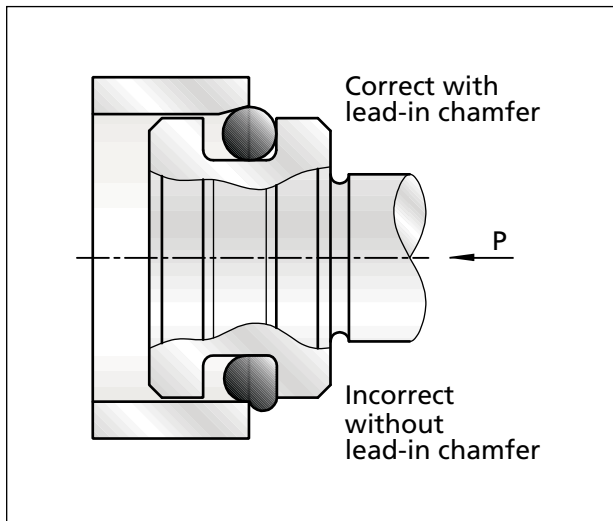


Figure 8 Piston installation with O-Ring

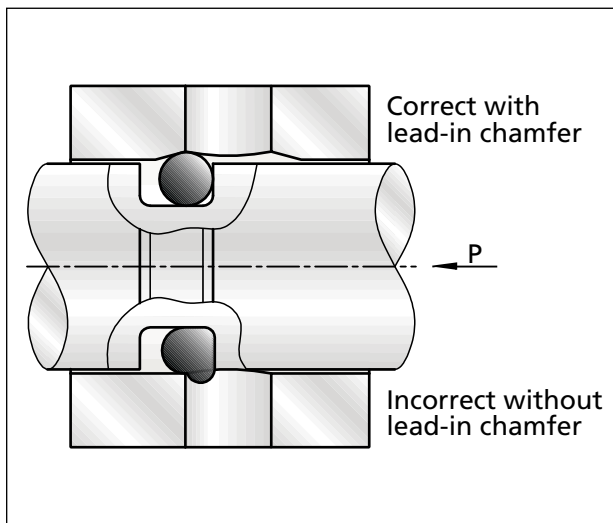


Figure 9 O-Ring installation over transverse bores

Installation over threads, splines etc.

Should an O-Ring have to be stretched over threads, splines, keyways etc., then an assembly mandrel is essential. This mandrel can either be manufactured in a soft metal or a plastic material, without burrs or sharp edges.

Automated installation

Before automated O-Ring installation, good preparation is required. The surfaces of O-Rings can

be treated in several ways to reduce installation forces and prevent O-Rings sticking together.

For further details contact your local Trelleborg Sealing Solutions marketing company.

Initial Compression

An initial compression or squeeze of the O-Ring in the groove is essential to ensure its function as a primary or secondary sealing element. This is required to:

- achieve the initial sealing capability
- bridge production tolerances
- assure defined frictional forces
- compensate for compression set and wear

Depending on the application, the following values apply for the initial squeeze as a proportion of the cross section (d_2):

Dynamic applications: 6 to 20 percent
 Static applications: 15 to 30 percent

The design of the grooves can be based on the guide values for the initial squeeze shown in the diagrams in Figures 11 and 12. These take into account the relationship between loads and cross sections according to ISO 3601-2 (version 1987).

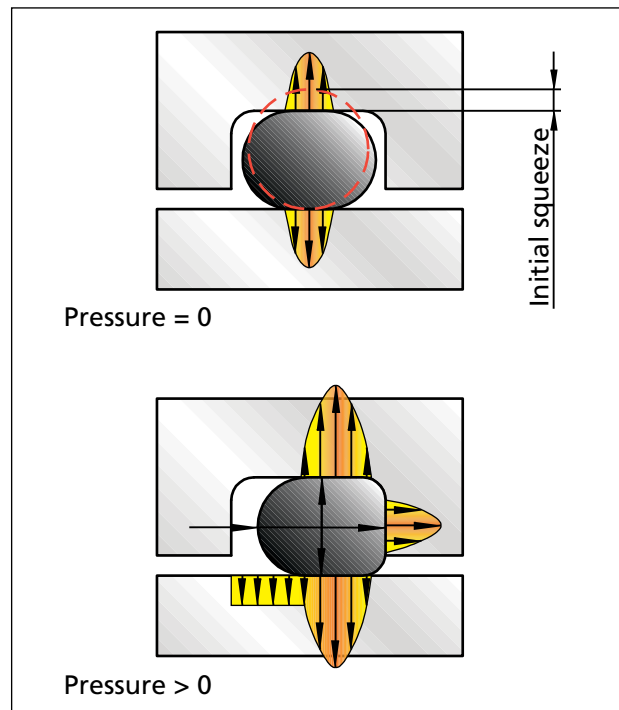


Figure 10 O-Ring contact pressure installed and under service pressure

O-Rings

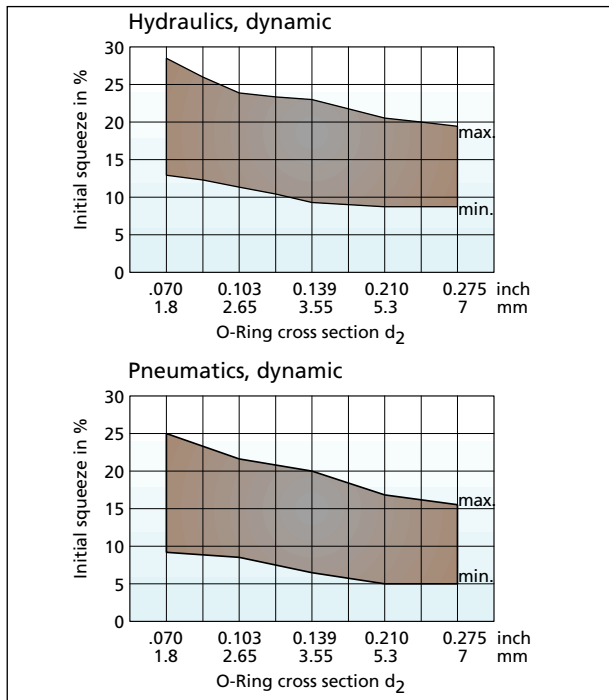


Figure 11 Permissible range of initial squeeze as a function of cross section, radial dynamic

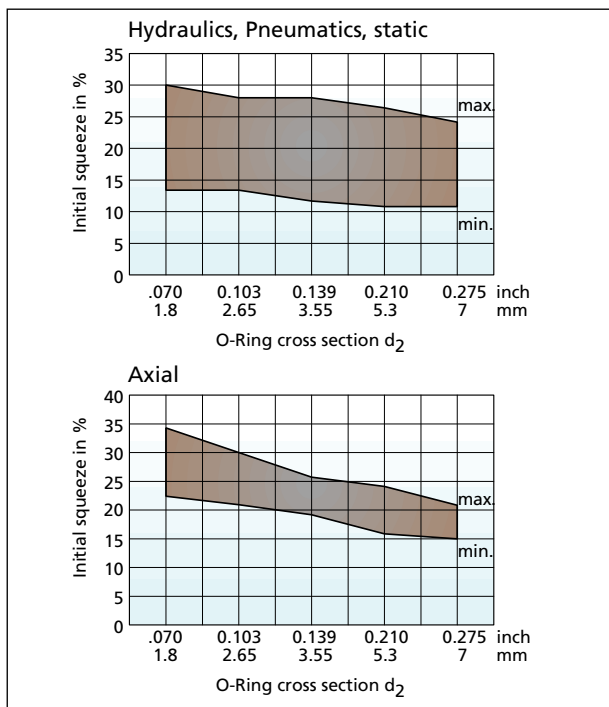


Figure 12 Permissible range of initial squeeze as a function of cross section, radial static and axial

Compression forces

Deformation forces vary depending on the extent of the initial squeeze on the O-Ring and the Shore hardness of its material. Figure 13 shows the specific compression force of the seal circumference as a function of the cross section.

The compression forces shown can be used to estimate the total force to be applied for static installation of O-Rings.

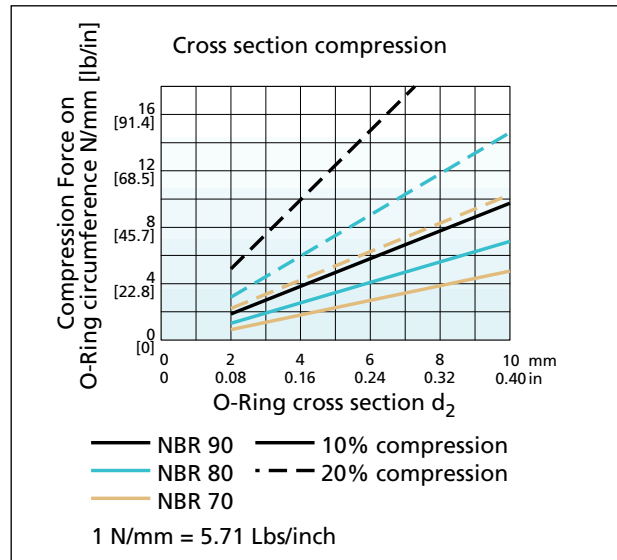


Figure 13 Compression forces on the O-Ring circumference depending on material

Elongation - Compression

With a radial sealing configuration, the O-Ring in an internal gland - "outside sealing" - should be stretched over the diameter of the gland. Maximum elongation in the installed state is six percent for O-Rings with an inner diameter of more than 1.968 in/ 50 mm and eight percent for O-Rings with an inner diameter of less than 1.968 in/ 50 mm.

With external grooves - "inside sealing" - the O-Ring is preferably compressed along its circumference. The maximum circumferential compression in the installed state is three percent.

Exceeding these values will result in an increase or decrease that is too large in the O-Ring cross section, potentially affecting the service life of the seal.

The reduction in cross section diameter (d_2) can be calculated as:

$$\text{Reduction}_{\max} = \frac{d_{2\min}}{10} \times \sqrt{6 \times \left(\frac{d_{3\max} - d_{1\min}}{d_{1\min}} \right)}$$

O-Rings

With d_{1min} = minimum inside diameter of the O-Ring
 d_{2min} = minimum cross section of the O-Ring
 d_{3max} = maximum housing diameter

This figure is approximately half the amount of stretch in percentage terms. An elongation of one percent therefore corresponds to a reduction in the cross section (d_2) of approximately half a percent.

Methods of Installation and Design of Seal Housing

Methods of installation

O-Rings can be used in components in a wide variety of ways. During the design stage, in order to avoid damage during installation, how the O-Ring is to be installed into the component must be taken into consideration. For instance, there should be no edges or bores for the O-Ring to pass over. When long sliding movements are involved, the seal seat should be recessed, if possible, or the O-Rings arranged so that they only have to travel short distances during installation to reduce risk of twisting.

Radial installation (static and dynamic)

Outer sealing

The O-Ring size should be selected so that the inside diameter d_1 is equal to or smaller than groove diameter d_3 .

Axial installation (static)

Inner sealing

The O-Ring size should be selected so that the inside diameter d_1 has the smallest possible deviation from the diameter to be sealed d_4 .

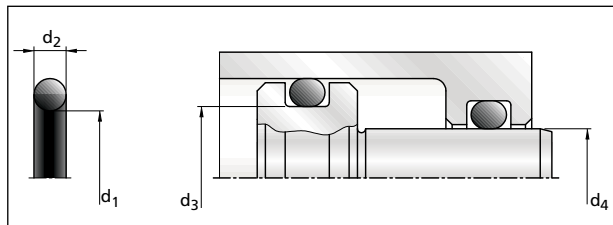


Figure 14 Radial Installation, Static and Dynamic

During axial-static installation, the direction of pressure should be taken into consideration when choosing the O-Ring size. With internal pressure the O-Ring should be chosen so that the outside diameter of the O-Ring is approximately one or two percent larger than the outer groove diameter d_5 . With external pressure the

O-Ring is chosen approximately one to three percent smaller than the inner groove diameter d_6 .

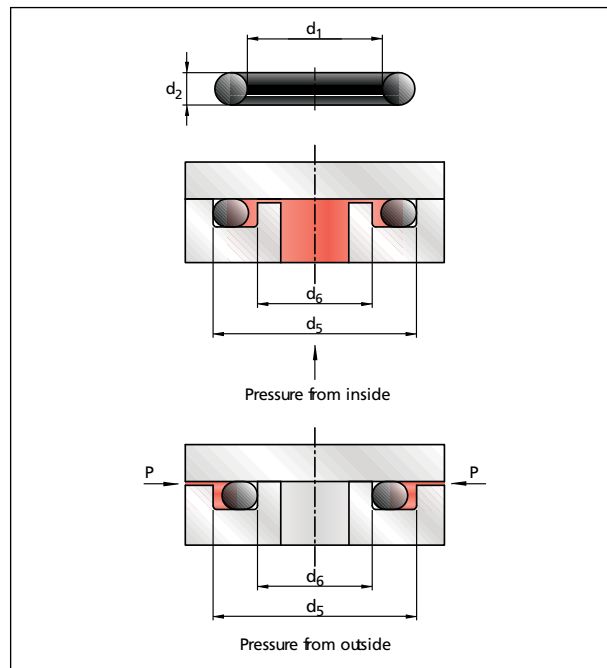


Figure 15 Axial Installation, Static

The O-Ring as a rotary seal

In some applications, for example with short running periods, O-Ring can be used as a rotary seal on shafts.

In order for an O-Ring to be able to function as a rotary seal it must be installed in accordance with specific guidelines, the rotary seal principle. This is based on the fact that an elongated elastomer ring contracts when heated - the Gough-Joule effect.

Using normal design criteria, the inside diameter d_1 of the O-Ring will be slightly smaller than the shaft diameter. The heat generated by friction causes the ring to contract even more. This results in a higher pressure on the rotating shaft, so that a lubricating film is prevented from forming under the seal and even higher friction occurs. The result is increased wear and premature failure of the seal.

Using the rotary seal principle, this is prevented by the O-Ring having an inside diameter approximately two to five percent larger than the shaft diameter to be sealed. The O-Ring is installed so that it is compressed radially and pressed against the shaft by the groove diameter. The O-Ring is therefore slightly corrugated in the groove, helping to improve the lubrication.

O-Rings

Special materials are available for rotary seal applications. Trelleborg Sealing Solutions does not recommend the use of O-Rings as rotary seals. Please contact your local Trelleborg Sealing Solutions marketing company for further details.

Technical data

O-Rings can be used in a wide range of applications. The operating temperature, pressure and contact media of the application determine the choice of appropriate materials. In order to be able to assess the suitability of an O-Ring as a sealing element for a given application, the interaction of all the operating parameters have to be taken into consideration.

Working Pressure

Static applications

- Up to 725 psi / 5 MPa for O-Rings with inside diameter greater than 1.968 in / 50 mm without Back-up Ring
 - Up to 1,500 psi / 10 MPa for O-Rings with inside diameter less than 1.968 in / 50 mm without Back-up Ring
- Depending on material, cross section and clearance
- Up to 5,800 psi / 40 MPa with Back-up Ring
 - Up to 36,260 psi / 250 MPa with a special Back-up Ring
- Please note the permissible extrusion gaps.

Dynamic applications

- Reciprocating up to 5 MPa without a Back-up Ring
- Higher pressures with a Back-up Ring

Speed

- Reciprocating up to 1,640 ft/s / 0.5 m/s
 - Rotating up to 1,640 ft/s / 0.5 m/s
- Depending on material and application

Temperature

- From -76°F / -60 °C to +617°F / +325 °C
- Depending on material and media resistance

When assessing the application criteria, the peak and continuous operating temperature and the running period must be taken into consideration. For rotating applications the temperature increase due to frictional heat must be taken into account.

Media

From the wide range of materials offered by Trelleborg Sealing Solutions it is possible to seal against practically all liquids, gases and chemicals. To select the optimum material type use our online chemical compatibility guide and consult your local Trelleborg Sealing Solutions marketing company.

Groove design / Groove dimensions

Lead-in chamfers

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

Since O-Rings are squeezed during installation, lead-in chamfers and rounded edges must be provided.

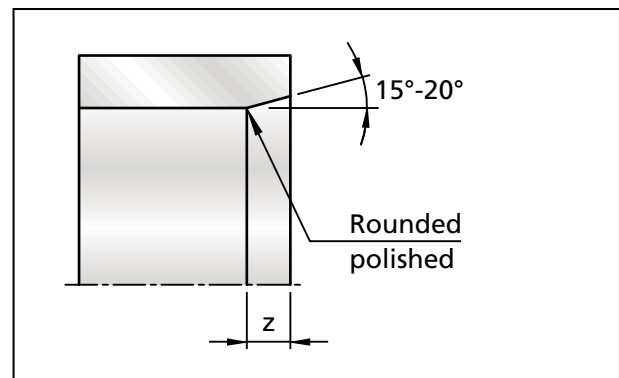


Figure 16 Lead-in Chamfers for Bores, Tubes

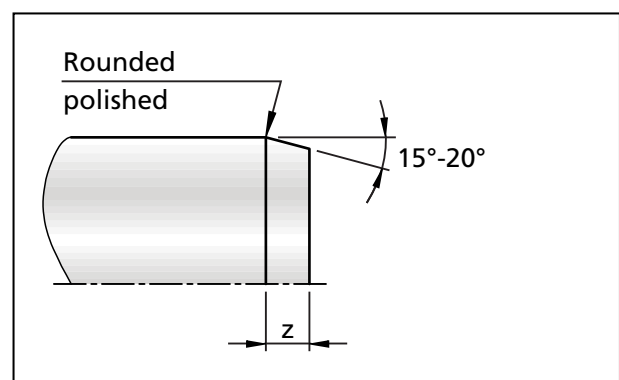


Figure 17 Lead-in Chamfers for Shafts, Rods

O-Rings

The minimum length of the lead-in chamfer is listed in Table I as a function of the cross section d_2 .

Table I Lead-in Chamfers

Lead-in chamfers length Z min.		O-Ring cross section d_2
15°	20°	
2.5	1.5	up to 1.78 1.80
3.0	2.0	up to 2.62 2.65
3.5	2.5	up to 3.53 3.55
4.5	3.5	up to 5.33 5.30
5.0	4.0	up to 7.00
6.0	4.5	above 7.00

The surface roughness of a lead-in chamfer is:
 $R_a \leq 32 \mu\text{in}/ 0.8 \mu\text{m}$ $R_z \leq 248 \mu\text{in}/ 6.3 \mu\text{m}$

Table II Lead-in Chamfers

Lead-in chamfers length Z min.		O-Ring cross section d_2
15°	20°	
.100	.060	up to .070
.120	.080	up to .103
.140	.100	up to .139
.180	.140	up to .210
.200	.160	up to .275
.240	.180	above .275

The surface roughness of a lead-in chamfer is:
 $R_z \leq 250 \mu\text{in}/ 6.3 \mu\text{m}$ $R_a \leq 30 \mu\text{in}/ 0.8 \mu\text{m}$

Radial clearance

The tolerances given in AS4716 and AS5857 and the maximum permissible radial clearance, or extrusion gap, must be maintained.

If the clearance is too large, there is a risk of seal extrusion which can result in the destruction of the O-Ring.

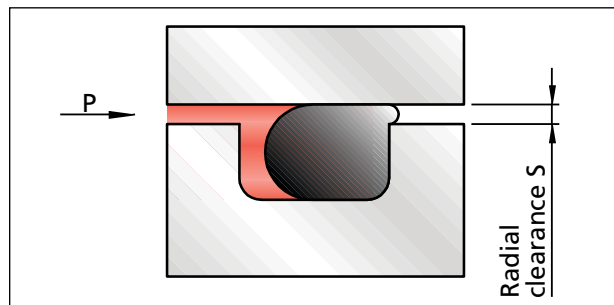


Figure 18 Radial Clearance

The permissible radial clearance between the sealed parts depends on the system pressure, the cross section, and the hardness of the O-Ring and Back-up Ring materials.

Table III contains recommendations for the permissible clearance S as a function of O-Ring cross section and shore hardness. The table is valid for elastomeric materials with the exception of polyurethane and FEP-encapsulated O-Rings.

For pressure above 725 PSI (5 MPa) for O-Rings with inside diameter > 2.000 inches (>50 mm) and above 1500 PSI (10 MPa) for O-Rings with inside diameter < 2.000 inches (<50 mm) we recommend the use of Back-up Rings.

Table III Radial clearance S

O-Ring cross section d_2	up to .080	.080 - .120	.120 - .200	.200 - .275	above .275
O-Rings with hardness of 70 Shore A					
Pressure PSI	Radial clearance S				
≤ 500	.003	.004	.004	.005	.006
≤ 1000	.002	.003	.003	.004	.004
≤ 1500	.001	.002	.002	.003	.003
O-Rings with hardness of 90 Shore A					
Pressure PSI	Radial clearance S				
≤ 500	.005	.006	.007	.009	.010
≤ 1000	.004	.005	.006	.007	.008
≤ 1500	.003	.004	.004	.005	.006
≤ 2000	.002	.003	.003	.004	.004
≤ 2500	.002	.002	.003	.003	.004
≤ 3000	.001	.002	.002	.003	.003
≤ 5100	.001	.001	.001	.002	.002

These values assume that the parts are fitted concentrically to one another and do not expand under pressure. If this is not the case, the clearance should be kept correspondingly smaller.

For static applications we recommend a fit of H8/f7.

O-Rings

Table IV Turel® O-Ring Types

TSS Part Number	Purchasing Callout	Industry Specification	International Turel® Code
ORMS2AXXA000NB	MS29512-9YY	MIL-P-5315 (AMS-P-5315)	NB
ORMS2BXXA000NB	MS29513-XXX	MIL-P-5315 (AMS-P-5315)	NB
ORMS2DXXA000NG	MS28775-XXX	MIL-P-25732	NG
ORMS2EXXA000NG	AS28775-XXX	AMS-P-25732	NG
ORMS2FXXA000NZ	AS3578-XXX	AMS7271	NZ
ORMS2GXXA000NZ	AS3578-9YY	AMS7271	NZ
ORMS2HXXA000SL	MS9385-XXX	AMS7267	SL
ORMS2JXXA000NZ	MS9020-XXX	AMS7271	NZ
ORMS2KXXA000SL	MS9068-XXX	AMS3304	SL
ORMS2LXXA000NZ	MS9021-XXX	AMS7271	NZ
ORMS2MXXA000SL	MS9386-XXX	AMS7267	SL
ORMI2EXXA000LF	M25988/1-XXX	AMS-R-25988 T1C1G70	LF
ORMI2GXXA000LB	M25988/2-XXX	AMS-R-25988 CL3 GR75	LB
ORMI2HXXA000LD	M25988/3-XXX	AMS-R-25988 CL1 GR60	LD
ORMI2FXXA000LA	M25988/4-XXX	AMS-R-25988 T1C1G80	LA
ORMI5DXXA000NE	AS83461/1-XXX	AMS-P-83461	NE
ORMI5EXXA000NE	AS83461/2-9YY	AMS-P-83461	NE
ORMI8FXXA000FT	M83485/1-XXX	AMS-R-83485	FT
ORMI8GXXA000FE	M83248/2-XXX	AMS-R-83248	FE
ORMI8HXXA000FE	M83248/1-XXX	AMS-R-83248	FE
ORMI8KXXA000FG	AS5729-XXX	AMS7379 -40F tg FKM	FG
ORMI8MXXA000FK	AS3208-9YY	AMS7276	FK
ORMI8NXXA000FL	AS3581-XXX	AMS7276	FL
ORMI8PXXA000FK	AS3209-XXX	AMS7276	FL
ORMI8QXXA000FK	AS3085-9YY	AMS7276	FK
ORMI8RXXA000FK	AS3084-9YY	AMS7276	FK
ORNA4AXXA000EP	NAS1611-XXXA	NAS1613 Rev. 5	EP
ORNA4BXXA000EH	NAS1611-XXX	NAS1613 Rev. 2	EH
ORNA4CXXA000EP	NAS1612-YYA	NAS1613 Rev. 5	EP
ORNA4DXXA000EH	NAS1612-YY	NAS1613 Rev. 2	EH

O-Rings are always supplied to the most current revision level.

O-Rings

Installation & Hardware Guidelines



Installation & Hardware Guidelines

■ Hardware Design Tips

The following recommendation for hydraulic hardware will simplify the installation of seals. AS4716 specification gives recommendations. They should be considered at an early hardware design stage in order to ensure damage-free installation of seals. These are general guidelines. Further information can be found in catalogs specific to each product types.

Piston and Rod

A lead-in chamfer on the end of the rod or bore helps installation. Recommended chamfer dimensions are given below. A lead-in chamfer is especially important where lip seals are to be installed face-first into the gland.

Lead-in Chamfer

AS4716 Dash No. Series	Z Length Minimum Inches/ mm
-0XX	.043/ 1.092
-1XX	.059/ 1.499
-2XX	.071/ 1.803
-3XX	.106/ 2.692
-4XX	.142/ 3.607

The cylinder bore or rod should have a lead-in chamfer of 20 to 25 degrees by Z length minimum to gently guide the seal assembly into the hardware as shown in Figure 1 and Figure 2. The chamfer should clear the seal assembly, in a free condition, after it has been sized.

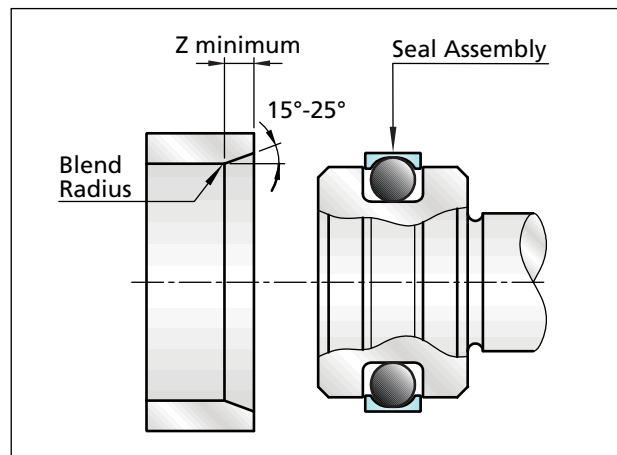


Figure 1 Piston Installation

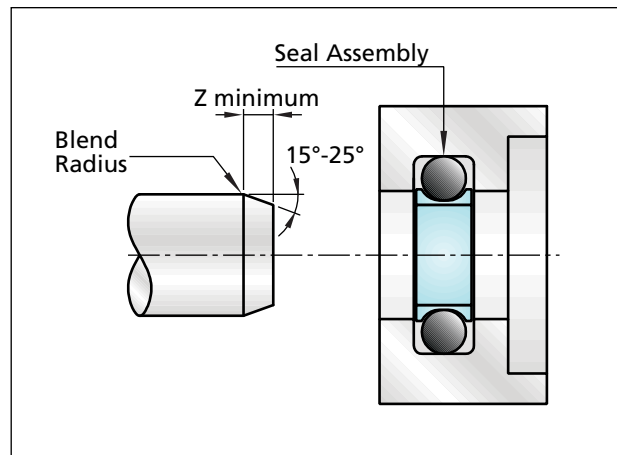


Figure 2 Rod Installation

Installation & Hardware Guidelines

Ports – Non-operational (Installation Only)

When installing a seal assembly across a port, in a non-operational capacity, a relief should be provided with 20 to 25 degrees by Z minimum, as shown in Figure 3.

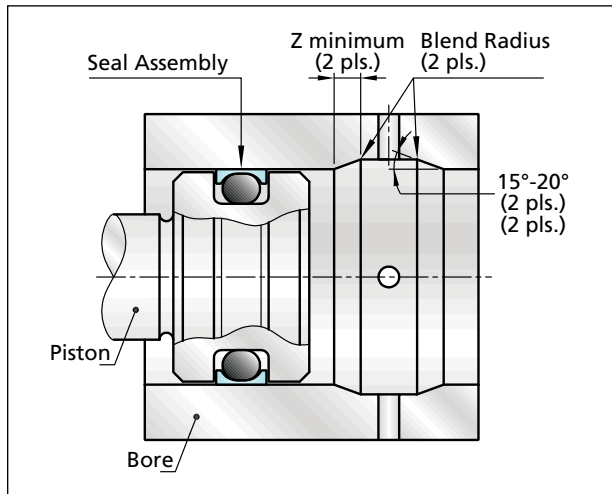


Figure 3 Relief Across Port, Non-operational, Installation Only

For dynamic seals that will cross ports during pressurized operation please contact your local Trelleborg Sealing Solutions marketing company for recommendations

Threads

When passing over threads, the seal assembly must clear the threads or other uneven surfaces. A lead-in chamfer of 20 to 25 degrees by Z minimum will gently guide the seal assembly into the bore as shown in Figure 4.

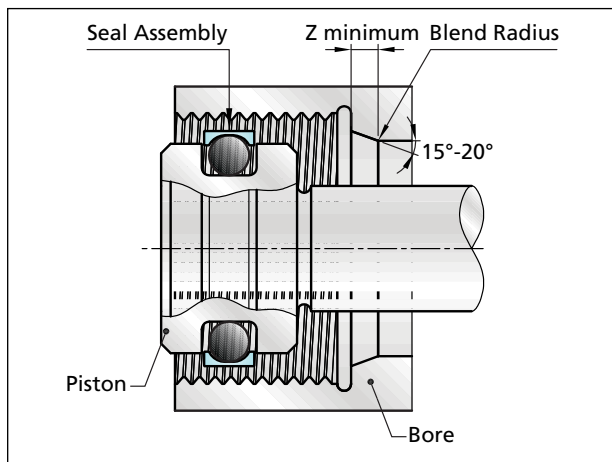


Figure 4 Threads

Material and Finish Recommendations

Recommended aerospace hardware:

Steel surface – bare for cylinders
 Aluminum surface – hard anodized (type III)
 Steel surface – HVOF coated (e.g. Tungsten Carbide-Cobalt-Chrome)

Recommended material hardness:

44-48 Rockwell "C" - Low to moderate pressure application
 55-60 Rockwell "C" - High-pressure applications

Surface finishes:

Dynamic surfaces:

- Bare metal, hard chrome, hard anodized:
 Ra = 4-8 Ra µin/0,1-0.2 µm

Dynamic surfaces:

- HVOF: Ra = >4 µin/ 0.1 µm

Static surface in seal groove:

- Slipper Seal (Elastomer contact):

- Ra ≤ 32 µin/ 0.8 µm

- Variseal® (PTFE contact):

- Ra ≤ 12 µin/ 0.3 µm

- Groove sidewall:

- Ra ≤ 63 µin/ 1.6 µm

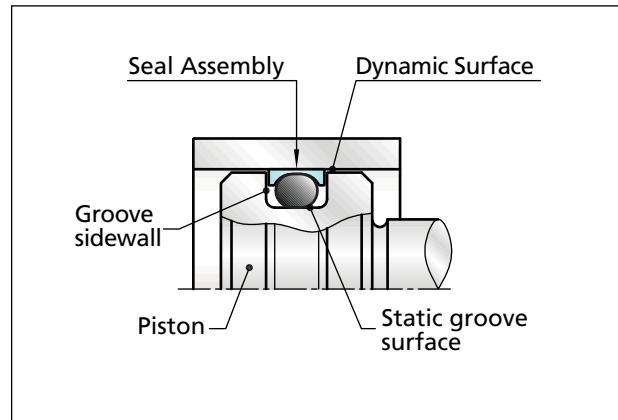


Figure 5 Surface Finishes µ In

Note:

All dynamic surfaces must be either burnished, post-ground, honed or super-finished (HVOF applied coatings). All dynamic and static surfaces must be free of nicks, scratches and burrs.

Installation & Hardware Guidelines

■ General Guidelines

The following installation guidelines should be considered at an early hardware design stage in order to ensure damage-free installation of seals. These are

general guidelines. Further information can be found in catalogs specific to each product type.

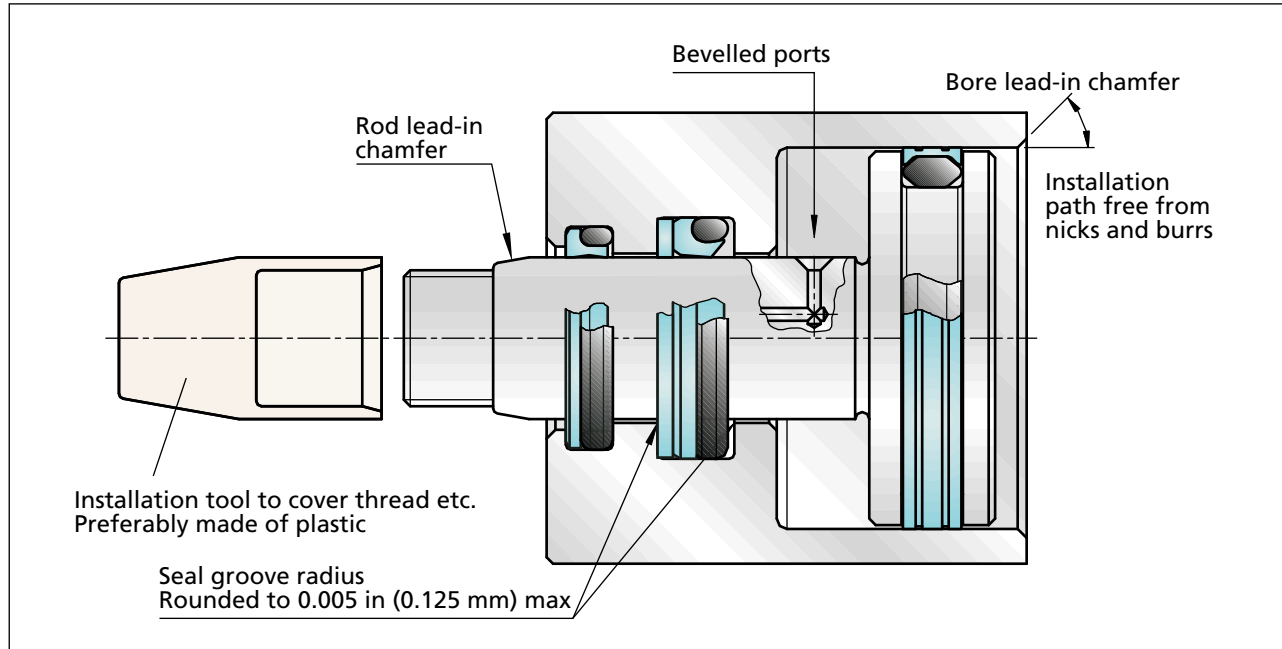


Figure 1 Methods of hardware design to prevent seal damage

- The seal installation path should be kept free of nicks, burrs, scratches or any sharp edges that could damage the seal.
- Any tool used to install a seal should be free of sharp edges. Screwdrivers often damage sealing lips and should not be used to handle seals.
- Tools should preferably be made of hard plastics such as Delrin®.
- In situations where heat is required to soften and expand Turcon® PTFE based seal components, submerge them for a few minutes in hot oil or water at +200°F/ +93°C. Heat should not be required to install elastomer components.
- Application of a lubricant to surfaces of the seal and hardware reduces the force required to push the seal into a difficult gland, such as a solid O-Ring groove.
- When using lubricant during installation, ensure that the material of Turel® elastomer components is compatible with the lubricant.
- Piston seals may be sized by freezing them prior to installing the piston in the bore. This is an advantage on spool valve pistons with multiple seals within the hardware.
- When seals are installed across ports, the edge of the ports should be smooth and rounded.
- Design splines or keyways to be of a smaller diameter than the sealing surface or use a protective sleeve to cover them during installation as illustrated in Figure 1.
- Avoid glands that require bending of the seal during installation. When seals must be stretched or compressed into a difficult gland, resize the seals using recommended tools as shown in Figure 2-4.
- Do not side-load the seals any more than is necessary. Avoid situations in the gland where a heavy rod or piston bears against one side of the seal.

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Installation & Hardware Guidelines

Procedure for installation of piston seals

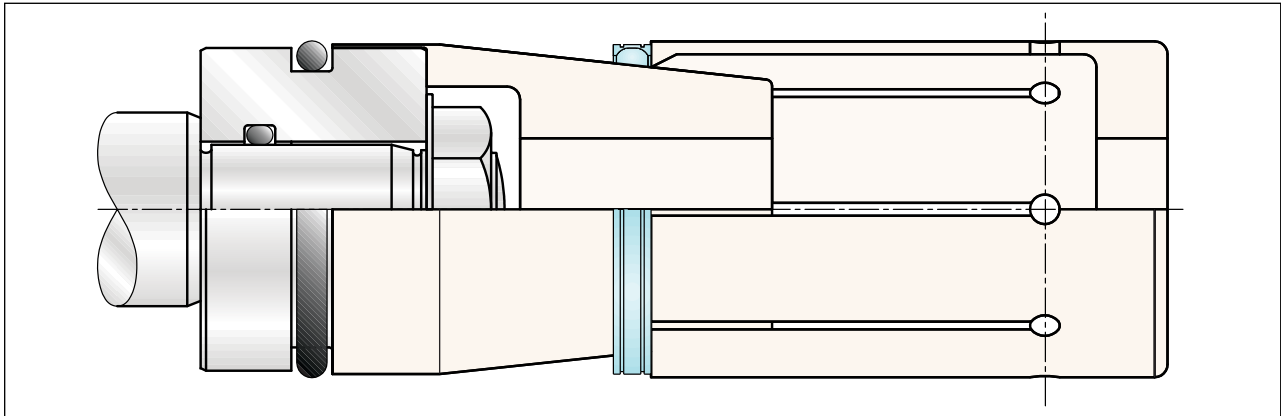


Figure 2 Expanding the Turcon® sealing element using an expanding sleeve over the installation sleeve

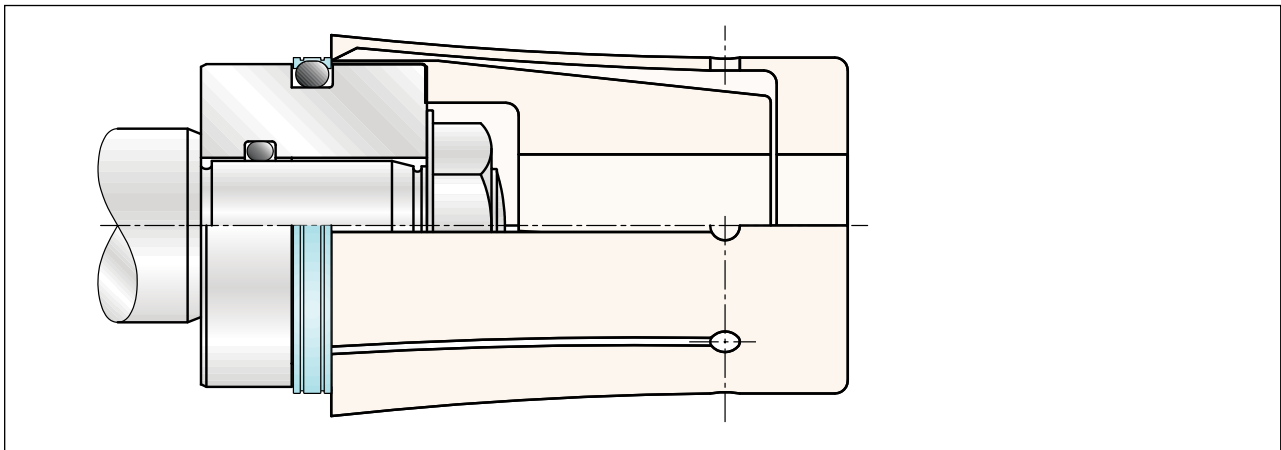


Figure 3 Sealing element after snapping into the groove

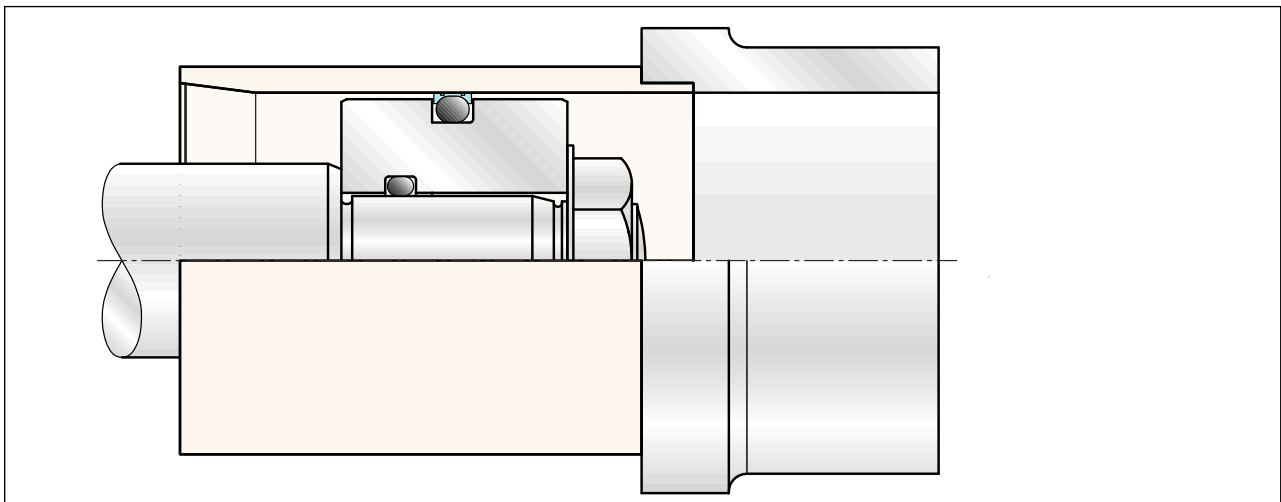


Figure 4 Sizing the sealing element with a sizing sleeve

Installation & Hardware Guidelines

If the Turcon® seal is expanded more than 15 percent (10 percent for the high-filled materials Turcon® T11 and Turcon® T29), a split groove is necessary.

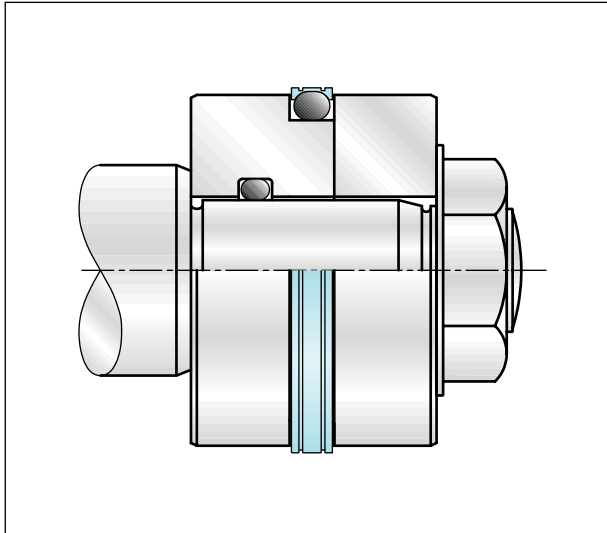


Figure 5 Installation in a split groove

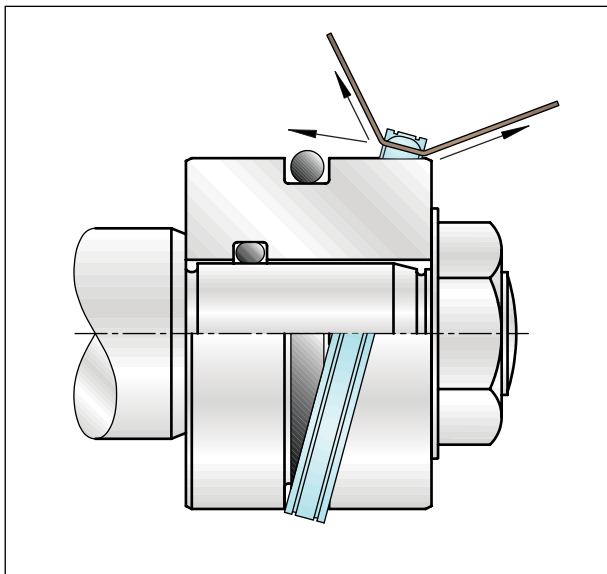


Figure 6 Fitting the seal ring onto the O-Ring in the groove, using a thin plastic strip

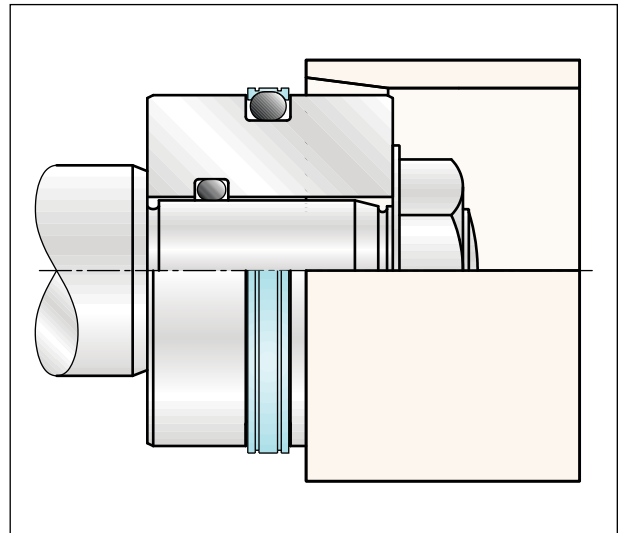


Figure 7 Sizing of the installation

Installation & Hardware Guidelines

Procedure for installation of rod seals

- Place the elastomer part into the groove.
- Compress the Turcon® part into a kidney shape. The seal must have no sharp bends, see figure below. Use a rounded object to compress the Turcon® part without pinching or creating sharp bends.

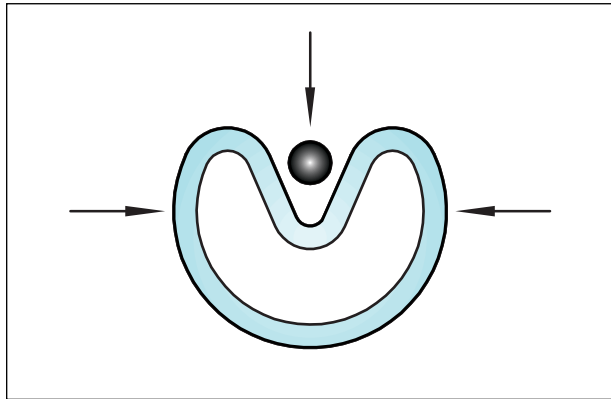


Figure 8 Kidney-shaped deformation of the seal ring

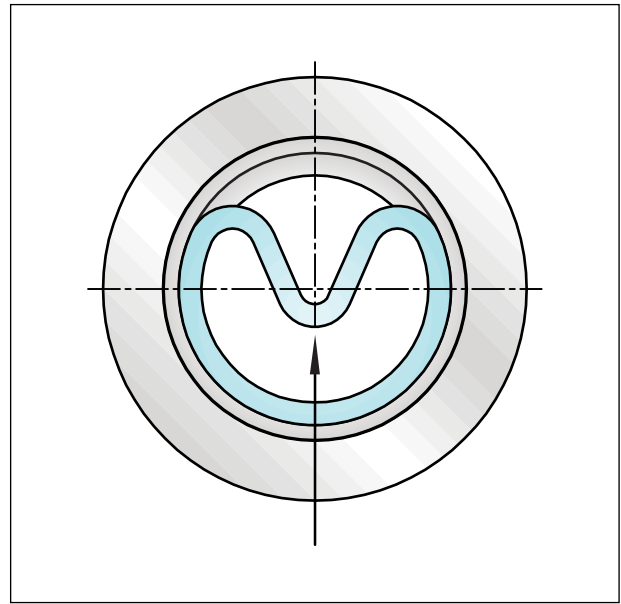


Figure 9 Inserting the seal ring into a closed groove

- After placing the seal into the groove, form it into a ring again by smoothing the ID by hand.
- Finally, size the seal ring using a mandrel which should have a chamfer of 10 to 15 degrees over a length of approximately 1.18 in/ 30 mm. See Figure 10.

In order to avoid damage to the seals the sizing mandrel should be made from a polymer material with good sliding characteristics and high surface quality such as Delrin®.

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

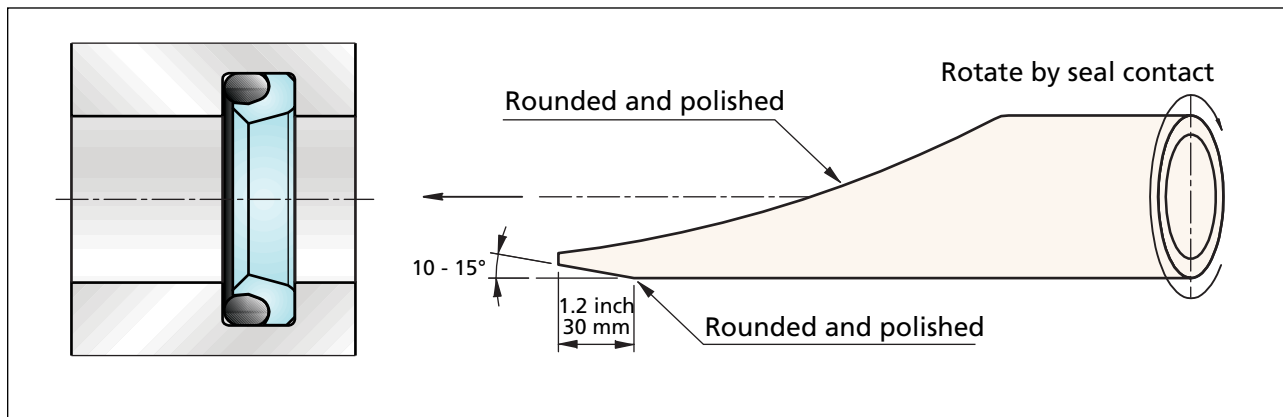


Figure 10 Sizing of the installed seal

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Installation & Hardware Guidelines

■ Shelf Life and Correct Storage

Seals and bearings are often stored for prolonged periods of time.

Turcon® PTFE based sealing materials have an unlimited shelf life as the material is inert to all commonly occurring gases and chemicals. It is therefore not adversely affected by exposure to air, light ozone or oxygen. Temperature variations do not harm Turcon® materials.

Elastomer seals have a limited shelf life and various external factors such as heat, moisture, light, oxygen, ozone and contact with liquid media can alter their properties. Resulting deformation, aging and weathering can cause deterioration of mechanical and physical properties.

The shelf life of seals can be preserved by correct storage in their original packaging.

General Advice on Storage of All Seal Types

Physical damage

All seals and bearings should be stored so that they are safe from physical damage. In particular, deformation should be avoided. Do not store heavy goods or packages on top of seals as this may permanently damage them.

Heat

The ideal temperature for storage is between +41°F and +77°F/ +5°C and +25°C. Direct contact with heaters should be avoided.

Moisture

Parts must be stored dry under normal atmospheric conditions: 65 percent relative moisture ± 10 .

Packaging

Seals and bearings should be kept in their original sealed packaging, as supplied from Trelleborg Sealing Solutions.

Advice on Storage of Elastomer Seals

Instructions on storage, cleaning and maintenance of elastomer seal elements are described in international standards, such as:

Storage of rubber products:
DIN 7716/BS 3F68: 1977

Maximum age limitation:
ARP5316
ISO/CD 27996

The individual guidelines give several recommendations to preserve the shelf life of elastomers, depending on their material type.

Light

Elastomer seals should not be exposed to ultraviolet or neon light.

Oxygen

To protect elastomer seals from oxygen, they should be kept in their original packaging or in airtight containers.

Ozone

Elastomer seals should be stored away from the following equipment. These appliances can cause deterioration of the elastomers due to ozone discharge.

- Mercury discharge lamps
- High voltage equipment
- Electric motors
- Electric spark sources or discharges





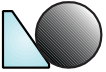







Part Number Guide


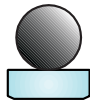
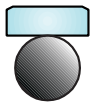


























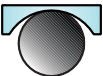
Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S11052	PF00_B	Turcon® Dual Piston Ring (S13126 is preferred design)	Piston	Trelleborg Standard Fractional
	S11065	WM650S	Turcon® Scraper Ring (S34382 is preferred design)	Rod	MS33675 MIL-P-5514 thru MIL-G-5514; All Revisions
	S11109	BP090A	Turcon® Back-up Ring Spiral	Rod/Piston	MIL-P-5514; Revisions A, B, C, D, E One or Two Back-up Rings
	S11114	PF01_B	Turcon® Dual Piston Ring (S13126 is preferred design)	Piston	Trelleborg Standard Fractional
	S11214	OC140M	PTFE O-Ring (S13126 is preferred design)	Piston	Trelleborg Standard Fractional
	S11242	N/A	Turcon® Delta Back-up Ring Single Turn (S33823 is preferred design)	Rod	LS4652 MIL-P-5514: Revisions C, D, E One or Two Back-up Rings
	S11243	N/A	Turcon® Delta Back-up Ring Single Turn (S33823 is preferred design)	Piston	LS4653 MIL-P-5514: Revisions C, D, E One or Two Back-up Rings
	S11248	BG480M	Turcon® Back-up Ring Single Turn	Rod/Piston	MIL-P-5514 thru MIL-G-5514; All Revisions One or Two Back-up Rings
	S11338	PD130M	Turcon® Cap Seal	Piston	MIL-P-5514: Revisions A, B, C, D, E Zero Back-up Rings
	S11370	N/A	Turcon® Channel Seal	Rod	MIL-P-5514: Revisions A, B Two Back-up Rings
	S11395	N/A	Turcon® Back-up Ring	Rod/Piston	Trelleborg Standard
	S11399	N/A	Turcon® Back-up Ring	Rod/Piston	Trelleborg Standard
	S11413	N/A	Turcon® Back-up Ring	Rod/Piston	Trelleborg Standard


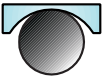

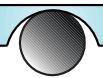




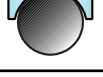


Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S11589	RD890M	Turcon® Cap Seal	Rod	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S11717	RG00_B	Turcon® Glyd Ring®	Rod	Trelleborg Standard Fractional Rod
	S11718	PG00_B	Turcon® Glyd Ring®	Piston	Trelleborg Standard Fractional Bore
	S11732	OC320M	PTFE O-Ring (general purpose application)	Rod/Piston	AS568A
	S11859	RD240B	Turcon® Cap Seal	Rod	Trelleborg Standard
	S11860	N/A	Turcon® Cap Seal	Rod	Trelleborg Standard
	S11940	RP40_M	Turcon® Plus Seal® (S30775 is preferred design)	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S11943	N/A	Turcon® Plus Seal® (S34750 is preferred design)	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S12066	RG66_B	Turcon® Glyd Ring® Series B	Rod	Trelleborg Standard MIL-P-5514; Revisions A, B, C, D, E
	S12068	PG68_B	Turcon® Glyd Ring® Series B	Piston	Trelleborg Standard MIL-P-5514; Revisions A, B, C, D, E
	S12083	PF02_B	Turcon® Dual Piston Ring (S30071 is preferred design)	Piston	Trelleborg Standard MIL-P-5514; Revisions A, B, C, D, E
	S12095	RF95_B	Turcon® Footseal (S33121 is preferred design)	Rod	Boeing Standard BAS: BACS11AA
	S12223	RD03_M	Turcon® Double Delta®	Rod	MIL-P-5514; Revisions A, B Two Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S12230	PF03_B	Turcon® Dual Piston Ring (S30071 is preferred design)	Piston	Trelleborg Standard MIL-P-5514; Revisions A, B, C, D, E
	S12257	N/A	Turcon® Dual Piston Ring (S13126 is preferred design)	Piston	Trelleborg Standard Fractional
	S12508	PDO3_M	Turcon® Double Delta® (S30642 is preferred design)	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S12517	BP170M	Turcon® Back-up Ring Spiral, Heavy Duty	Rod/Piston	MIL-P-5514; Revisions C, D, E Fractional One or Two Back-up Rings
	S12546	RG46_B	Turcon® Glyd Ring® Series C	Rod	Trelleborg Standard Fractional Rod
	S12547	PG47_B	Turcon® Glyd Ring® Series C	Piston	Trelleborg Standard Fractional Bore
	S12560	RD040M	Turcon® Channel Seal	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S12561	RD05_M	Turcon® Double Delta® (S30632 is preferred design)	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S12562	RD06_M	Turcon® Double Delta® (S30630 is preferred design)	Rod	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S12563	PDO4_M	Turcon® Double Delta® (S30640 is preferred design)	Piston	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S12587	BU870M	Turcon® Back-up Ring Solid	Rod/Piston	MIL-P-5514; Revisions A, B, C, D, E One or Two Back-up Rings
	S12599	PG990B	Turcon® Channel Seal	Piston	Trelleborg Standard
	S12603	PDO5_M	Turcon® Double Delta® (S30641 is preferred design)	Piston	MIL-P-5514; Revisions C, D, E One Back-up Ring











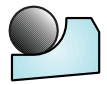

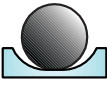
Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S12604	RD07_M	Turcon® Double Delta® (S30631 is preferred design)	Rod	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S12714	PD00_M	Turcon® Double Delta®	Piston	MIL-P-5514; Revisions A, B One Back-up Ring
	S12715	RD08_M	Turcon® Double Delta® (S30611 is preferred design)	Rod	MIL-P-5514; Revisions A, B One Back-up Ring
	S12716	PD06_M	Turcon® Double Delta® (S30622 is preferred design)	Piston	MIL-P-5514; Revisions A, B Two Back-up Rings
	S12735	RP35_M	Turcon® Grooved Plus Seal® (S30855 is preferred design)	Rod	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S12737	PP37_M	Turcon® Grooved Plus Seal® (S34760 is preferred design)	Piston	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S12766	BG660M	Turcon® Back-up Ring	Rod/Piston	MIL-P-5514; Revisions D, E One or Two Back-up Rings
	S12794	RG94_B	Turcon® Glyd Ring®	Rod	Trelleborg Standard MIL-P-5514; Revisions A, B
	S12795	PG95_B	Turcon® Glyd Ring®	Piston	Trelleborg Standard Metric
	S12956	RD090M	Turcon® Cap Seal	Rod	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S12957	PD070M	Turcon® Cap Seal	Piston	MIL-P-5514; Revisions A, B, C, D, E Zero Back-up Rings
	S13050	BUS00M	Turcon® Back-up Ring, Heavy Duty	Rod/Piston	MIL-P-5514; Revisions C, D, E One or Two Back-up Rings
	S13068	RD100M	Turcon® Camseal®	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings

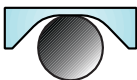









Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S13069	BG690M	Turcon® Camseal®	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S13076	N/A	Grooved Turcon® Double Delta®	Piston	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S13077	N/A	Grooved Turcon® Double Delta®	Rod	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S13095	PF04_B	Turcon® Piston Ring	Piston	Trelleborg Standard Fractional
	S13122	BGS20M	Turcon® Back-up Ring Single Turn, Heavy Duty, Scarf-cut	Rod/Piston	MIL-P-5514 thru MIL-G-5514 All Revisions One or Two Back-up Rings
	S13126	PF05_B	Turcon® Dual Piston Ring	Piston	Trelleborg Standard Fractional
	S13135	PF06_B	Turcon® Dual Piston Ring	Piston	Trelleborg Standard MIL-G-5514
	S13180	N/A	Grooved Turcon® Double Delta®	Piston	MIL-P-5514; Revisions A, B One Back-up Ring
	S13181	N/A	Grooved Turcon® Double Delta®	Rod	MIL-P-5514; Revisions A, B One Back-up Ring
	S13200	RD12_M	Grooved Turcon® Double Delta®	Rod	MIL-P-5514; Revisions A, B Two Back-up Rings
	S13201	N/A	Grooved Turcon® Double Delta®	Piston	MIL-P-5514; Revisions A, B Two Back-up Rings
	S13206	N/A	Grooved Turcon® Double Delta®	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S13207	N/A	Grooved Turcon® Double Delta®	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings



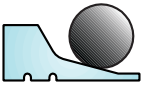

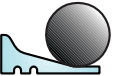
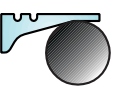
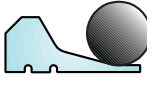




Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S30010	RD140M	Turcon® Channel Seal	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30050	RD160M	Turcon® Delta Seal®	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30058	RG58N	Turcon® Glyd Ring®	Rod	Trelleborg Standard Metric
	S30059	PG59N	Turcon® Glyd Ring®	Piston	Trelleborg Standard Metric
	S30071	PF07_B	Turcon® Dual Piston Ring	Piston	Trelleborg Standard MIL-P-5514; Revisions C, D, E
	S30213	N/A	Turcon® Cap Seal	Rod	Trelleborg Standard MIL-P-5514; Revisions C, D, E
	S30289	PD080M	Turcon® Channel Seal	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30294	BG940M	Turcon® Back-up Ring Cut	Rod/Piston	Boeing Standard BACR12BM
	S30310	BU100M	Turcon® Back-up Ring Solid	Rod/Piston	Boeing Standard BACR12BP
	S30388	WM880S	Turcon® Scraper Ring (S34382 is preferred design)	Rod	Boeing Standard BACS34A
	S30395	WE95_B	Turcon® Excluder® (S32925 is preferred design)	Rod	Trelleborg Standard MIL-P-5514 thru MIL-G-5514 All Revisions
	S30471	N/A	Turcon® Footseal (S33121 is preferred design)	Rod	Boeing Standard BACS11AA
	S30611	N/A	Turcon® Double Delta®II	Rod	MIL-P-5514; Revisions A, B One Back-up Ring














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S30622	N/A	Turcon® Double Delta®II	Piston	MIL-P-5514; Revisions A, B Two Back-up Rings
	S30630	RD17_M	Turcon® Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S30631	RD18_M	Turcon® Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S30632	RD19_M	Turcon® Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30640	PD09_M	Turcon® Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S30641	PD10_M	Turcon® Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S30642	PD11_M	Turcon® Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30650	RD50_M	Turcon® Double Delta®II	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S30651	RD51_M	Turcon® Double Delta®II	Rod	MIL-G-5514; Revision F One Back-up Ring
	S30652	RD52_M	Turcon® Double Delta®II	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S30660	PD60_M	Turcon® Double Delta®II	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S30661	PD61_M	Turcon® Double Delta®II	Piston	MIL-G-5514; Revision F One Back-up Ring
	S30662	PD62_M	Turcon® Double Delta®II	Piston	MIL-G-5514; Revision F Two Back-up Rings


Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S30669	WE69_S	Turcon® Scraper, Series E (S33865 is preferred design)	Rod	MS33675 MIL-P-5514 thru MIL-G-5514 All Revisions
	S30675	RD200M	Turcon® Delta Seal®	Rod	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S30676	N/A	Turcon® Delta Seal®	Piston	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S30677	RD210M	Turcon® Delta Seal®	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30678	PD780M	Turcon® Delta Seal®	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S30681	N/A	Turcon® Delta Seal®	Rod	MIL-G-5514; Revision F One Back-up Ring
	S30682	N/A	Turcon® Delta Seal®	Piston	MIL-G-5514; Revision F One Back-up Ring
	S30683	N/A	Turcon® Delta Seal®	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S30684	N/A	Turcon® Delta Seal®	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S30772	PP72_M	Turcon® Plus Seal® II (S34750 is preferred design)	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S30775	RP75_M	Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S30852	PP52_M	Grooved Turcon® Plus Seal® II (S34760 is preferred design)	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S30855	RP55_M	Grooved Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F Zero Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S30989	BU890M	Turcon® Back-up Ring, Solid	Rod/Piston	AS568 One or Two Back-up Rings
	S32152	PF52_B	Turcon® Dual Piston Ring	Piston	Trelleborg Standard MIL-G-5514; Revision F
	S32240	PV920M	Turcon® Variseal® M	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32240	RV920M	Turcon® Variseal® M	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32265	PV930M	Turcon® Variseal® M	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32265	RV930M	Turcon® Variseal® M	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32571	RS570B	Turcon® Stepseal®	Rod	Trelleborg Standard MIL-P-5514; Revision E
	S32572	PS720B	Turcon® Stepseal®	Piston	Trelleborg Standard MIL-P-5514; Revision E
	S32573	RS730B	Turcon® Stepseal®	Rod	Trelleborg Standard MIL-P-5514; Revision E
	S32574	PS740B	Turcon® Stepseal®	Piston	Trelleborg Standard MIL-P-5514; Revision E
	S32830	RD22_M	Turcon® Grooved Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32831	N/A	Turcon® Grooved Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S32832	N/A	Turcon® Grooved Double Delta®II	Rod	MIL-P-5514; Revisions C, D, E Two Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S32840	N/A	Turcon® Grooved Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings
	S32841	N/A	Turcon® Grooved Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E One Back-up Ring
	S32842	N/A	Turcon® Grooved Double Delta®II	Piston	MIL-P-5514; Revisions C, D, E Two Back-up Rings
	S32850	RD80_M	Turcon® Grooved Double Delta®II	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S32851	RD81_M	Turcon® Grooved Double Delta®II	Rod	MIL-G-5514; Revision F One Back-up Ring
	S32852	RD82_M	Turcon® Grooved Double Delta®II	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S32860	PD80_M	Turcon® Grooved Double Delta®II	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S32861	PD81_M	Grooved Turcon® Double Delta®II	Piston	MIL-G-5514; Revision F One Back-up Ring
	S32862	PD82_M	Grooved Turcon® Double Delta®II	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S32891	N/A	Turcon® Glyd Ring® DC Series C	Rod	Trelleborg Standard Fractional Rod
	S32892	N/A	Turcon® Glyd Ring® DC Series C	Piston	Trelleborg Standard Fractional Bore
	S32893	N/A	Turcon® Glyd Ring® DC Series B	Rod	Trelleborg Standard MIL-P-5514; Revisions C, D, E
	S32894	N/A	Turcon® Glyd Ring® DC Series B	Piston	Trelleborg Standard MIL-P-5514; Revisions C, D, E














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S32909	N/A	Turcon® Glyd Ring® Series J	Rod	Trelleborg Standard Fractional Rod
	S32910	PG02_B	Turcon® Glyd Ring® Series J	Piston	Trelleborg Standard Fractional Bore
	S32913	RG13_B	Turcon® Glyd Ring® DC Series J	Rod	Trelleborg Standard Fractional Rod
	S32914	PG14_B	Turcon® Glyd Ring® DC Series J	Piston	Trelleborg Standard Fractional Bore
	S32925	WE25_B	Turcon® Excluder® DC	Rod	Trelleborg Standard MIL-P-5514 thru MIL-G-5514 All Revisions
	S32927	RG27_B	Turcon® Glyd Ring® Series J	Rod	Trelleborg Standard MIL-P-5514 Revision F
	S32928	PG28_B	Turcon® Glyd Ring® Series J	Piston	Trelleborg Standard MIL-P-5514 Revision F
	S32933	RGE3_B	Turcon® Glyd Ring® DC Series J	Rod	Trelleborg Standard Rod MIL-P-5514; Revision F
	S32934	PGE4_B	Turcon® Glyd Ring® DC Series J	Piston	Trelleborg Standard MIL-P-5514; Revision F
	S32979	RH790M	Turcon® Hatseal® II Two-Piece (S34852 is preferred design)	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S32985	N/A	Turcon® Hatseal® II Two-Piece (S34851 is preferred design)	Rod	MIL-G-5514; Revision F One Back-up Ring
	S32991	RH910M	Turcon® Hatseal® II Two-Piece (S34853 is preferred design)	Rod	Boeing Standard
	S33081	N/A	Turcon® Plus Seal® II (S34571 is preferred design)	Rod	MIL-G-5514; Revision F One Back-up Ring

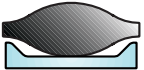








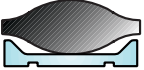

Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S33084	N/A	Turcon® Plus Seal® II (S34581 is preferred design)	Piston	MIL-G-5514; Revision F One Back-up Ring
	S33087	N/A	Turcon® Plus Seal® II (S34711 is preferred design)	Rod	MIL-G-5514; Revision F One Back-up Ring
	S33090	N/A	Grooved Turcon® Plus Seal® II (S34721 is preferred design)	Piston	MIL-G-5514; Revision F One Back-up Ring
	S33121	RF210B	Turcon® Foot Seal II	Rod	Boeing Standard
	S33157	BUS70M (Solid) BGS70M (Scarf-cut)	Turcon® Back-up Ring Solid or Scarf-cut, two required	Rod/Piston	MIL-G-5514; Revisions C, D, E Two Back-up Rings
	S33277	N/A	Turcon® Delta Back-up Ring, Solid	Rod	MIL-P-5514; Revisions C, D, E One or Two Back-up Rings
	S33278	N/A	Turcon® Delta Back-up Ring, Solid	Piston	MIL-P-5514; Revisions C, D, E One or Two Back-up Rings
	S33317	RH170M	Turcon® Hatseal® II Three-Piece (S34831 is preferred design)	Rod	MIL-G-5514; Revision F One Back-up Ring
	S33353	N/A	Turcon® Hatseal® II Three-Piece (S34832 is preferred design)	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S33528	N/A	Turcon® Hatseal® II Three-Piece (S34842 is preferred design)	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S33555	RD550M	Turcon® Hatseal® II Two-Piece (S34842 is preferred design)	Rod	Boeing Standard
	S33557	N/A	Turcon® Plus Seal® II (S34572 is preferred design)	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S33565	N/A	Turcon® Hatseal® II Three-Piece (S34841 is preferred design)	Piston	MIL-G-5514; Revision F One Back-up Ring

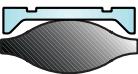











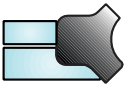
Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S33709	PPO9_M	Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S33823	BU230M	Turcon® Delta Back-up Ring, Solid	Rod	MIL-G-5514; Revision F One or Two Back-up Rings
	S33824	BU440M	Turcon® Delta Back-up Ring, Solid	Piston	MIL-G-5514; Revision F One or Two Back-up Rings
	S33861	BGS10M (solid) BUS10M (Scarf-cut)	Turcon® Back-up Ring Solid or Scarf-cut, one required	Rod/Piston	MIL-G-5514; Revision F One Back-up Ring
	S33865	WE65_S	Turcon® Excluder® DC, Series E	Rod	MS33675 MIL-P-5514 thru MIL-G-5514F All Revisions
	S34382	WM820S	Turcon® DC Scraper Ring	Rod	MS33675 MIL-P-5514 thru MIL-G-5514F All Revisions
	S34435	RP01_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34545	GP__XB	Turcon® Slydring® (1/32 thick)	Piston	Trelleborg Standard MIL-G-5514F
	S34546	GP__WB	Turcon® Slydring® (1/16 thick)	Piston	Trelleborg Standard MIL-G-5514F
	S34547	GP__YB	Turcon® Slydring® (3/32 thick)	Piston	Trelleborg Standard MIL-G-5514F
	S34548	GR__XB	Turcon® Slydring® (1/32 thick)	Rod	Trelleborg Standard MIL-G-5514F
	S34549	GR__WB	Turcon® Slydring® (1/16 thick)	Rod	Trelleborg Standard MIL-G-5514F
	S34550	GR__YB	Turcon® Slydring® (3/32 thick)	Rod	Trelleborg Standard MIL-G-5514F








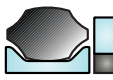
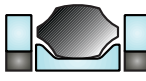
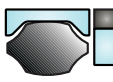



Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S34571	RP71_M	Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34572	RP72_M	Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34581	PP81_M	Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F One Back-up Ring
	S34582	PP82_M	Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S34690	RB90_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S34691	RB91_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34692	RB92_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34700	PB00_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S34701	PB01_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F One Back-up Ring
	S34702	PB02_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S34711	RP11_M	Grooved Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34712	RP12_M	Grooved Turcon® Plus Seal® II	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34721	PP21_M	Grooved Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F One Back-up Ring


Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S34722	PP22_M	Grooved Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S34750	PP50_M	Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S34760	PP60_M	Grooved Turcon® Plus Seal® II	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S34767	RSA70B	Turcon® Stepseal®	Rod	Trelleborg Standard MIL-G-5514; Revision F
	S34768	PSA80B	Turcon® Stepseal®	Piston	Trelleborg Standard MIL-G-5514; Revision F
	S34770	RA70_M	Turcon® Wedgpak®	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S34771	RA71_M	Turcon® Wedgpak®	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34772	RA72_M	Turcon® Wedgpak®	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34780	PA80_M	Turcon® Wedgpak®	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S34781	PA81_M	Turcon® Wedgpak®	Piston	MIL-G-5514; Revision F One Back-up Ring
	S34782	PA82_M	Turcon® Wedgpak®	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S34831	RH310M	Turcon® Hatseal® II Three-Piece	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34832	RH320M	Turcon® Hatseal® II Three-Piece	Rod	MIL-G-5514; Revision F Two Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S34841	N/A	Turcon® Hatseal® II Three-Piece	Piston	MIL-G-5514; Revision F One Back-up Ring
	S34842	N/A	Turcon® Hatseal® II Three-Piece	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S34851	RH510M	Turcon® Hatseal® II Two-Piece	Rod	MIL-G-5514; Revision F One Back-up Ring
	S34852	RH520M	Turcon® Hatseal® II Two-Piece	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S34853	RH530M	Turcon® Hatseal® II Two-Piece	Rod	Boeing Standard BACS11AA
	S35961	RA610M	Turcon® Wedgpak®	Rod Static	MIL-G-5514; Revision F Zero Back-up Rings
	S35964	PA640M	Turcon® Wedgpak®	Piston Static	MIL-G-5514; Revision F Zero Back-up Rings
	S36611	RP00_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F One Back-up Ring, Unbonded
	S36612	RP99_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F Two Back-up Rings, Unbonded
	S36621	PP01_M	Turcon® Plus Seal® II Set	Piston	MIL-G-5514; Revision F One Back-up Ring, Unbonded
	S36622	PP03_M	Turcon® Plus Seal® II Set	Piston	MIL-G-5514; Revision F Two Back-up Rings, Unbonded
	S36991	BG990M	Turcon® Stakbak®, Scarf-cut	Rod	MIL-G-5514; Revision F One Back-up Ring
	S36992	BG920M	Turcon® Stakbak®, Scarf-cut	Rod	MIL-G-5514; Revision F Two Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S37001	BG010M	Turcon® Stakbak®, Scarf-cut	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37002	BG020M	Turcon® Stakbak®, Scarf-cut	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S37011	BG110M	Turcon® Stakbak®, Scarf-cut	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37021	BG210M	Turcon® Stakbak®, Scarf-cut	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37051	RP51_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37052	RP52_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S37055	BG550M	Turcon® Stakbak®, Scarf-cut	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S37060	BG600M	Turcon® Stakbak®, Scarf-cut	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37061	PP61_M	Turcon® Plus Seal® II Set	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37062	PP62_M	Turcon® Plus Seal® II Set	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S37076	BG760M	Turcon® Stakbak®, Scarf-cut	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37083	BG830M	Turcon® Stakbak®, Scarf-cut	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37241	BG410M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Piston	MIL-G-5514; Revision F One Back-up Ring














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S37242	BG420M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S37251	BG510M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37252	BG520M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S37261	BG610M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37271	BG710M	Turcon® Stakbak®, Scarf-cut, Static Seal Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37401	PP02_M	Turcon® Plus Seal® II Set	Piston	MIL-G-5514; Revision F One Back-up Ring
	S37411	RP02_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37431	RP03_M	Turcon® Plus Seal® II Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S37804	PP040M	Turcon® Plus Seal® AQ	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S37967	WE670B	Turcon® Excluder® AS	Rod	AS4088
	S37971	WE710B	Turcon® Excluder® AS	Rod	AS4052 Rev. B Type I
	S37972	WE720B	Turcon® Excluder® AS	Rod	AS4052 Rev. A Type II
	S38000	DW000B	Turcon® Wedgpak®	Face (External Pressure)	Trelleborg Face Seal Gland Standard




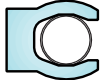
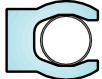








Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S38001	DW010B	Turcon® Wedgpak®	Face (Internal Pressure)	Trelleborg Face Seal Gland Standard
	S38002	PF09_B	Turcon® Single Piston Ring	Piston	Trelleborg Standard MIL-G-5514; Revision F
	S38003	PF08_B	Turcon® Single Piston Ring	Piston	Trelleborg Standard MIL-G-5514; Revision F
	S38362	PP00_M	Turcon® Plus Seal® PR	Piston	Two Back-up Rings MIL-G-5514; Revision F
	S38371	RP31_M	Turcon® Plus Seal® PR	Rod	One Back-up Ring MIL-G-5514; Revision F
	S38372	RP32_M	Turcon® Plus Seal® PR	Rod	Two Back-up Rings MIL-G-5514; Revision F
	S38410	RB10_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F Zero Back-up Rings
	S38411	RB11_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F One Back-up Ring
	S38412	RB12_M	Turcon® T-Seal	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S38420	PB20_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F Zero Back-up Rings
	S38421	PB21_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F One Back-up Ring
	S38422	PB22_M	Turcon® T-Seal	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S38544	BG440G	Turcon® Back-up Ring Scarf-cut	Rod	AS4716 One or Two Back-up Rings














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S38545	BG450G	Turcon® Back-up Ring Scarf-cut	Piston	AS4716 One or Two Back-up Rings
	S38587	BG870G	Turcon® Back-up Ring, Scarf-cut (1/2 Width)	Rod	AS4716 Two Back-up Rings in One Back-up Ring Width Gland
	S38588	BG880G	Turcon® Back-up Ring, Scarf-cut (1/2 Width)	Piston	AS4716 Two Back-up Rings in One Back-up Ring Width Gland
	S38611	RA1__OM	Turcon® Wedgpak® EP	Rod	MIL-G-5514; Revision F One Back-up Ring
	S38612	RA2__OM	Turcon® Wedgpak® EP	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S38618	BU180G	Turcon® Back-up Ring Solid	Piston	AS4716 One or Two Back-up Rings
	S38619	BU190G	Turcon® Back-up Ring Solid	Rod	AS4716 One or Two Back-up Rings
	S38620	PQ200M	Turcon® AQ-Seal® 5	Piston	Trelleborg Standard MIL-G-5514; Revision F
	S38621	PA1__OM	Turcon® Wedgpak® EP	Piston	MIL-G-5514; Revision F One Back-up Ring
	S38622	PA2__OM	Turcon® Wedgpak® EP	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S38647	RP470B	Grooved Turcon® Plus Seal® PR	Rod	Boeing Standard BACS11AA
	S38649	RA490B	Turcon® Wedgpak®	Rod	Boeing Standard BACS11AA
	S38661	PP68_M	Grooved Turcon® Plus Seal® PR	Piston	One Back-up Ring MIL-G-5514; Revision F


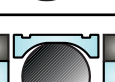





Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	S38662	PP66_M	Grooved Turcon® Plus Seal® PR	Piston	MIL-G-5514; Revision F Two Back-up Rings
	S38671	RP81_M	Turcon® Plus Seal® PR Set	Rod	MIL-G-5514; Revision F One Back-up Ring
	S38672	RP82_M	Turcon® Plus Seal® PR Set	Rod	MIL-G-5514; Revision F Two Back-up Rings
	S62600	PV910M	Turcon® Variseal® H	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings, MIL-G-5514F and AS4716
	S62600	RV910M	Turcon® Variseal® H	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings, MIL-G-5514F and AS4716
	S910	PV950M	Turcon® Variseal® W	Piston	MIL-P-5514; Revisions C, D, E Zero Back-up Rings, MIL-G-5514F and AS4716
	S910	RV950M	Turcon® Variseal® W	Rod	MIL-P-5514; Revisions C, D, E Zero Back-up Rings, MIL-G-5514F and AS4716
	N/A	DVA	Turcon® Variseal® M	Face, (Internal Pressure)	Trelleborg Face Seal Gland Standard
	N/A	DVC	Turcon® Variseal® M	Face, (External Pressure)	Trelleborg Face Seal Gland Standard
	N/A	DVE	Turcon® Variseal® H	Face, (Internal Pressure)	Trelleborg Face Seal Gland Standard
	N/A	DVL	Turcon® Variseal® H	Face, (External Pressure)	Trelleborg Face Seal Gland Standard
	S38686	DYHA	Turcon® HST Seal	Face, (Internal Pressure)	Trelleborg Face Seal Gland Standard
	N/A	DYHB	Turcon® HST Seal	Face, (External Pressure)	Trelleborg Face Seal Gland Standard














Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	PA00_G	Turcon® Wedgpak®II	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PAA1_G	Turcon® Wedgpak®II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PAA2_G	Turcon® Wedgpak®II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PAB1_G	Turcon® Wedgpak®EP	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PAB2_G	Turcon® Wedgpak®EP	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PAU0_G	Turcon® Unidirectional Wedgpak®II	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PAU1_G	Turcon® Unidirectional Wedgpak®II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PAU2_G	Turcon® Unidirectional Wedgpak®II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PBA0_G	Turcon® T-Seal	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PBA1_G	Turcon® T-Seal	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PBA2_G	Turcon® T-Seal	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PBB2_G	Turcon® T-Seal Staged	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDA0_G	Grooved Turcon® Double Delta® II	Piston	AS4716 Rev. A Zero Back-up Rings

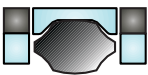






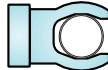
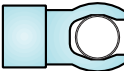




Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	PDA1_G	Grooved Turcon® Double Delta® II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDA2_G	Grooved Turcon® Double Delta® II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDA1AG	Grooved Turcon® Double Delta® II w/ one Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDA2AG	Grooved Turcon® Double Delta® II w/ two Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDA18G	Grooved Turcon® Double Delta® II w/ one Stakbak® Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDA28G	Grooved Turcon® Double Delta® II w/ two Stakbak® Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDB0_G	Turcon® Double Delta® II	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PDB1_G	Turcon® Double Delta® II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDB2_G	Turcon® Double Delta® II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDB1AG	Turcon® Double Delta® II w/ one Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDB2AG	Turcon® Double Delta® II w/ two Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PDB18G	Turcon® Double Delta® II w/ one Stakbak® Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PDB28G	Turcon® Double Delta® II w/ two Stakbak® Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings








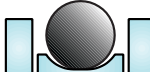




Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	PPA0	Grooved Turcon® Plus Seal® II	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PPA1	Grooved Turcon® Plus Seal® II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PPA2	Grooved Turcon® Plus Seal® II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PPA1A	Grooved Turcon® Plus Seal® II w/ one Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PPA2A	Grooved Turcon® Plus Seal® II w/ two Back- up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PPA18G	Grooved Turcon® Plus Seal® II w/ one Stakbak® Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PPA28G	Grooved Turcon® Plus Seal® w/ two Stakbak® Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PPB0	Turcon® Plus Seal® II	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PPB1	Turcon® Plus Seal® II	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PPB2	Turcon® Plus Seal® II	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PPB1A	Turcon® Plus Seal® II w/ one Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PPB2A	Turcon® Plus Seal® II w/ two Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PPB18G	Turcon® Plus Seal® II w/ one Stakbak® Back-up Ring	Piston	AS4716 Rev. A One Back-up Ring






Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	PPB28G	Turcon® Plus Seal® II w/ two Stakbak® Back-up Rings	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PSF00B	Turcon® Stepseal®	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PVA_0	Turcon® Variseal® M2	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PVA_B	Turcon® Variseal® M2	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PVA_E	Turcon® Variseal® M2	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PVC	Turcon® Variseal® M2S	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PVE_0	Turcon® Variseal® H	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PVE_B	Turcon® Variseal® H	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PVE_E	Turcon® Variseal® H	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PVJ_0	Turcon® Variseal® W2	Piston	AS4716 Rev. A Zero Back-up Rings
	N/A	PVJ_B	Turcon® Variseal® W2	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PVJ_E	Turcon® Variseal® W2	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	PVP_0	Turcon® Variseal® SA	Piston	AS4716 Rev. A Zero Back-up Rings

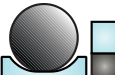












Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	PVP_B	Turcon® Variseal® SA	Piston	AS4716 Rev. A One Back-up Ring
	N/A	PVP_E	Turcon® Variseal® SA	Piston	AS4716 Rev. A Two Back-up Rings
	N/A	RBB2_G	Turcon® T-Seal Staged	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RDA0_G	Grooved Turcon® Double Delta® II	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RDA1_G	Grooved Turcon® Double Delta® II w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDA2_G	Grooved Turcon® Double Delta® II w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RDA1AG	Grooved Turcon® Double Delta® II w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDA2AG	Grooved Turcon® Double Delta® II w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RDA18G	Grooved Turcon® Double Delta® II w/ one Stakbak® Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDA28G	Grooved Turcon® Double Delta® II w/ two Stakbak® Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RDB0_G	Turcon® Double Delta® II	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RDB1_G	Turcon® Double Delta® II	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDB2_G	Turcon® Double Delta® II	Rod	AS4716 Rev. A Two Back-up Rings

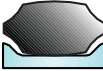
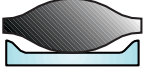

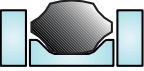

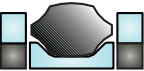








Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	RAAO_G	Turcon® Unidirectional Wedgpak® II	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RAA1_G	Turcon® Wedgpak® II	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RAA2_G	Turcon® Wedgpak® II	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RAB1_G	Turcon® Wedgpak® EP	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RAB2_G	Turcon® Wedgpak® EP	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RAUO_G	Turcon® Unidirectional Wedgpak® II	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RAU1_G	Turcon® Unidirectional Wedgpak® II	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RAU2_G	Turcon® Unidirectional Wedgpak® II	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RBA0_G	Turcon® T-Seal	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RBA1_G	Turcon® T-Seal	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RBA2_G	Turcon® T-Seal	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RDB1AG	Turcon® Double Delta® II w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDB2AG	Turcon® Double Delta® II w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings







Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	RDB18G	Turcon® Double Delta® II w/ one Stakbak® Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RDB28G	Turcon® Double Delta® II w/ two Stakbak® Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	REL2	Turcon® VL seal	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	REL2B	Turcon® VL seal w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	REL2E	Turcon® VL seal w/ one Back-up Ring	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPA0	Grooved Turcon® Plus Seal® II	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RPA1	Grooved Turcon® Plus Seal® II	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPA2	Grooved Turcon® Plus Seal® II	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPA1A	Grooved Turcon® Plus Seal® II w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPA2A	Grooved Turcon® Plus Seal® II w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPA18G	Grooved Turcon® Plus Seal® II w/ one Stakbak® Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPA28G	Grooved Turcon® Plus Seal® II w/ two Stakbak® Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPB0	Turcon® Plus Seal® II	Rod	AS4716 Rev. A Zero Back-up Rings

Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	RPB1	Turcon® Plus Seal® II	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPB2	Turcon® Plus Seal® II	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPB1A	Turcon® Plus Seal® II w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPB2A	Turcon® Plus Seal® II w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RPB18G	Turcon® Plus Seal® II w/ one Stakbak® Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RPB28G	Turcon® Plus Seal® II w/ two Stakbak® Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RSFOOB	Turcon® Stepseal® 2K	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVA_0	Turcon® Variseal® M2	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVA_B	Turcon® Variseal® M2 w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RVA_E	Turcon® Variseal® M2 w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RVC	Turcon® Variseal® M2S	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVE_0	Turcon® Variseal® H	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVE_B	Turcon® Variseal® H w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RVE_E	Turcon® Variseal® H w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings

Part Number Guide

Cross Section	Old Part No.	New Part No.	Description	Seal Type	Gland Standard
	N/A	RVJ_0	Turcon® Variseal® W2	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVJ_B	Turcon® Variseal® W2 w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RVJ_E	Turcon® Variseal® W2 w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings
	N/A	RVP_0	Turcon® Variseal® SA	Rod	AS4716 Rev. A Zero Back-up Rings
	N/A	RVP_B	Turcon® Variseal® SA w/ one Back-up Ring	Rod	AS4716 Rev. A One Back-up Ring
	N/A	RVP_E	Turcon® Variseal® SA w/ two Back-up Rings	Rod	AS4716 Rev. A Two Back-up Rings

Part Number Guide

Aerospace Part Number Reference Guide - (By New Part Number)

New P/N	Old P/N
BG010M	S37001
BG020M	S37002
BG110M	S37011
BG210M	S37021
BG410M	S37241
BG420M	S37242
BG440G	S38544
BG450G	S38545
BG480M	S11248
BG510M	S37251
BG520M	S37252
BG550M	S37055
BG600M	S37060
BG610M	S37261
BG660M	S12766
BG690M	S13069
BG710M	S37271
BG760M	S37076
BG830M	S37083
BG870G	S38587
BG880G	S38588
BG920M	S36992
BG940M	S30294
BG990M	S36991
BGS10M	S33861
BGS20M	S13122
BP090A	S11109
BP170M	S12517
BU100M	S30310
BU180G	S38618
BU190G	S38619
BU230M	S33823

New P/N	Old P/N
BU440M	S33824
BU870M	S12587
BU890M	S30989
BUS00M	S13050
BUS70M	S33157
DW000B	S38000
DW010B	S38001
GP_WB	S34546
GP_XB	S34545
GP_YB	S34547
GR_WB	S34549
GR_XB	S34548
GR_YB	S34550
N/A	S11242
N/A	S11243
N/A	S11370
N/A	S11943
N/A	S12257
N/A	S13076
N/A	S13077
N/A	S13180
N/A	S13181
N/A	S13201
N/A	S13206
N/A	S13207
N/A	S30471
N/A	S30611
N/A	S30622
N/A	S30676
N/A	S30681
N/A	S30682
N/A	S30683

Part Number Guide

Aerospace Part Number Reference Guide - (By New Part Number)

New P/N	Old P/N
N/A	S30684
N/A	S32831
N/A	S32832
N/A	S32840
N/A	S32841
N/A	S32842
N/A	S32891
N/A	S32892
N/A	S32893
N/A	S32894
N/A	S32909
RG13_B	S32913
PG14_B	S32914
N/A	S32985
N/A	S33081
N/A	S33084
N/A	S33087
N/A	S33090
N/A	S33277
N/A	S33278
N/A	S33353
N/A	S33528
N/A	S33557
N/A	S33565
N/A	S34841
N/A	S34842
OC140M	S11214
OC320M	S11732
PA1_M	S38621
PA2_M	S38622
PA640M	S35964
PA80_M	S34780

New P/N	Old P/N
PA81_M	S34781
PA82_M	S34782
PB00_M	S34700
PB01_M	S34701
PB02_M	S34702
PB20_M	S38420
PB21_M	S38421
PB22_M	S38422
PD00_M	S12714
PD03_M	S12508
PD04_M	S12563
PD05_M	S12603
PD06_M	S12716
PD070M	S12957
PD080M	S30289
PD10_M	S30641
PD11_M	S30642
PD130M	S11338
PD19_M	S30640
PD60_M	S30660
PD61_M	S30661
PD62_M	S30662
PD780M	S30678
PD80_M	S32860
PD81_M	S32861
PD82_M	S32862
PF00_B	S11052
PF01_B	S11114
PF02_B	S12083
PF03_B	S12230
PF04_B	S13095
PF05_B	S13126

Part Number Guide

Aerospace Part Number Reference Guide - (By New Part Number)

New P/N	Old P/N
PF06_B	S13135
PF07_B	S30071
PF08_B	S38003
PF09_B	S38002
PF52_B	S32152
PG00_B	S11718
PG02_B	S32910
PG28_B	S32928
PG47_B	S12547
PG59N	S30059
PG68_B	S12068
PG95_B	S12795
PG990B	S12599
PGE4_B	S32934
PP00_M	S38362
PP01_M	S36621
PP02_M	S37401
PP03_M	S36622
PP040M	S37804
PP09_M	S33709
PP21_M	S34721
PP22_M	S34722
PP37_M	S12737
PP50_M	S34750
PP52_M	S30852
PP60_M	S34760
PP61_M	S37061
PP62_M	S37062
PP66_M	S38662
PP68_M	S38661
PP72_M	S30772
PP81_M	S34581

New P/N	Old P/N
PP82_M	S34582
PQ200M	S38620
PS720B	S32572
PS740B	S32574
PSA80B	S34768
PV920M	S32240
PV930M	S32265
RA1_M	S38611
RA2_M	S38612
RA490G	S38649
RA610M	S35961
RA70_M	S34770
RA71_M	S34771
RA72_M	S34772
RB10_M	S38410
RB11_M	S38411
RB12_M	S38412
RB90_M	S34690
RB91_M	S34691
RB92_M	S34692
RD03_M	S12223
RD040M	S12560
RD05_M	S12561
RD06_M	S12562
RD07_M	S12604
RD08_M	S12715
RD090M	S12956
RD100M	S13068
RD12_M	S13200
RD140M	S30010
RD160M	S30050
RD17_M	S30630

Part Number Guide

Aerospace Part Number Reference Guide - (By New Part Number)

New P/N	Old P/N
RD18_M	S30631
RD19_M	S30632
RD200M	S30675
RD210M	S30677
RD22_M	S32830
RD240B	S11859
RD50_M	S30650
RD51_M	S30651
RD52_M	S30652
RD550M	S33555
RD80_M	S32850
RD81_M	S32851
RD82_M	S32852
RD890M	S11589
RF210B	S33121
RF95_B	S12095
RG00_B	S11717
RG27_B	S32927
RG46_B	S12546
RG58N	S30058
RG66_B	S12066
RG94_B	S12794
RGE3_B	S32933
RH170M	S33317
RH310M	S34831
RH320M	S34832
RH510M	S34851
RH520M	S34852
RH530B	S34853
RH790M	S32979
RH910M	S32991
RP00_M	S36611

New P/N	Old P/N
RP01_M	S34435
RP02_M	S37411
RP03_M	S37431
RP11_M	S34711
RP12_M	S34712
RP31_M	S38371
RP32_M	S38372
RP35_M	S12735
RP40_M	S11940
RP470G	S38647
RP51_M	S37051
RP52_M	S37052
RP55_M	S30855
RP71_M	S34571
RP72_M	S34572
RP75_M	S30775
RP81_M	S38671
RP82_M	S38672
RP99_M	S36612
RS570B	S32571
RS730B	S32573
RSA70B	S34767
WE25_B	S32925
WE65_S	S33865
WE670B	S37967
WE69_S	S30669
WE710B	S37971
WE720B	S37972
WE95_B	S30395
WM650S	S11065
WM820S	S34382
WM880S	S30388

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