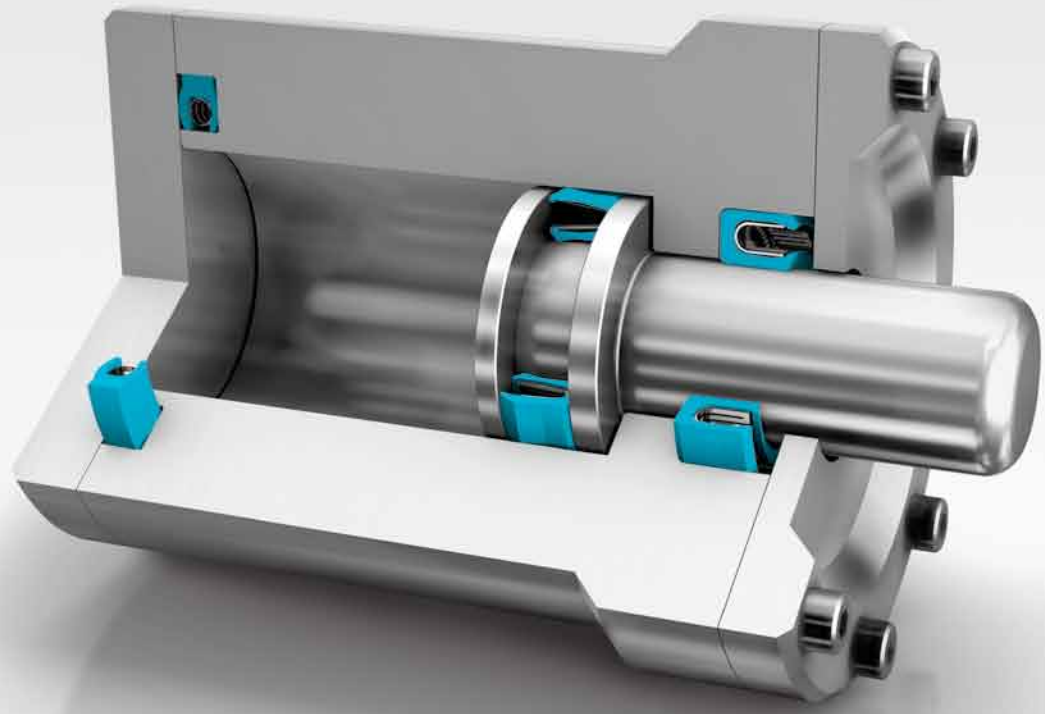
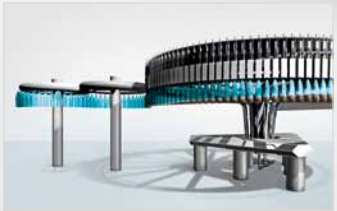
TRELLEBORG

Turcon® Variseal®





YOUR PARTNER FOR SEALING TECHNOLOGY

Your Partner for Sealing Technology

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

With 50 years of experience, Trelleborg Sealing Solutions engineers support customers with design, prototyping, production, test and installation using state-of-the-art design tools. An international network of over 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 experience and resources of Trelleborg Group, one of the world's foremost experts in polymer technology.

ISO 9001:2008

ISO/TS 16949:2009

Contents

■ Choosing the Right Seal for your Application

Turcon® Variseal® offers major benefits in the design of components such as cylinders. These include:

- Excellent leakage control
- High resistance to wear
- High resistance to extrusion into gaps
- Withstanding aggressive and abrasive process media
- Very good temperature capabilities
- Low friction
- Compact form

Turcon® Variseal® is available in a range of geometries and designs that allow the optimum profile to be selected for each application. They can be produced from a wide range of Turcon® materials, our proprietary PTFE based compounds. These are specially formulated for sealing elements and offer superior characteristics specifically matched to the demands of our customers.

When required, Variseal® can also be manufactured from Zurcon® Z80, our UHMWPE based material or Zurcon® Z48, our Thermoplastic Elastomer material.

To choose the best Turcon® Variseal® or your application, you must first decide the functional parameters. Table 1 and Table 2 on page 6 and Table 3 on page 7 can then be used to make an initial selection of seals and materials. These tables give details of where further details can be found in the catalog.

It is also important to consider the quality of the mating surface, which has a significant effect on the function and service life of the sealing system. Guidelines on these are given on page 20 and page 21.

If help is required in specification of a seal then contact Trelleborg Sealing Solutions. To find your local marketing company go to www.tss.trelleborg.com.

General

Turcon® Variseal® are single acting, spring-energized seals which are used for dynamic and static applications.

Variseal® are effective in a wide range of applications. They are chosen when higher resistance to chemical media is required, if the seal is required to operate in extremes of temperature and/or where good extrusion and compression characteristics are needed.

Turcon® Variseal® designs have three main characteristics:

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

Standard or custom geometries available in metric, inch and intermediate sizes ranging from 2 to 3,300 mm / 0.079 to 126 inches.

METHOD OF OPERATION

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

The 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).

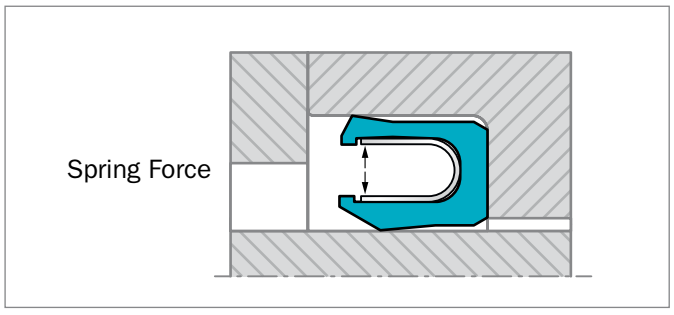


Figure 1: Turcon® Variseal® without system pressure

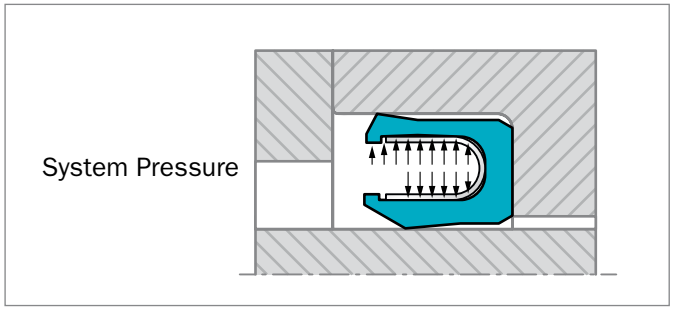


Figure 2: Turcon® Variseal® with system pressure

PERFORMANCE

The different types of Variseal® designs combined with the properties of Turcon® and Zurcon® materials offer design engineers a wide range of solutions to a large number of applications.

The most important characteristics of Variseal® designs are listed below:

- Very low coefficient of friction
- Good dynamic and static sealing
- Capable of sealing at high speeds up to 15 m/s / 2,940 fpm
- Almost universal chemical compatibility
- Operating temperature of -253 °C up to +300 °C (-423 °F to +572 °F)
- Very good thermal resistance
- Properties unaffected by contact with chemicals
- Good aging characteristics
- Low compression set
- Capable of withstanding high pressures above 200 MPa (2,000 bar / 29,000 psi) when using Back-up Rings
- Very good dry-running properties
- Can be installed in grooves according to AS4716 (Mil-G-5514 is an old spec) and DIN 3771

Table 1: Turcon® Variseal® Selection Table

Seal		Application			Technical Data				
		Type of Application			Maximum Pressure		Working Temp.	Maximum Speed	
Type	Page	Static	Reciprocating	Rotary	Dynamic MPa (bar, psi)	Static MPa (bar, psi)	°C / (°F)	Reciprocating m/s (fpm)	Rotating m/s (fpm)
M2 	page 22	C	A	B	20 (200, 2900)	40 (400, 5800)	-70 to +300 (-94 to +572)	15 (2940)	1.27 (250)
M2S 	page 23	C	A	C	20 (200, 2900)	40 (400, 5800)	-70 to +300 (-94 to +572)	15 (2940)	1.27 (250)
W2 	page 24	C	A	B	20 (200, 2900)	40 (400, 5800)	-70 to +300 (-94 to +572)	15 (2940)	1.27 (250)
H 	page 25	A	B	C	20 (200, 2900)	40 (400, 5800)	-100 to +200 (-148 to +392)	5 (985)	0.10 (18)
HF 	page 46	A	-	C	n/a	60 (600, 8702)	-150 to +200 (-238 to +392)	n/a	n/a
Roto 	page 60	B	B	A	20 (200, 2900)	25 (250, 3626)	-70 to +300 (-94 to +572)	15 (2940)	2.00 (360)

Properties: A Excellent B Good C Satisfactory

Table 2: Application Guide

Contact medium or operating condition	Static or slightly Dynamic	Reciprocating	Rotating
Air, Gas	Turcon® T05	Turcon® T24	Turcon® T24
Water, Steam	Turcon® T05	Turcon® T40	Turcon® T40
Oil, Crude oil	Turcon® T05	Turcon® T40	Turcon® T40
General chemical	Turcon® T05	Turcon® T40	Turcon® T40
Petrochemicals	Turcon® T05	Turcon® T40	Turcon® T40
Food, Drugs	Turcon® MF1	Zurcon® Z80[1)]	Turcon® MF6
Vacuum	Turcon® T01	Turcon® T05	Turcon® T05

[1)] Maximum operating temperature +93 °C (+200 °F). In a pressure-free state, sterilization is possible for a short period at higher temperature

Table 3: Turcon® and Zurcon® Material Selection Guide

Material Code	Material Description	Temperature Range °C (°F)	Chemical Compatibility	Radiation Resistance
T01 / MF1	Premium grade virgin PTFE for static, slow dynamic or light duty applications. MF1 for food contact service requiring a FDA compliant material. Color: white	-253 to +260 (-423 to +500)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T05	Premium grade modified PTFE. Light duty material with greater wear resistance than Turcon T01. Reciprocating and slow rotary applications. Color: turquoise	-200 to +260 (-328 to +500)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T07	Proprietary polymer-reinforced compound for long wear life in difficult combinations of pressure and temperature. Color: black	-60 to +300 (-76 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T12	Use where poor lubrication is a problem, good performance in valve applications. Color: black	-60 to +300 (-76 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T24	High-grade formulation of virgin polytetrafluoroethylene (PTFE) based material compounded with carbon additive. Recommended for dynamic applications, in particular dry-running air and gas). Color: black	-60 to +300 (-76 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T25	High-grade formulation of virgin polytetrafluoroethylene (PTFE) based material compounded with glass fibers and lubricant additives. Excellent wear and low friction characteristics for lubricated rotary applications. Color: black / grey	-60 to +300 (-76 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
T40 / MF4	High-grade formulation of virgin polytetrafluoroethylene (PTFE) based material compounded with carbon fiber additive. Excellent wear and low friction characteristics. Suited to reciprocating and rotary applications. Suitable for use in media with poor lubricating properties and for dry-running situations. MF4, a specialized grade of Turcon® T40 compound, available with certification of FDA compliance. Color: black / grey	-60 to +300 (-76 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
M79	High grade formulation of virgin polytetrafluoroethylene (PTFE) based material compounded with an aromatic polymer and lubricant. Especially suited for low pressure rotary applications and running against soft surfaces. Color: black / grey	-100 to +300 (-148 to +572)	A	7 x 10^2 Gray (7 x 10^4 Rads)
MF6	High grade formulation of virgin polytetrafluoroethylene (PTFE) based material compounded with an aromatic polymer. Especially suited for low pressure rotary applications and running against soft surfaces. MF6 for food contact service requiring a FDA compliant material. Color: beige	-60 to +260 (-76 to +500)	A	7 x 10^2 Gray (7 x 10^4 Rads)
Z48	TPE (thermoplastic elastomer) for tight sealing with long wear life in applications without high temperatures or corrosive chemicals. Color: black	-62 to +135 (-80 to +275)	C	1.5 x 10^5 Gray (1.5 x 10^7 Rads)
Z80	UHMW Polyethylene. Excellent wear and abrasion resistance. Very good lubricity in water based media. Color: translucent white	-253 to +93 (-423 to +200)	B	1 x 10^5 Gray (1 x 10^7 Rads)

For temps above 500 °F (260 °C), please reference the Society of Plastics Industry's Safe Handling Guide.

■ Turcon® Seal Materials

Turcon® materials are high performance thermoplastics specifically developed for sealing applications. They are based on premium-grade PTFE fluoropolymer resins, with the properties of each compound achieved by the addition of fillers and special processing techniques.

Turcon® materials offer the following benefits:

Low Coefficient of Friction
Friction is dependent on pressure, contact surface area, speed and lubrication. Turcon® materials have very good friction characteristics. For example, a coefficient of friction on steel mating surfaces of 0.04 can be achieved under lubricated and hydrodynamic conditions.
Turcon® materials do not adhere to their mating surfaces and show only a slight difference between static and dynamic friction, thus eliminating the danger of the stick-slip effect in dynamic applications.

Chemical Compatibility
Turcon® materials are stable in all hydraulic fluids. Seal materials should be chosen to suit the lubricating properties of hydraulic media and the wear properties of seal and mating surfaces.

There is only a slight change in chemical properties of Turcon® materials, compared to chemically inert virgin PTFE, dependent on the type of filler material added.

Temperature Range
Turcon® materials can be used at temperatures between -253 °C and +300 °C (-423 °F and +572 °F). The limits for low temperatures are dependent on seal design and the thermal contraction of the material. Special designs are available for sealing cryogenic fluids at temperatures below -200 °C (-328 °F).

General service temperature is limited to +300 °C (+572 °F). At temperatures above this, the seal materials begin to lose their strength and are subject to plastic deformation.

For temperatures above +260 °C (+500 °F), please reference the Society of the Plastics Industry‘s Safe Handling Guide.

Temperature Cycling
Cyclical temperature fluctuations do not change the properties of Turcon® materials.

High Surface Speeds
The mechanical properties of Turcon® materials mean they are excellent in dynamic applications, even under extreme loads.

Turcon® seals offer higher operational reliability than elastomer seals in dynamic situations, especially in dry starting or operating conditions, as they do not suffer from adhesion or heat generation. When the application is lubricated, seal life will be extended further.

Wear Resistance
Wear resistance is dependent upon material fillers which influence the Turcon® material‘s mechanical and physical properties. Fillers in Turcon® include graphite, carbon, carbon fiber, glass fiber, molybdenum disulphide and other polymers. They can give increased resilience, improved wear resistance, reduced thermal expansion and extremely high resistance to abrasive wear.

Aging
Turcon® materials remain unchanged over extended periods. They are practically non-aging and do not become brittle or degrade, even when subject to severe weathering from heat, light, water or salt spray.

Radiation
Turcon® materials exhibit a low resistance to electron and gamma radiation and are not recommended for use in applications where the accumulated radiation doses exceed 7×10^2 Gy (7×10^4 rad). For applications, subject to high radiation doses, special fluoropolymers such as ETFE and PCTFE or Zurcon® materials should be selected.

Other Properties
Some Turcon® materials have outstanding electrical properties, such as a low dielectric constant or a very high electric strength, even at elevated temperatures.

Physiologically safe Turcon® materials are available which meet the requirements of the German Federal Health Authority (BGA) and the FDA Regulation (Food and Drug Administration) No. 21 CFR, Part 177.

The water absorption of Turcon® materials is < 0.01 %.

Zurcon® Seal Materials

Zurcon® Z80
Zurcon® Z80 is a virgin Ultra High Molecular Weight Polyethylene, or UHMWPE. Because the water absorption of Zurcon® Z80 is zero, it is ideal for water service. Its abrasion resistance is five to ten times higher than PTFE, making it the material of choice in abrasive environments. As it is physiologically safe, it is also suitable for use in food and pharmaceutical processing.

The main characteristics of Zurcon® Z80 are:

Low Friction
The dry friction coefficient of Zurcon® Z80 is lower than most other materials though higher than many filled PTFE materials. Zurcon® Z80 forms a self-lubricating, non-stick surface.

Chemical Compatibility
Zurcon® Z80 is stable in all hydraulic fluids. It has a high resistance to acids, bases and aggressive media. The material has limited resistance to aromatic and halogenated hydrocarbons.

Water Service
Zurcon® Z80 is water repellent and does not swell in water. Its self-lubricating properties in water-based media are excellent, giving it significant advantage over many other materials including PTFE-based ones. This combined with its high strength and wear resistance means it has a long service life in aqueous solutions.

Temperature Range
Zurcon® Z80 has a maximum continuous operating temperature of +93 °C (+200 °F). Above this temperature its wear resistance and strength begins to decrease. In low-pressure applications it can be used at temperatures of +120 °C (+248 °F) for short periods and can be sterilized briefly at even higher temperatures. Its lowest operating temperature is -200 °C (-328 °F).

Wear Resistance
The abrasive wear resistance of Zurcon® Z80 is 5 to 10 times higher than that of PTFE based materials. It is therefore recommended in applications where seals are in contact with abrasive media such as paints, adhesives, salts, sludges, etc.

Zurcon® Z80 is also highly resistant to extrusion at high pressures.

Radiation Resistance
The radiation resistance of Zurcon® Z80 is significantly higher than that of PTFE based materials, maintaining good mechanical properties at radiation dosages of up to 100 kGy.

Applications in the food and pharmaceutical industries
Zurcon® Z80 is physiologically safe and can be used for sealing in food and pharmaceutical processing. It has no odor or taste and is suitable for food contact.

The material complies with the recommendations of the BGA and FDA Regulation 21 CFR, Part 177.

Zurcon® Z48 (TPE)
Thermoplastic elastomer (TPE) materials combine several of the most desirable features of high performance elastomers and flexible plastics. They have exceptional toughness and resilience, with high resistance to creep, impact and fatigue. The premium grades used in the Variseal® are fully machinable as well as injection moldable and have the following notable properties.

Sealing ability
TPE conforms well to mating surfaces and, when energized by a spring load, has very good resilience making it an excellent sealing material with very low leakage rates.

Friction
The coefficient of friction of a typical TPE material ranges from 0.30 to 0.60, depending on the mating surface finish and other service conditions. It is not normally recommended for dry service except at very slow speeds due to concerns about heat generation leading to material degradation.
In lubricated service conditions the speed rating is greatly increased and TPE materials may then be considered for use in moderate to high speed reciprocating applications, or in slow to moderate speed rotary service.

Wear and extrusion resistance
TPE blends have excellent wear resistance in well lubricated service where heat generation is kept to a minimum. It is especially long lasting in low to moderate speeds in reciprocating service at low or high pressures. TPE is also noted for its excellent extrusion resistance in high pressure applications up to 68.9 MPa (10,000 psi).

Temperature range
TPE materials exhibit excellent physical properties over a broad temperature range. Various grades are flexible to -62 °C (-80 °F), and retain good physical properties at temperatures to +135 °C (+275 °F). At temperatures above +135 °C (+275 °F), however, TPE is only recommended in short term service because it is subject to heat aging and embrittlement.

Compatibility
Thermoplastic elastomers resist deterioration from many industrial chemicals, oils and solvents. They are resistant to swelling in oils and aliphatic and aromatic hydrocarbons at moderate temperatures. TPE is limited in its compatibility with hot water applications. For example, in long-term service sealing water at +71 °C (+160 °F), TPE loses much of its resilience and experiences a significant drop in tensile strength.

Spring Types and Materials

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 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 the Variseal® designs to take up wear and compensate for variations in gland dimensions.

V-Spring

V-Spring is the standard spring type for Variseal® **M2,** Variseal® **M2S** and **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 Variseal® **H** and 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 Slantcoil® spring used in Variseal® **W2** 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.

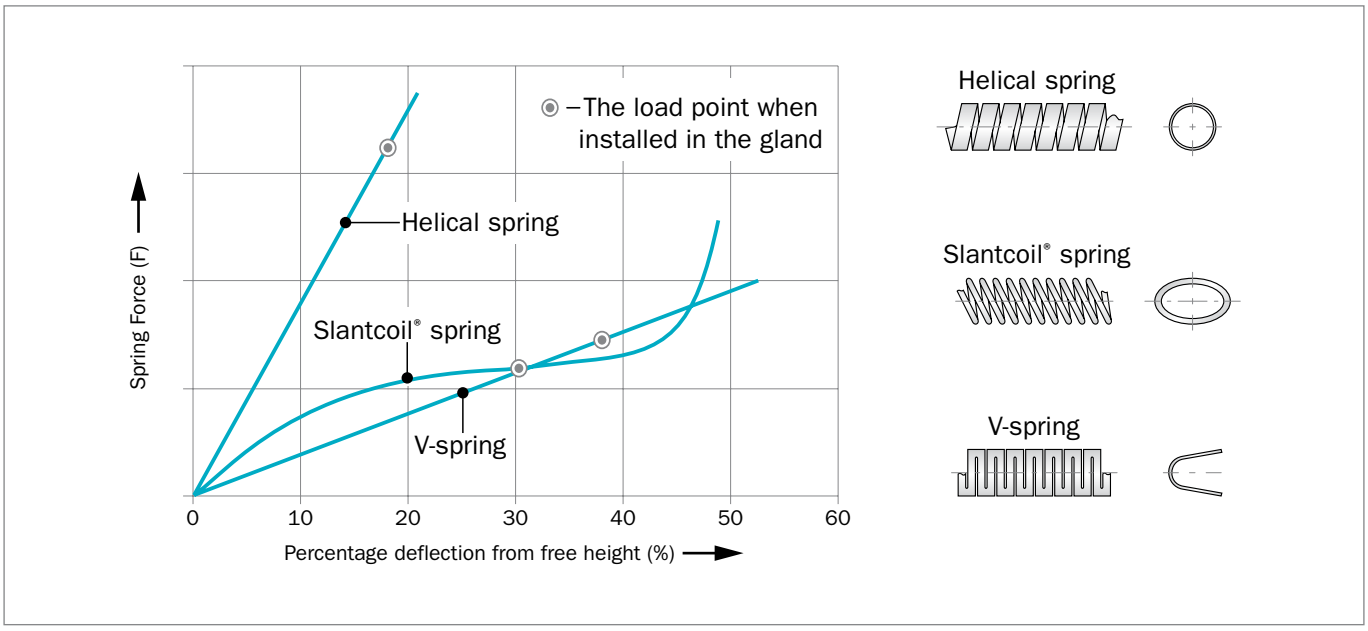


Figure 3: Comparison of load curves for the three spring types

Spring Materials
The standard spring material for Turcon® Variseal® is stainless steel (spring code S). Two further materials are available for the specific applications, as detailed in the table below.

Table 4: Spring Materials Selection Guide

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

® Hastelloy is a registered trademark of Haynes International, Inc.
® Elgiloy is a registered trademark of the Elgiloy Specialty Metals
Alternative brand may be used.
1) NACE-approval

■ Quality Criteria

Seals and bearings manufactured by Trelleborg Sealing Solutions are continuously monitored according to strict quality standards from material supply to delivery of finished parts.

Production plants are certified to international standards such as EN ISO 9001, covering quality control and management of purchasing, production and marketing functions.

All testing of materials and products is performed in accordance with accepted test standards and specifications. Our sealing materials are produced free of chlorofluorinated hydrocarbons and carcinogenic elements.

The tenth digit of our Trelleborg Sealing Solutions part number defines the quality characteristics of the part. A hyphen indicates compliance with standard quality criteria outlined in this catalog. Customer-specific requirements are indicated by a different symbol. Customers who require special quality criteria should contact their local Trelleborg Sealing Solutions marketing company for assistance.

Hardware Design Considerations

The best way to obtain optimum Variseal® performance is to plan ahead - during the design phase of your product. The initial phase should bring into alignment the three factors having the greatest impact on seal performance - the hardware design, the service conditions, and the seal design.

Design issues such as gland style, mating surface hardness and surface finish, and dynamic alignment should be reviewed and adjusted to work with the intended service conditions and to suit the selected seal design. The information in this section is primarily intended as a guide for the design of new hardware, however, it is completely applicable to the task of reviewing or modifying existing hardware to improve seal performance.

A primary goal in selecting a basic gland style is to be able to install the seals without damaging them. The first half of this Section describes the various gland types and installation procedures.

Once the issue of seal installation has been addressed, the goal of hardware design is then to improve seal performance in terms of wear life, leakage rate, friction, and so on.

Basic Gland Styles

There are three basic gland styles to be considered - split, stepped, and solid (see Figure 4). The gland required for a radial Variseal® is similar to an O-Ring gland with one major difference - an O-Ring gland has a typically solid (one piece) construction with a full gland wall on each side. Since the Variseal® is made from polymers, which do not stretch like elastomers, installation in such glands can be difficult - or in many cases impossible. To install the Variseal® easily requires either the split gland or the stepped gland. The solid groove is sometimes used, but only when no other option exists and then only with certain diameter restrictions described later in the Groove Design section.

When retrofitting an existing solid gland for which the hardware cannot be modified, the solution might involve a special seal design or installation tools. Our engineering and technical support personnel are always available to assist you with these situations. To discuss your application, please contact your local Variseal® representative.

The basic gland styles shown above are described in further detail on the following pages.

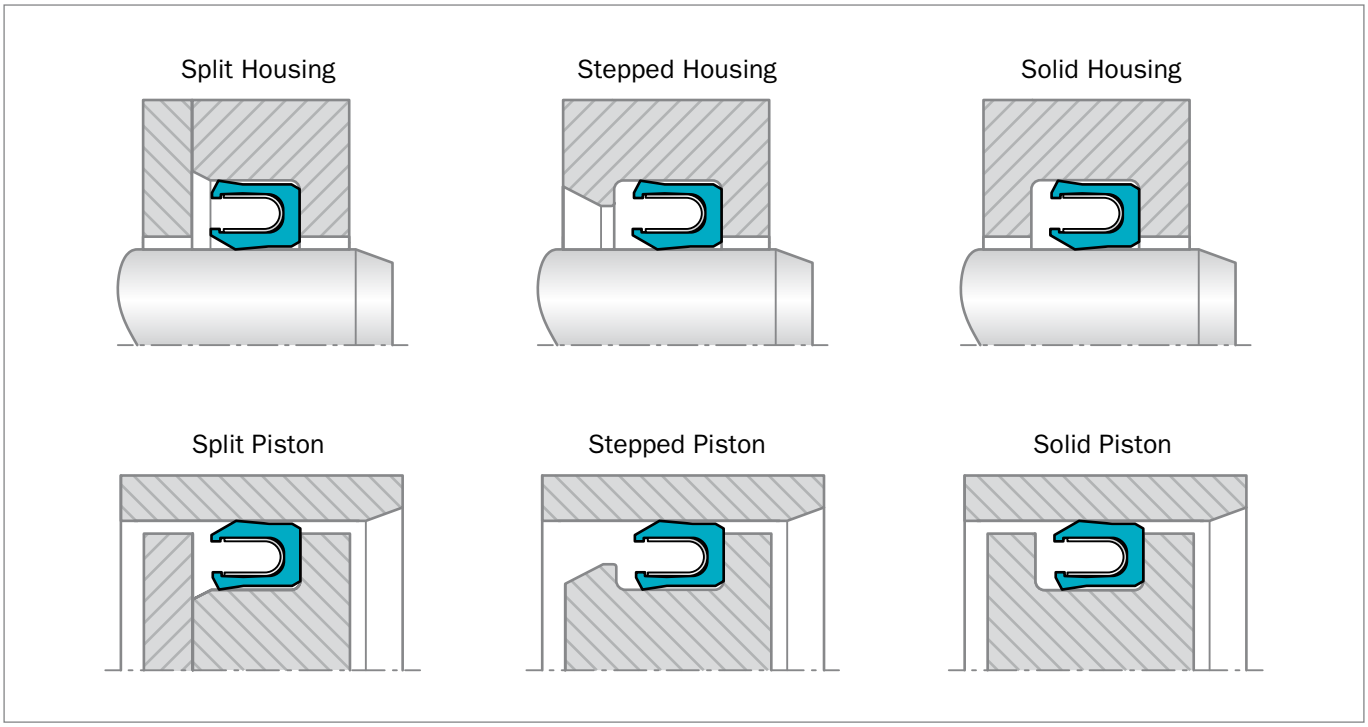


Figure 4: Basic Radial Gland Styles

Basic Gland Types

Split Gland
The best way to obtain optimum Variseal® performance is to plan a Split gland. A split gland designates hardware that is separated or “split” into two pieces to allow assembly without deforming the seal. The split gland minimizes potential damage to the seal. Its advantages include:

- No stretching of the seal
- Repeated installation without damage
- No special installation tools

The disadvantage is that a second piece such as an end plate is required to retain the seal. This might also involve a third piece such as a bolt to secure the end plate.

Stepped Glands
A stepped gland has a small “step” or ledge, which retains the seal. The step height is small, so that the seal can be pushed past it easily. See the Groove Design section for recommended step heights. In most cases, no special tooling or installation procedures are required.

The stepped gland has the advantage of being a simpler configuration (with fewer pieces than the split gland) while maintaining relative ease of assembly. The stepped gland is an excellent configuration for piston seal applications.

Solid Glands
Because the Variseal® does not stretch like an elastomeric O-ring, it is difficult to install in a solid radial groove. This gland is not recommended for new designs, but is often encountered when retrofitting existing glands. It can be used in those cases where the ratio of seal diameter to seal cross-section is large enough.

Face Seal Glands
Face seal glands for the Variseal® are typically the same as O-ring glands, with no problems installing the seal. One advantage of the Variseal® in face seal applications is that it does not require a full gland wall on the pressure side of the seal.

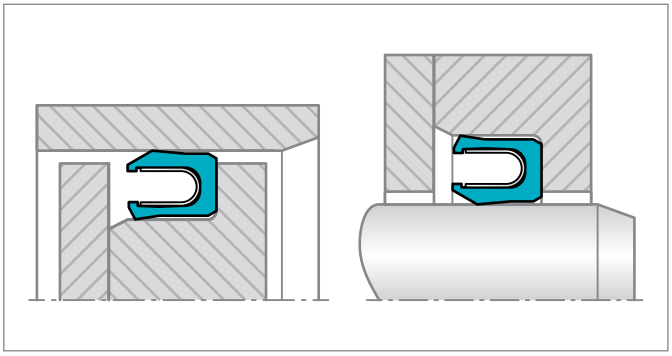


Figure 5: Split or “two piece” Glands

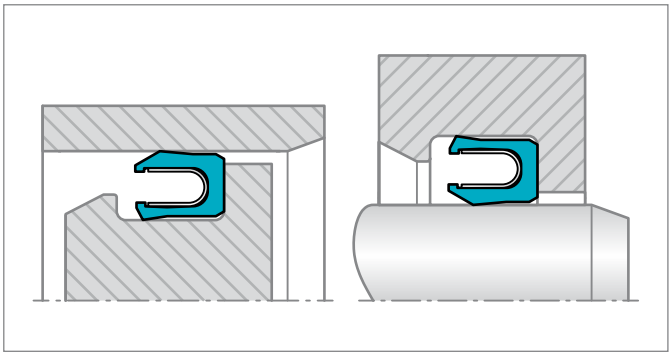


Figure 6: Stepped Glands

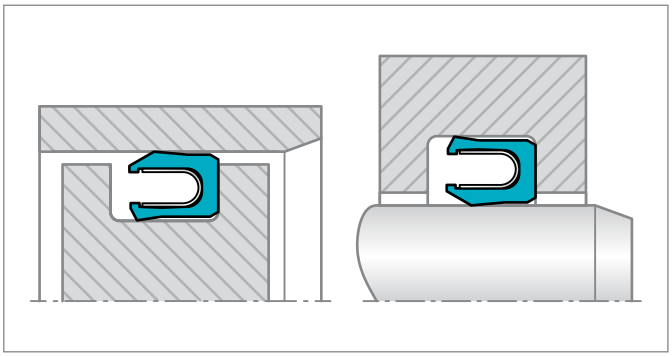


Figure 7: Solid or “one piece” Glands

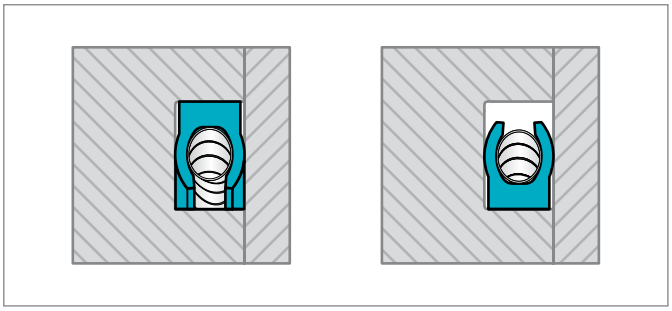


Figure 8: Face Seal Glands

Preventing Seal Damage

Taking a few reasonable precautions to prevent scratching the seals will increase seal life and reliability. To prevent damage during installation, consider the following aspects of hardware design:

- The installation path should be kept free of nicks, burrs, scratches, or any sharp edge that could damage the seal.
- Any tool used to install seals should be free of sharp edges. Screw drivers are especially notorious for damaging seals and should not be used to handle the Variseal® .
- A lead-in chamfer on the end of the rod or bore helps during installation. The proper chamfer dimensions are given in Groove design pages found later in this section. This is especially important where seals are to be installed face first (spring cavity side first) into the gland.
- When seals must be installed across ports, bevel and smooth the edges of the ports.
- Designate splines or keyways to fall on a smaller diameter than the sealing surface or use a protective sleeve to cover them during installation as illustrated in Figure 9 below.
- The Variseal® is typically installed without the aid of heat or lubrication. In situations where heat is required to soften and expand the seal, submerse them for a few minutes in very hot oil or water.
- 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.
- During handling, place the seals where they will not be crushed by tools or other items. It is advisable to leave the seals in their shipping containers until just before installation.
- Avoid glands which require bending the seals during installation. When seals must be stretched or compressed into a difficult gland, be sure to use the recommended tooling to resize the seals.
- Do not sideload the seals any more than is necessary. Avoid gland situations where a heavy rod or piston rests against one side of the seal.

If you feel that your application poses an especially difficult problem with installation, contact the your local Variseal® representative.

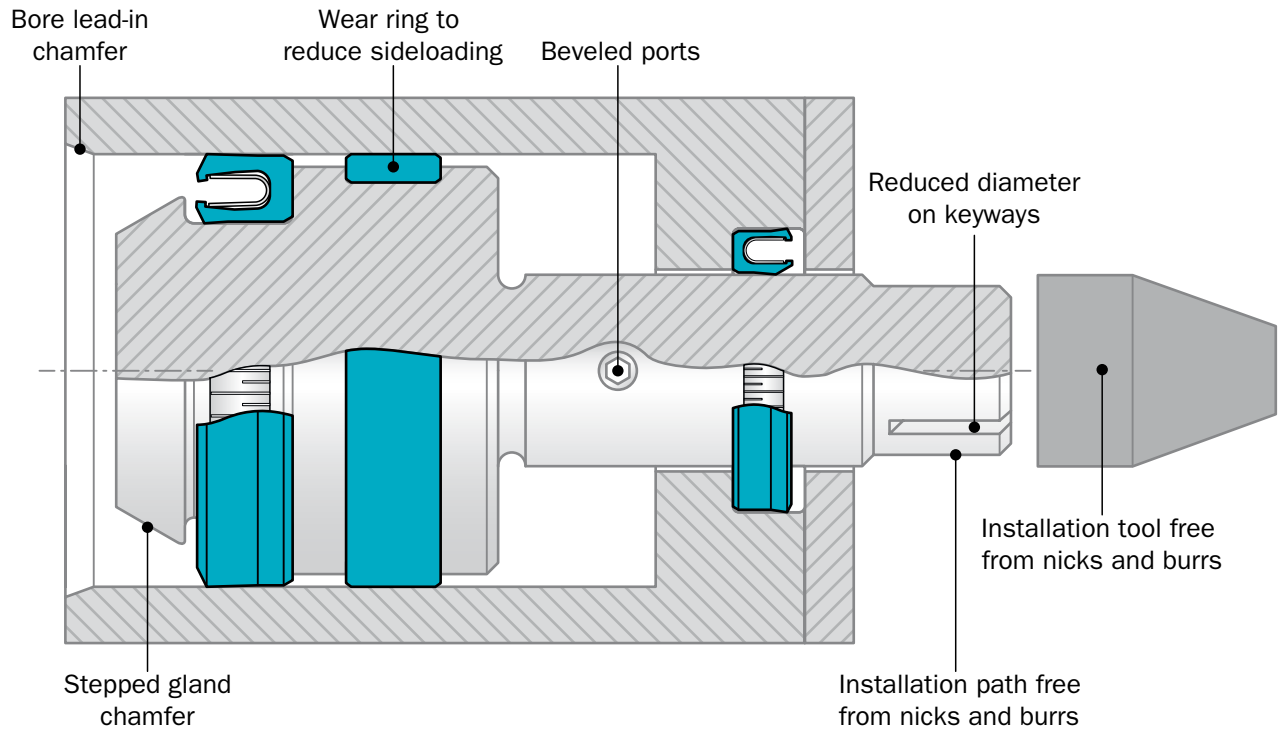


Figure 9: Methods of Hardware Design to Prevent Seal Damages

■ Groove Design – Metric

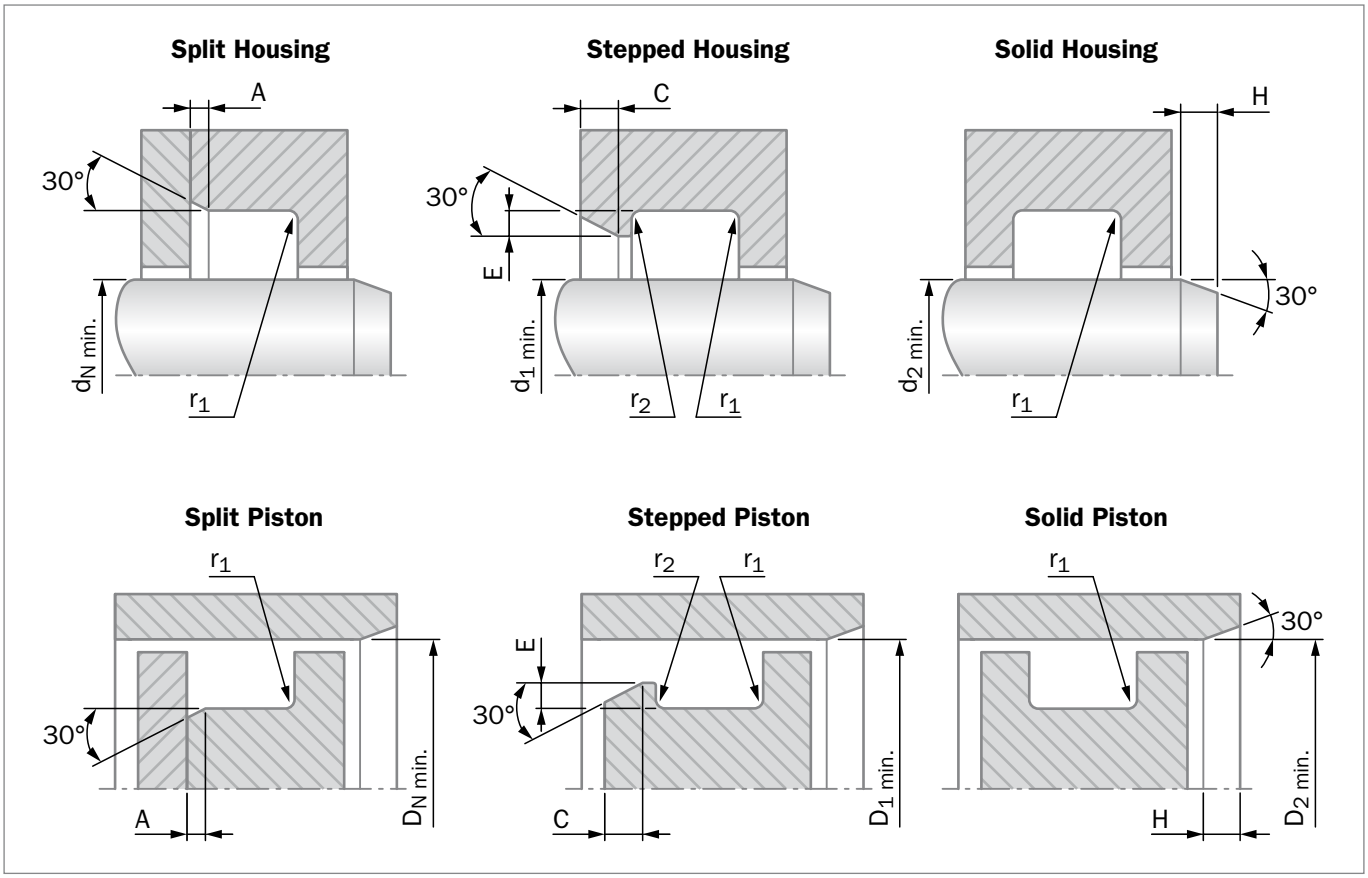


Figure 10: Variseal Groove Configurations

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

Table 5: Dimensions for Groove Designs – Metric

Series	Rod / Piston Groove Dimensions					
	A Chamfer	r1 Maximum Radius	C Minimum Chamfer	r2 Maximum Radius	E Minimum Step Height	H Minimum Chamfer
000	0.25 / 0.38	0.25	0.70	0.13	0.40	1.20
100	0.38 / 0.51	0.38	1.10	0.13	0.60	1.50
200	0.38 / 0.51	0.38	1.25	0.18	0.70	2.50
300	0.51 / 0.69	0.38	1.40	0.25	0.80	4.50
400	0.51 / 0.69	0.51	1.60	0.25	0.90	6.00
500	0.76 / 1.02	0.51	2.60	0.38	1.50	11.00

Table 6: Groove Design for Rod – Metric

Series	Rod Diameter Recommendations				
	Split Groove Ø d_N Minimum	**Stepped Groove Ø d_1 Minimum**	**Solid Groove Ø d_2 Minimum**		
	Type M2,M2S, W2, H	Type M2, M2S, W2, H	Type M2, M2S	Type W2	Type H
000	3.00	20.00	31.75	25.40	25.40
100	6.00	30.00	69.85	63.50	63.50
200	10.00	35.00	111.13	107.95	107.95
300	20.00	40.00	298.45	228.60	228.60
400	35.00	45.00	495.30	400.05	400.05
500	80.00	80.00	762.00	635.00	635.00

Table 7: Groove Design for Piston – Metric

Series	Piston Diameter Recommendations				
	Split Groove Ø D_N Minimum	**Stepped Groove Ø D_1 Minimum**	**Solid Groove Ø D_2 Minimum**		
	Type M2, M2S, W2, H	Type M2, M2S, W2, H	Type M2, M2S	Type W2	Type H
000	6.00	11.50	34.93	19.05	19.05
100	10.00	17.50	50.80	28.58	28.58
200	16.00	20.00	69.85	44.45	44.45
300	28.00	28.00	104.78	60.33	60.33
400	45.00	45.00	139.70	95.25	95.25
500	100.00	100.00	254.00	203.20	203.20

■ Groove Design – Inch

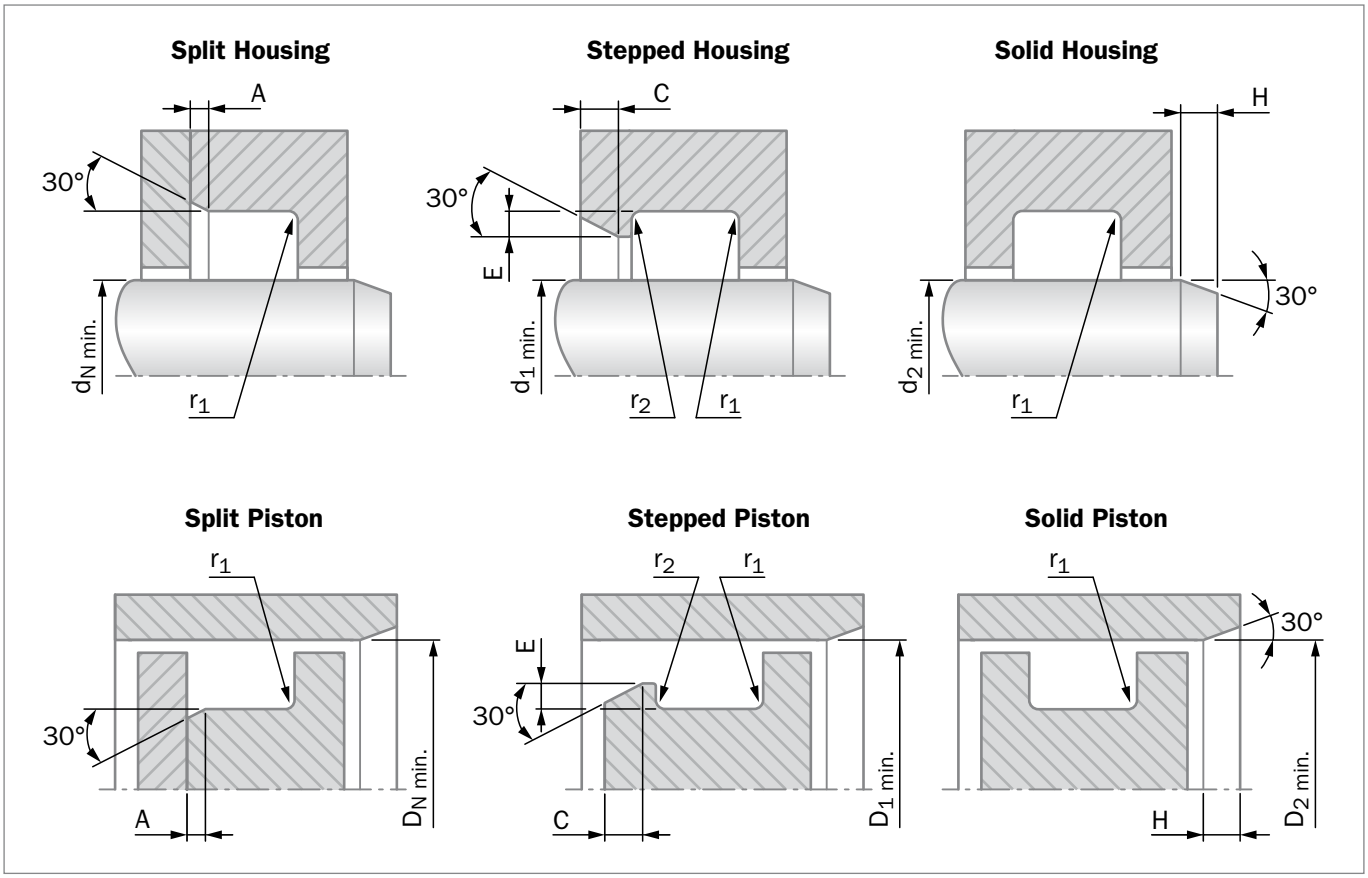


Figure 11: Variseal Groove Configurations

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

Table 8: Dimensions for Groove Designs – Inch

Series	Rod / Piston Groove Dimensions					
	A Chamfer	r1 Maximum Radius	C Minimum Chamfer	r2 Maximum Radius	E Minimum Step Height	H Minimum Chamfer
000	0.010 / 0.015	0.010	0.028	0.005	0.016	0.047
100	0.015 / 0.020	0.015	0.043	0.005	0.024	0.059
200	0.015 / 0.020	0.015	0.050	0.007	0.028	0.098
300	0.020 / 0.027	0.015	0.055	0.010	0.031	0.177
400	0.020 / 0.027	0.020	0.063	0.010	0.035	0.236
500	0.030 / 0.040	0.020	0.102	0.015	0.059	0.433

Table 9: Groove Design for Rod – Inch

Series	Rod Diameter Recommendations				
	Split Groove Ø d_N Minimum	Stepped Groove Ø d_1 Minimum	Solid Groove Ø d_2 Minimum		
	Type M2,M2S, W2, H	Type M2, M2S, W2, H	Type M2, M2S	Type W2	Type H
000	0.118	0.787	1.250	1.000	1.000
100	0.236	1.181	2.750	2.500	2.500
200	0.394	1.378	4.375	4.250	4.250
300	0.787	1.575	11.750	9.000	9.000
400	1.378	1.772	19.500	15.750	15.750
500	3.150	3.150	30.000	25.000	25.000

Table 10: Groove Design for Piston – Inch

Series	Piston Diameter Recommendations				
	Split Groove Ø D_N Minimum	Stepped Groove Ø D_1 Minimum	Solid Groove Ø D_2 Minimum		
	Type M2, M2S, W2, H	Type M2, M2S, W2, H	Type M2, M2S	Type W2	Type H
000	0.236	0.453	1.375	0.750	0.750
100	0.394	0.689	2.000	1.125	1.125
200	0.630	0.787	2.750	1.750	1.75
300	1.102	1.102	4.125	2.675	2.375
400	1.772	1.772	5.500	3.750	3.750
500	3.937	3.937	10.000	8.000	8.000

Surface Roughness

The functional reliability and service life of a sealing system is dependent upon the quality and surface finish of the mating surface to be sealed.

Scores, scratches, pores, concentric or spiral machining marks are not permitted. Higher demands must be made on the surface finish of dynamic mating surfaces than of static mating surfaces (Table 11).

The characteristics most frequently used to describe the surface micro finish R_a, R_z and R_{max} are defined in DIN 4762/ISO 4287/1. These characteristics are not sufficient for assessing the suitability of a surface finish in seal engineering.

The material contact area M_r (previously percentage contact area tp) in accordance with ISO 4287/1, must also be taken into consideration. The significance of this surface specification is illustrated in Figure 12. It shows that specification of R_a and R_z does not describe the profile form accurately enough. The material contact area M_r is essential to assess surface suitability, as the specific profile form determines this parameter. This in turn is directly dependent on the machining process employed.

Figure 13 shows a printout from a commercially available surface measuring instrument. It contains all the information necessary to permit a precise description of a surface finish. Trelleborg Sealing Solutions recommends that the following surface finishes be observed:

Table 11: Surface Roughness

Recommended Maximum Surface Roughness µm and µin						
Media	**Rotary Surface[1)]**		**Reciprocating Surface**		**Static Groove Surface**	
Cryogenic and low molecular gases, hydrogen, helium, freon, oxygen, nitrogen	Rmax = 1.0 µm Rz = 0.63 µm Ra = 0.1 µm	Rmax = 39 µin Rz = 25 µin Ra = 4 µin	Rmax = 2.5 µm Rz = 1.6 µm Ra = 0.2 µm	Rmax = 98 µin Rz = 63 µin Ra = 8 µin	Rmax = 3.5 µm Rz = 2.2 µm Ra = 0.3 µm	Rmax = 138 µin Rz = 87 µin Ra = 12 µin
Low viscosity fluids water, alcohols, hydrazine, gaseous nitrogen, natural gas, skydrol, air	Rmax = 2.5 µm Rz = 1.6 µm Ra = 0.2 µm	Rmax = 9.8 µin Rz = 6.3 µin Ra = 8 µin	Rmax = 3.5 µm Rz = 2.2 µm Ra = 0.3 µm	Rmax = 138 µin Rz = 87 µin Ra = 12 µin	Rmax = 5.0 µm Rz = 3.5 µm Ra = 0.6 µm	Rmax = 197 µin Rz = 138 µin Ra = 24 µin
High viscosity fluids hydraulic oils, crude oil, gear oil, sealants, glue, milk products	Rmax = 2.5 µm Rz = 1.6 µm Ra = 0.2 µm	Rmax = 9.8 µin Rz = 6.3 µin Ra = 8 µin	Rmax = 4.0 µm Rz = 2.5 µm Ra = 0.4 µm	Rmax = 157 µin Rz = 98 µin Ra = 16 µin	Rmax = 6.5 µm Rz = 5.0 µm Ra = 0.8 µm	Rmax = 256 µin Rz = 197 µin Ra = 32 µin

1) The sealing surface must be free from spiral grooves.

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

Figure 12 shows two surface profiles, both of which give nearly the same values for R_z in the test procedure. The difference shows up when the material contact areas are compared. These show that the upper profile with M_r = 70 % has the better seal to mating surface ratio.

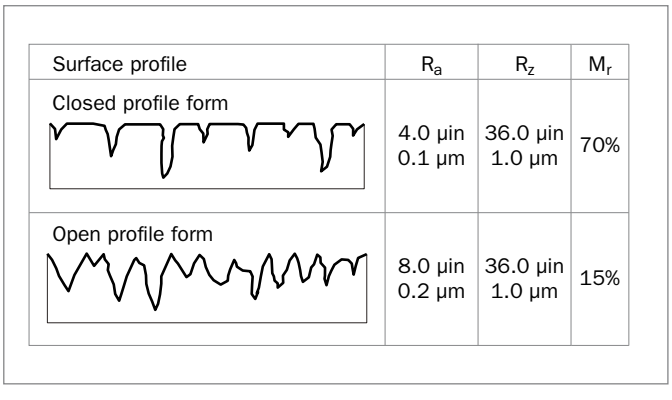


Figure 12: Profile forms of surfaces

TEST PROCEDURE

Depending on the current test program, the test procedure can contain the following elements:

- Company text (1)
- Workpiece text (2)
- Program number, measurement number, test conditions (3)
- Characteristics (4)
- Material contact area (5)
- Characteristic curves (6)
- Profile curve (7)

1	Trelleborg Sealing Solutions Perthometer S3P V2.1			
2	Obj.: Name: Date.:	Piston rod GJ 19.05.93 09:40		
3	Program Measuring T1 RFHTB-50	 50		6 2 1
	LT		5.600 mm	
	LM		4.000 mm	
	VB		25.00 µm	
4	LC	GS	0.800 mm	
	RA		0.079 µm	
	RZ		0.775 µm	
	RMAX		1.215 µm	
	RK		0.221 µm	
	RPK		0.089 µm	
	RVK		0.131 µm	
	LC	GS	0.800 mm	
5	R	MR (0.125 5)		0%
	R	MR (0.000 5)		5% C ref
	R	MR (- 0.050 5)		13%
	R	MR (- 0.100 5)		30%
	R	MR (- 0.150 5)		52%
	R	MR (- 0.200 5)		73%
	R	MR (- 0.250 5)		87%
	R	MR (- 0.300 5)		95%
	R	MR (- 0.350 5)		98%
	R	MR (- 0.400 5)		99%
	R	MR (- 0.450 5)		99%
	R	MR (- 0.500 5)		100%
	R	MR (- 0.550 5)		100%
	R	MR (- 0.600 5)		100%

Evaluation of the test procedure

a) The values for R_a, R_z and $R_{max.}$ correspond to our recommendations.

b) The cut length is calculated with c = 0.25 · R_z = 0.25 · 0.7752 = approximately 0.200 with a material contact area M_r = approximately 70%

c) The ratio R_z/R_a = 9.81 indicates a closed profile.

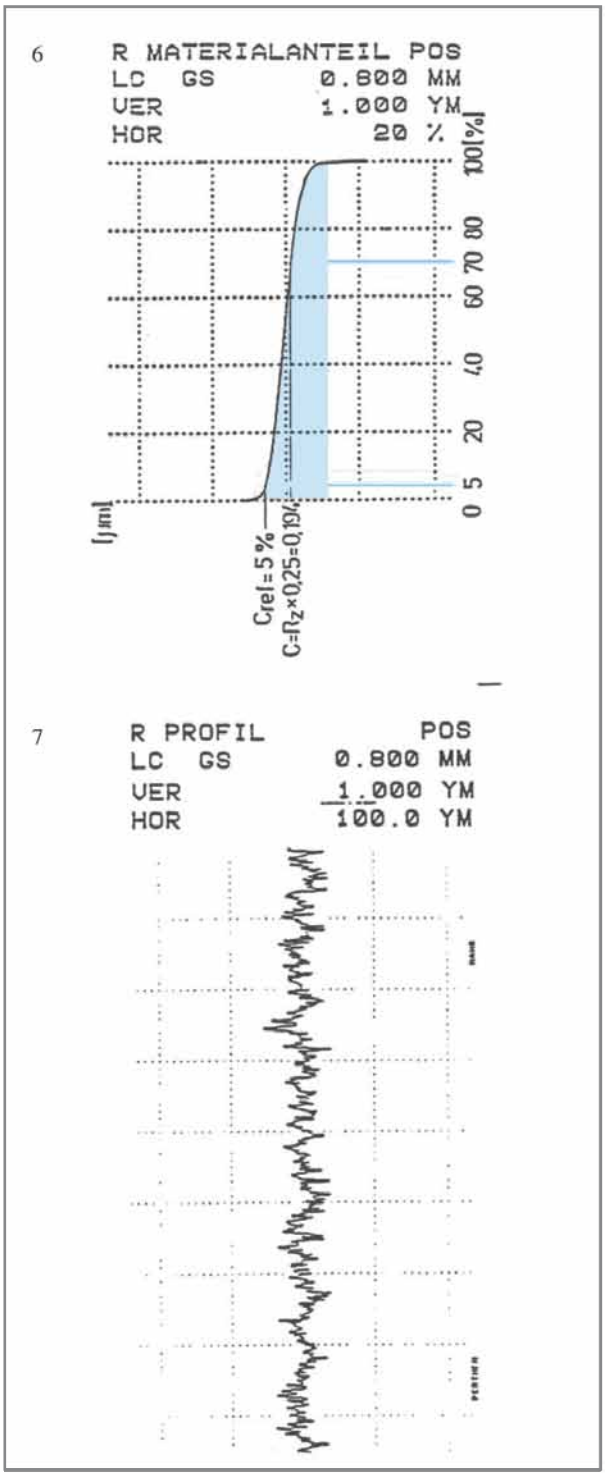


Figure 13: Measurement printout

■ 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. Variseal® M2 has an asymmetric seal profile. The optimized front angle offers good leakage control, reduced friction and long service life.

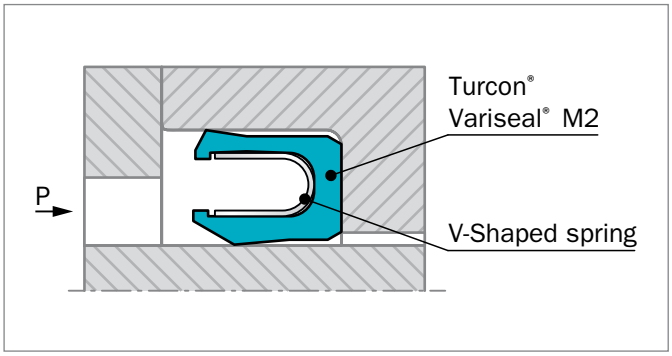


Figure 14: Turcon® Variseal® M2

ADVANTAGES

- Suitable for reciprocating and rotary applications
- Low coefficient of friction
- Stick-slip free operating
- High abrasion resistance
- Dimensionally stable
- Resistant to most fluids, chemicals and gases
- Withstands rapid changes in temperature
- No vulcanizing between seal and hardware
- Excellent resistance to aging
- Can be sterilized
- Available in Hi-Clean version
- Interchangeable with O-Ring and Back-up Ring combinations to AS4716 and ISO 6194

AREAS OF APPLICATION

- Hydraulic components, e.g. cylinders, valves, pumps, etc.
- Chemical processing equipment
- Pharmaceutical processing
- Food and beverage processing
- Spindle seals for machine tools
- Pneumatics, cylinders and valves

TECHNICAL DATA

Operating pressure:	Maximum dynamic load: 20 MPa / 2,900 psi Maximum static load: 40 MPa / 5,800 psi (207 MPa / 30,000 psi with back-up ring)
Speed:	Reciprocating up to 15 m/s / 3,000 fpm Rotating up to 1.27 m/s / 240 fpm
Operating temperature:	-70 °C to +300 °C / -94 °F to +572 °F Special Turcon® and Zurcon® materials as well as alternative spring materials are available for applications outside this temperature range.
Media compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

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

■ Turcon® Variseal® M2S

DESCRIPTION

Turcon® Variseal® **M2S** is a single acting seal consisting of a U-shaped jacket and a V-shaped corrosion resistant spring. Variseal® M2S has an asymmetric seal profile. The dynamic lip is optimized, offering long service life and a good scraping ability even in media with high viscosity.

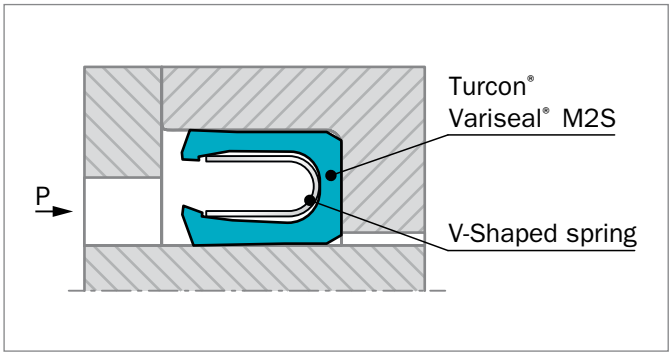


Figure 15: Turcon® Variseal® M2S

AREAS OF APPLICATION

- Hydraulic components with highly viscous media
- Food processing, for example bottling plants for dairy and food products
- Pharmaceutical and chemical industries
- Processing of sealing compounds, adhesives, pastes, etc.
- Media with particle ingress

ADVANTAGES

- Suitable for reciprocating and light duty rotary movement
- Excellent scraping ability
- High abrasion resistance
- Dimensionally stable
- Resistant to most fluids and chemicals
- Excellent resistance to aging
- Available in Hi-Clean version
- Interchangeable with O-Ring and Back-up Ring in most cases

TECHNICAL DATA

Operating pressure:	Maximum dynamic load: 20 MPa / 2,900 psi Maximum static load: 40 MPa / 5,800 psi (207 MPa / 30,000 psi with custom designs)
Speed:	Reciprocating up to 15 m/s / 3,000 fpm Rotating up to 1.27 m/s / 250 fpm
Operating temperature:	-70 °C to +300 °C / -94 °F to +572 °F Special Turcon® and Zurcon® materials as well as alternative spring materials are available for applications outside this temperature range.
Media compatibility:	Fluids of medium to high viscosity or containing hard particles

IMPORTANT NOTE

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

■ 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 Variseal® W2 provides an almost constant load irrespective of hardware tolerances, eccentricity and seal wear.

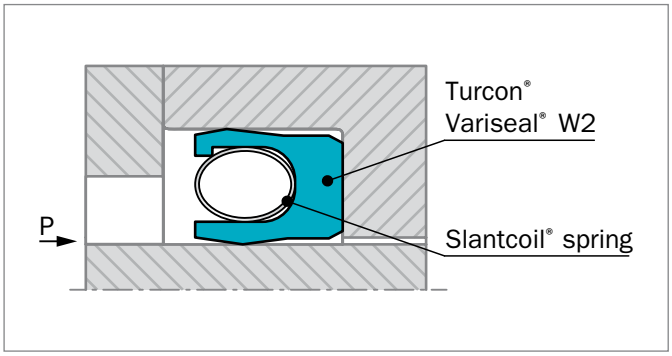


Figure 16: Turcon® Variseal® W2

AREAS OF APPLICATION

- Hydraulic or pneumatic measuring instruments
- Servo valves, pressure switches
- Electronic equipment
- Laboratory apparatus

ADVANTAGES

- Suitable for reciprocating and light duty rotary movement
- Constant initial squeeze of spring over a large control area
- Interchangeable with O-Ring and Back-up Ring in most cases

TECHNICAL DATA

Operating pressure:	Maximum dynamic load: 20 MPa / 2,900 psi Maximum static load: 40 MPa / 5,800 psi (207 MPa / 30,000 psi with custom designs)
Speed:	Reciprocating up to 15 m/s / 3,000 fpm Rotating up to 1.27 m/s / 250 fpm
Operating temperature:	-70 °C to +300 °C -94 °F to +572 °F
Media compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

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

■ Turcon® Variseal® H

DESCRIPTION

Turcon® Variseal® **H** is a single acting seal consisting of a U-shaped jacket and a helical wound corrosion resistant spring. The helical spring of Variseal® H has a high spring loading, which gives excellent sealing integrity at low pressure. Variseal® H is suitable for dynamic applications and ideal in static applications.

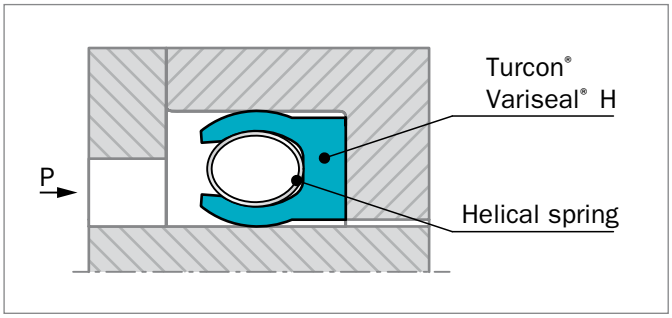


Figure 17: Turcon® Variseal® H

AREAS OF APPLICATION

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

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
- Excellent resistance to aging
- Interchangeable with O-Ring and Back-up Ring in most cases

TECHNICAL DATA

Operating pressure:	Maximum dynamic load: 20 MPa / 2,900 psi Maximum static load 40 MPa / 5,800 psi (207 MPa / 30,000 psi with custom designs)
Operating temperature:	-100 °C to +200 °C / -148 °F to +392 °F
Media compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

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

■ Installation Recommendations for Rod Seals – Types M2, M2S, W2 and H – Metric

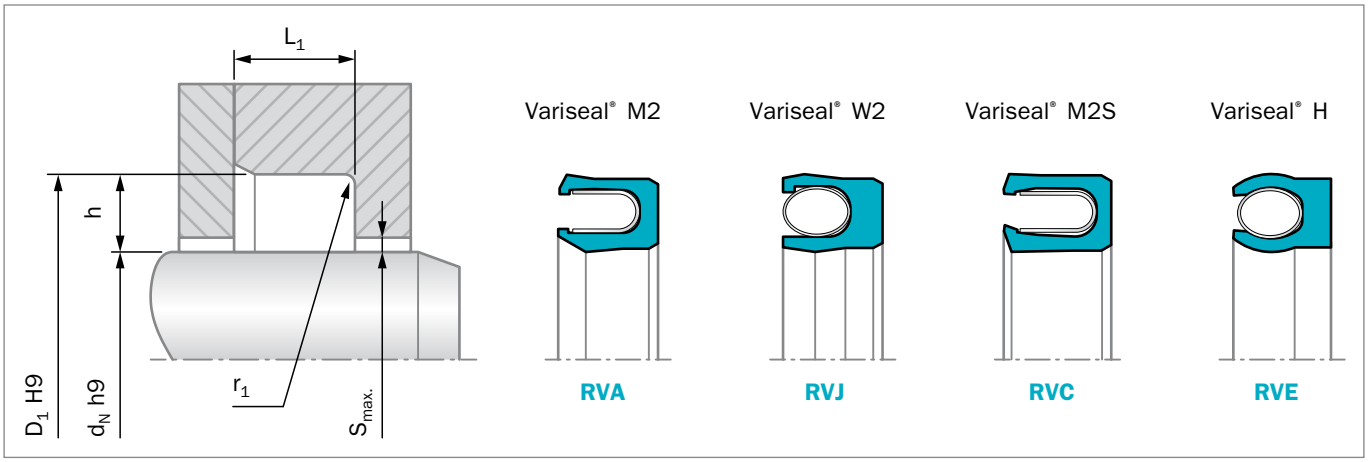


Figure 18: Installation Drawing

Table 12: Installation Dimensions – Metric

Series Number for Types				Rod Diameter dN h9		h	D1	L1	r1	Radial Clearance Smax			
M2	M2S	W2	H	Standard Range	Extended Range	Groove Depth	Groove Diameter H9	Groove Width +0.2	Radius Max	2 MPa	10 MPa	20 MPa	40 MPa
RVA0	RVC0	RVJ0	RVE0	3.0 - 9.9	3.0 - 40.0	1.45	d_N + 2.9	2.4	0.25	0.20	0.10	0.08	0.05
RVA1	RVC1	RVJ1	RVE1	10.0 - 19.9	6.0 - 200.0	2.25	d_N + 4.5	3.6	0.38	0.25	0.15	0.10	0.07
RVA2	RVC2	RVJ2	RVE2	20.0 - 39.9	10.0 - 400.0	3.10	d_N + 6.2	4.8	0.38	0.35	0.20	0.15	0.08
RVA3	RVC3	RVJ3	RVE3	40.0 - 119.9	20.0 - 700.0	4.70	d_N + 9.4	7.1	0.38	0.50	0.25	0.20	0.10
RVA4	RVC4	RVJ4	RVE4	120.0 - 999.9	35.0 - 1600.0	6.10	d_N + 12.2	9.5	0.51	0.60	0.30	0.25	0.12
RVA5	RVC5	RVJ5	RVE5	1000.0 - 2500.0	80.0 -2500.0	9.50	d_N + 19.0	15.0	0.51	0.90	0.50	0.40	0.20

Table 13: Size Series – Metric

d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.
3.0	**5.9**	**RV_0_0030**	**32.0**	**38.2**	**RV_2_0320**	**80.0**	**89.4**	**RV_3_0800**
4.0	**6.9**	**RV_0_0040**	35.0	41.2	RV_2_0350	85.0	94.4	RV_3_0850
5.0	**7.9**	**RV_0_0050**	**36.0**	**42.2**	**RV_2_0360**	**90.0**	**99.4**	**RV_3_0900**
6.0	**8.9**	**RV_0_0060**	**40.0**	**49.4**	**RV_3_0400**	95.0	104.4	RV_3_0950
8.0	**10.9**	**RV_0_0080**	42.0	51.4	RV_3_0420	**100.0**	**109.4**	**RV_3_1000**
10.0	**14.5**	**RV_1_0100**	**45.0**	**54.4**	**RV_3_0450**	105.0	114.4	RV_3_1050
12.0	**16.5**	**RV_1_0120**	48.0	57.4	RV_3_0480	**110.0**	**119.4**	**RV_3_1100**
14.0	**18.5**	**RV_1_0140**	**50.0**	**59.4**	**RV_3_0500**	115.0	124.4	RV_3_1150
15.0	**19.5**	**RV_1_0150**	52.0	61.4	RV_3_0520	120.0	132.2	RV_4_1200
16.0	**20.5**	**RV_1_0160**	55.0	64.4	RV_3_0550	**125.0**	**137.2**	**RV_4_1250**
18.0	**22.5**	**RV_1_0180**	**56.0**	**65.4**	**RV_3_0560**	130.0	142.2	RV_4_1300
20.0	**26.2**	**RV_2_0200**	60.0	69.4	RV_3_0600	135.0	147.2	RV_4_1350
22.0	**28.2**	**RV_2_0220**	**63.0**	**72.4**	**RV_3_0630**	**140.0**	**152.2**	**RV_4_1400**
25.0	**31.2**	**RV_2_0250**	65.0	74.4	RV_3_0650			
28.0	**34.2**	**RV_2_0280**	**70.0**	**79.4**	**RV_3_0700**			
30.0	36.2	RV_2_0300	75.0	84.4	RV_3_0750			

Rod diameters in **bold** type correspond to the recommendations of ISO 3320.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 14: Part Number System for Rod Variseal® – Metric

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
RVA Variseal M2 **RVC** Variseal M2S **RVE** Variseal H **RVJ** Variseal W2	**0** 1.45 **1** 2.25 **2** 3.10 **3** 4.70 **4** 6.10 **5** 9.50	**With Notches** **0**xxxx Rod dia <1000 (dia x 10.0) **X**xxxx Rod dia. >= 1000 (dia x 1.0) **No Notches** **N**xxxx Rod dia <1000 (dia x 10.0) **V**xxxx Rod dia. >= 1000 (dia x 1.0)	- Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **RVA & RVC** **M** Medium **R** High Clean **RVE** **H** Heavy **RVJ** **M** Medium

ORDERING EXAMPLE 1

R V A	3	0 0 8 0 0	-	T 4 0	S M
Design Rod Seal Variseal M2	**Cross-Section** 4.70 mm	**Size** Notched seal design Leading indicator is 0 therefore 0800 size number represents a 80.0 mm rod diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

R V E	5	V 1 2 0 0	-	T 4 0	S H
Design Rod Seal Variseal H	**Cross-Section** 9.50 mm	**Size** Not Notched seal design Leading indicator is V therefore 1200 size number represents a 1200.0 mm rod diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Heavy spring load

■ Installation Recommendations for Rod Seals – Types M2, M2S, W2 and H – Inch

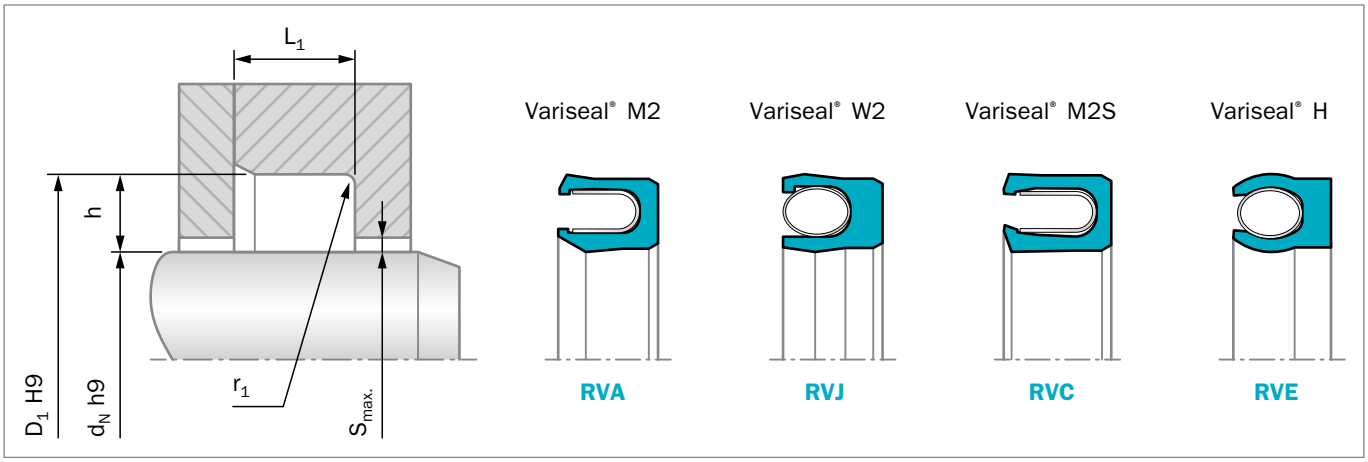


Figure 19: Installation Drawing

Table 15: Installation Dimensions – Inch

Series Number for Types				h	L_1	r_1	Radial Clearance S_{max}			
M2	M2S	W2	H	Groove Depth	Groove Width	Radius	290 psi	1,450 psi	2,900 psi	5,800 psi
					+0.010	Max				
RVAA	RVCA	RVJA	RVEA	0.062	0.094	0.010	0.008	0.004	0.003	0.002
RVAB	RVCB	RVJB	RVEB	0.093	0.141	0.015	0.010	0.006	0.004	0.003
RVAC	RVCC	RVJC	RVEC	0.125	0.188	0.015	0.014	0.008	0.006	0.003
RVAD	RVCD	RVJD	RVED	0.187	0.281	0.015	0.020	0.010	0.008	0.004
RVAE	RVCE	RVJE	RVEE	0.250	0.375	0.020	0.024	0.012	0.010	0.005
RVAG	RVCG	RVJG	RVEG	0.375	0.591	0.020	0.030	0.015	0.012	0.006

Table 16: Size Series – Inch

d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.
0.125	**0.250**	**RV_A_B006**	**0.437**	**0.625**	**RV_B_B111**	0.750	1.000	RV_C_B210
0.156	**0.281**	**RV_A_B007**	0.437	0.687	RV_C_B205	0.812	0.937	RV_A_B019
0.187	**0.312**	**RV_A_B008**	0.500	0.625	RV_A_B014	**0.812**	**1.000**	**RV_B_B117**
0.187	0.375	RV_B_B106	**0.500**	**0.687**	**RV_B_B112**	0.812	1.062	RV_C_B211
0.219	**0.343**	**RV_A_B009**	0.500	0.750	RV_C_B206	0.875	1.000	RV_A_B020
0.219	0.406	RV_B_B107	0.562	0.687	RV_A_B015	**0.875**	**1.062**	**RV_B_B118**
0.250	0.375	RV_A_B010	**0.562**	**0.750**	**RV_B_B113**	0.875	1.125	RV_C_B212
0.250	**0.437**	**RV_B_B108**	0.562	0.812	RV_C_B207	0.875	1.250	RV_D_B316
0.250	0.500	RV_C_B202	0.625	0.750	RV_A_B016	0.937	1.062	RV_A_B021
0.312	0.437	RV_A_B011	**0.625**	**0.812**	**RV_B_B114**	**0.937**	**1.125**	**RV_B_B119**
0.312	**0.500**	**RV_B_B109**	0.625	0.875	RV_C_B208	0.937	1.187	RV_C_B213
0.312	0.562	RV_C_B203	0.687	0.812	RV_A_B017	0.937	1.312	RV_D_B317
0.375	0.500	RV_A_B012	**0.687**	**0.875**	**RV_B_B115**	1.000	1.125	RV_A_B022
0.375	**0.562**	**RV_B_B110**	0.687	0.937	RV_C_B209	1.000	1.187	RV_B_B120
0.375	0.625	RV_C_B204	0.750	0.875	RV_A_B018	**1.000**	**1.250**	**RV_C_B214**
0.437	0.562	RV_A_B013	**0.750**	**0.937**	**RV_B_B116**	1.000	1.375	RV_D_B318

d_N	D_1	TSS Part No.
1.062	1.187	RV_A_B023
1.062	1.250	RV_B_B121
1.062	**1.312**	**RV_C_B215**
1.062	1.437	RV_D_B319
1.125	1.250	RV_A_B024
1.125	1.312	RV_B_B122
1.125	**1.375**	**RV_C_B216**
1.125	1.500	RV_D_B320
1.187	1.312	RV_A_B025
1.187	1.375	RV_B_B123
1.187	**1.437**	**RV_C_B217**
1.187	1.562	RV_D_B321
1.250	1.375	RV_A_B026
1.250	1.437	RV_B_B124
1.250	**1.500**	**RV_C_B218**
1.250	1.625	RV_D_B322
1.312	1.437	RV_A_B027
1.312	1.500	RV_B_B125
1.312	**1.562**	**RV_C_B219**
1.312	1.687	RV_D_B323
1.375	1.500	RV_A_B028
1.375	1.562	RV_B_B126
1.375	**1.625**	**RV_C_B220**
1.375	1.750	RV_D_B324
1.437	1.625	RV_B_B127
1.437	**1.687**	**RV_C_B221**
1.500	1.625	RV_A_B029
1.500	1.687	RV_B_B128
1.500	**1.750**	**RV_C_B222**
1.500	1.875	RV_D_B325
1.500	2.000	RV_E_B401
1.562	1.750	RV_B_B129
1.625	1.750	RV_A_B030
1.625	1.812	RV_B_B130
1.625	**1.875**	**RV_C_B223**
1.625	2.000	RV_D_B326
1.625	2.125	RV_E_B402
1.687	1.875	RV_B_B131
1.750	1.875	RV_A_B031
1.750	1.937	RV_B_B132
1.750	**2.000**	**RV_C_B224**
1.750	2.125	RV_D_B327
1.750	2.250	RV_E_B403
1.812	2.000	RV_B_B133
1.875	2.000	RV_A_B032
1.875	2.062	RV_B_B134
1.875	**2.125**	**RV_C_B225**
1.875	2.250	RV_D_B328
1.875	2.375	RV_E_B404
1.937	2.125	RV_B_B135
2.000	2.125	RV_A_B033
2.000	2.187	RV_B_B136
2.000	**2.250**	**RV_C_B226**
2.000	2.375	RV_D_B329
2.000	2.500	RV_E_B405
2.062	2.250	RV_B_B137
2.125	2.250	RV_A_B034
2.125	2.312	RV_B_B138
2.125	**2.375**	**RV_C_B227**
2.125	2.500	RV_D_B330
2.125	2.625	RV_E_B406
2.187	2.375	RV_B_B139
2.250	2.375	RV_A_B035
2.250	2.437	RV_B_B140
2.250	**2.500**	**RV_C_B228**
2.250	2.625	RV_D_B331
2.250	2.750	RV_E_B407
2.312	2.500	RV_B_B141
2.375	2.500	RV_A_B036
2.375	2.562	RV_B_B142
2.375	**2.625**	**RV_C_B229**
2.375	2.750	RV_D_B332
2.375	2.875	RV_E_B408
2.437	2.625	RV_B_B143
2.500	2.625	RV_A_B037
2.500	2.687	RV_B_B144
2.500	**2.750**	**RV_C_B230**
2.500	2.875	RV_D_B333
2.500	3.000	RV_E_B409
2.562	2.750	RV_B_B145
2.625	2.750	RV_A_B038
2.625	2.812	RV_B_B146
2.625	**2.875**	**RV_C_B231**
2.625	3.000	RV_D_B334
2.625	3.125	RV_E_B410
2.687	2.875	RV_B_B147
2.750	2.875	RV_A_B039
2.750	2.937	RV_B_B148
2.750	**3.000**	**RV_C_B232**
2.750	3.125	RV_D_B335
2.750	3.250	RV_E_B411
2.812	3.000	RV_B_B149
2.875	3.000	RV_A_B040
2.875	3.062	RV_B_B150
2.875	**3.125**	**RV_C_B233**
2.875	3.250	RV_D_B336
2.875	3.375	RV_E_B412
3.000	3.125	RV_A_B041
3.000	3.188	RV_B_B151
3.000	**3.250**	**RV_C_B234**
3.000	3.375	RV_D_B337
3.000	3.500	RV_E_B413
3.125	**3.375**	**RV_C_B235**
3.125	3.500	RV_D_B338
3.125	3.625	RV_E_B414
3.250	3.375	RV_A_B042
3.250	3.437	RV_B_B152
3.250	**3.500**	**RV_C_B236**
3.250	3.625	RV_D_B339
3.250	3.750	RV_E_B415
3.375	3.625	RV_C_B237
3.375	**3.750**	**RV_D_B340**
3.375	3.875	RV_E_B416
3.500	3.625	RV_A_B043
3.500	3.688	RV_B_B153
3.500	3.750	RV_C_B238
3.500	**3.875**	**RV_D_B341**
3.500	4.000	RV_E_B417
3.625	3.875	RV_C_B239
3.625	**4.000**	**RV_D_B342**
3.625	4.125	RV_E_B418
3.750	3.875	RV_A_B044
3.750	3.937	RV_B_B154
3.750	4.000	RV_C_B240
3.750	**4.125**	**RV_D_B343**
3.750	4.250	RV_E_B419
3.875	4.125	RV_C_B241
3.875	**4.250**	**RV_D_B344**
3.875	4.375	RV_E_B420
4.000	4.125	RV_A_B045
4.000	4.187	RV_B_B155
4.000	4.250	RV_C_B242
4.000	**4.375**	**RV_D_B345**
4.000	4.500	RV_E_B421
4.125	4.375	RV_C_B243

d_N	D_1	TSS Part No.
4.125	**4.500**	**RV_D_B346**
4.125	4.625	RV_E_B422
4.250	4.437	RV_B_B156
4.250	4.500	RV_C_B244
4.250	**4.625**	**RV_D_B347**
4.250	4.750	RV_E_B423
4.375	4.625	RV_C_B245
4.375	**4.750**	**RV_D_B348**
4.375	4.875	RV_E_B424
4.500	4.687	RV_B_B157
4.500	4.750	RV_C_B246
4.500	**4.875**	**RV_D_B349**
4.500	5.000	RV_E_B425
4.625	4.875	RV_C_B247
4.625	**5.000**	**RV_D_B350**
4.625	5.125	RV_E_B426
4.750	4.937	RV_B_B158
4.750	5.000	RV_C_B248
4.750	**5.125**	**RV_D_B351**
4.750	5.250	RV_E_B427
4.875	5.125	RV_C_B249
4.875	**5.250**	**RV_D_B352**
4.875	5.375	RV_E_B428
5.000	5.187	RV_B_B159
5.000	5.250	RV_C_B250
5.000	**5.375**	**RV_D_B353**
5.000	5.500	RV_E_B429
5.125	5.375	RV_C_B251
5.125	5.500	RV_D_B354
5.125	**5.625**	**RV_E_B430**
5.250	5.437	RV_B_B160
5.250	5.500	RV_C_B252
5.250	5.625	RV_D_B355
5.250	**5.750**	**RV_E_B431**
5.375	5.625	RV_C_B253
5.375	5.750	RV_D_B356

d_N	D_1	TSS Part No.
5.375	**5.875**	**RV_E_B432**
5.500	5.687	RV_B_B161
5.500	5.750	RV_C_B254
5.500	5.875	RV_D_B357
5.500	**6.000**	**RV_E_B433**
5.625	5.875	RV_C_B255
5.625	6.000	RV_D_B358
5.625	**6.125**	**RV_E_B434**
5.750	6.000	RV_C_B256
5.750	6.125	RV_D_B359
5.750	**6.250**	**RV_E_B435**
5.875	6.125	RV_C_B257
5.875	6.250	RV_D_B360
5.875	**6.375**	**RV_E_B436**
6.000	6.250	RV_C_B258
6.000	6.375	RV_D_B361
6.000	**6.500**	**RV_E_B437**
6.250	6.500	RV_C_B259
6.250	6.625	RV_D_B362
6.250	**6.750**	**RV_E_B438**
6.500	6.750	RV_C_B260
6.500	6.875	RV_D_B363
6.500	**7.000**	**RV_E_B439**
6.750	7.000	RV_C_B261
6.750	7.125	RV_D_B364
6.750	**7.250**	**RV_E_B440**
7.000	7.250	RV_C_B262
7.000	7.375	RV_D_B365
7.000	**7.500**	**RV_E_B441**
7.250	7.500	RV_C_B263
7.250	7.625	RV_D_B366
7.250	**7.750**	**RV_E_B442**
7.500	7.750	RV_C_B264
7.500	7.875	RV_D_B367
7.500	**8.000**	**RV_E_B443**
7.750	8.000	RV_C_B265

d_N	D_1	TSS Part No.
7.750	8.125	RV_D_B368
7.750	**8.250**	**RV_E_B444**
8.000	8.250	RV_C_B266
8.000	8.375	RV_D_B369
8.000	**8.500**	**RV_E_B445**
8.250	8.500	RV_C_B267
8.250	8.625	RV_D_B370
8.500	8.750	RV_C_B268
8.500	8.875	RV_D_B371
8.500	**9.000**	**RV_E_B446**
8.750	9.000	RV_C_B269
8.750	9.125	RV_D_B372
9.000	9.250	RV_C_B270
9.000	9.375	RV_D_B373
9.000	**9.500**	**RV_E_B447**
9.250	9.625	RV_D_B374
9.500	9.875	RV_D_B375
9.500	**10.000**	**RV_E_B448**
9.750	10.125	RV_D_B376
10.000	10.375	RV_D_B377
10.000	**10.500**	**RV_E_B449**
10.500	10.875	RV_D_B378
10.500	**11.000**	**RV_E_B450**
11.000	**11.500**	**RV_E_B451**
11.500	**12.000**	**RV_E_B452**
12.000	**12.500**	**RV_E_B453**
12.500	**13.000**	**RV_E_B454**
13.000	**13.500**	**RV_E_B455**
13.500	**14.000**	**RV_E_B456**
14.000	**14.500**	**RV_E_B457**
14.500	**15.000**	**RV_E_B458**
15.000	**15.500**	**RV_E_B459**
15.500	**16.000**	**RV_E_B460**

Figures in **bold** are preferred sizes.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 17: Part Number System for Rod Variseal® – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
RVA Variseal M2 **RVC** Variseal M2S **RVE** Variseal H **RVJ** Variseal W2	**Inch** **A** 0.062 **B** 0.093 **C** 0.125 **D** 0.187 **E** 0.250 **G** 0.375	**With Notches** **0**Bxxx Inch Dash # **S**xxxx Rod dia <10.0 Inch (dia x 1000.0) **L**xxxx Rod dia. >= 10.0 (dia x 100.0) **No Notches** **NB**xxx Inch Dash # **R**xxxx Rod dia <10.0 Inch (dia x 1000.0) **K**xxxx Rod dia. >= 10.0 (dia x 100.0)	- Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **RVA & RVC** **M** Medium **R** High Clean **RVE** **H** Heavy **RVJ** **M** Medium

ORDERING EXAMPLE 1

R V A	C	N B 2 3 0	-	T 4 0	S M
Design Rod Seal Variseal M2	**Cross-Section** 200 series (0.125 inch)	**Size** Not Notched seal design Leading indicator is NB therefore 230 is an inch dash number	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

R V J	D	R 3 4 0 0	-	T 4 0	S M
Design Rod Seal Variseal W2	**Cross-Section** 300 series (0.187 Inch)	**Size** Not Notched seal design Leading indicator is R therefore 3400 size number represents a 3.400 inch rod diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

Installation Recommendations for AS4716 Rod Seals – Types M2, M2S, W2 and H – Inch

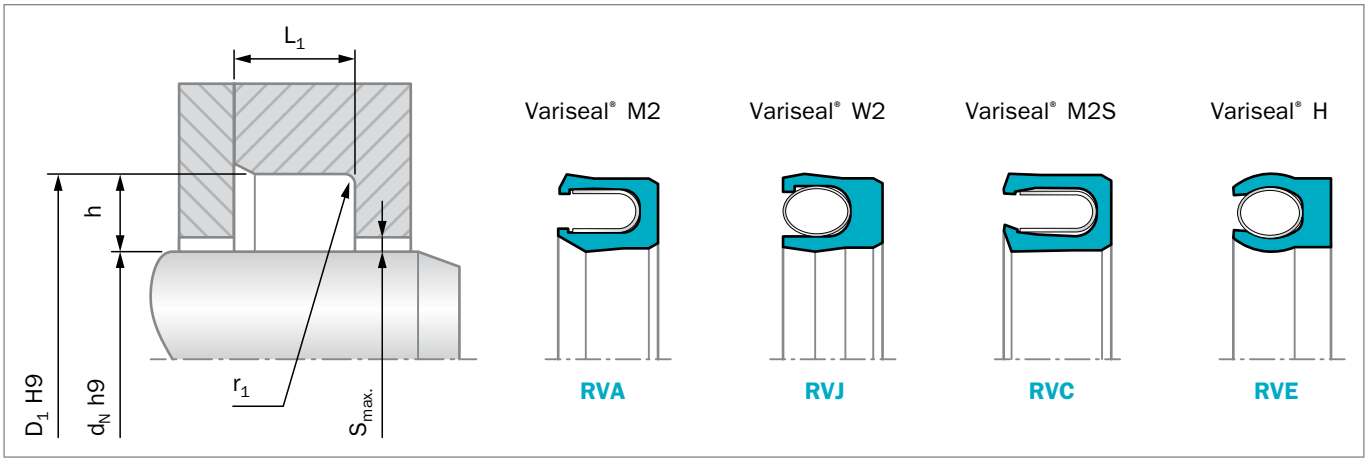


Figure 20: Installation Drawing

Table 18: Installation Dimensions AS4716 – Inch

Series Number for Types				h	L_1	r_1	Radial Clearance S_{max}			
M2	M2S	W2	H	Groove Depth	Groove Width +0.010	Radius Max	290 psi	1,450 psi	2,900 psi	5,800 psi
RVA0	RVC0	RVJ0	RVE0	0.056	0.094	0.010	0.008	0.004	0.003	0.002
RVA1	RVC1	RVJ1	RVE1	0.087	0.141	0.015	0.010	0.006	0.004	0.003
RVA2	RVC2	RVJ2	RVE2	0.122	0.188	0.015	0.014	0.008	0.006	0.003
RVA3	RVC3	RVJ3	RVE3	0.185	0.281	0.015	0.020	0.010	0.008	0.004
RVA4	RVC4	RVJ4	RVE4	0.239	0.375	0.020	0.024	0.012	0.010	0.005

AS4716 states hardware tolerances to h8/H8. However Variseals are suitable with h9/H9 tolerances.
h9/H9 tolerance dimensions can be found using the ISO Fits & Tolerances App, see page 84.

Table 19: Standard Dash Sizes AS4716 – Inch

d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.	d_N	D_1	TSS Part No.
0.123	**0.232**	**RV_0_M006**	0.498	0.608	RV_0_M014	0.873	0.983	RV_0_M020
0.154	**0.264**	**RV_0_M007**	**0.498**	**0.672**	**RV_1_M112**	**0.873**	**1.048**	**RV_1_M118**
0.185	**0.294**	**RV_0_M008**	0.560	0.670	RV_0_M015	0.873	1.115	RV_2_M212
0.185	0.359	RV_1_M106	**0.560**	**0.734**	**RV_1_M113**	0.935	1.045	RV_0_M021
0.217	**0.327**	**RV_0_M009**	0.623	0.733	RV_0_M016	0.935	**1.110**	**RV_1_M119**
0.217	0.392	RV_1_M107	**0.623**	**0.797**	**RV_1_M114**	0.935	1.177	RV_2_M213
0.248	0.359	RV_0_M010	0.685	0.795	RV_0_M017	0.998	1.108	RV_0_M022
0.248	**0.423**	**RV_1_M108**	**0.685**	**0.859**	**RV_1_M115**	0.998	1.173	RV_1_M120
0.310	0.421	RV_0_M011	0.748	0.858	RV_0_M018	**0.998**	**1.240**	**RV_2_M214**
0.310	**0.486**	**RV_1_M109**	**0.748**	**0.923**	**RV_1_M116**	1.060	1.170	RV_0_M023
0.373	0.484	RV_0_M012	0.748	0.989	RV_2_M210	1.060	1.235	RV_1_M121
0.373	**0.546**	**RV_1_M110**	**0.810**	0.920	RV_0_M019	**1.060**	**1.302**	**RV_2_M215**
0.435	0.545	RV_0_M013	0.810	**0.985**	**RV_1_M117**	1.123	1.233	RV_0_M024
0.435	**0.609**	**RV_1_M111**	0.810	1.051	RV_2_M211	1.123	1.298	RV_1_M122

d_N	D_1	TSS Part No.
1.123	**1.365**	**RV_2_M216**
1.185	1.295	RV_0_M025
1.185	1.360	RV_1_M123
1.185	**1.427**	**RV_2_M217**
1.248	1.358	RV_0_M026
1.248	1.423	RV_1_M124
1.248	**1.490**	**RV_2_M218**
1.310	1.420	RV_0_M027
1.310	1.485	RV_1_M125
1.310	**1.552**	**RV_2_M219**
1.373	1.483	RV_0_M028
1.373	1.548	RV_1_M126
1.373	**1.615**	**RV_2_M220**
1.435	1.610	RV_1_M127
1.435	1.677	RV_2_M221
1.498	1.673	RV_1_M128
1.498	**1.740**	**RV_2_M222**
1.498	1.870	RV_3_M325
1.560	1.735	RV_1_M129
1.623	1.798	RV_1_M130
1.623	**1.865**	**RV_2_M223**
1.623	1.995	RV_3_M326
1.685	1.860	RV_1_M131
1.748	1.923	RV_1_M132
1.748	**1.990**	**RV_2_M224**
1.748	2.120	RV_3_M327
1.810	1.984	RV_1_M133
1.873	2.047	RV_1_M134
1.873	**2.115**	**RV_2_M225**
1.873	2.245	RV_3_M328
1.936	2.110	RV_1_M135
1.998	2.172	RV_1_M136
1.998	**2.240**	**RV_2_M226**
1.998	2.370	RV_3_M329
2.061	2.235	RV_1_M137
2.123	2.297	RV_1_M138
2.123	**2.365**	**RV_2_M227**
2.123	2.495	RV_3_M330
2.186	2.360	RV_1_M139
2.248	2.422	RV_1_M140
2.248	**2.490**	**RV_2_M228**
2.248	2.620	RV_3_M331
2.311	2.485	RV_1_M141
2.373	2.547	RV_1_M142

d_N	D_1	TSS Part No.
2.373	**2.615**	**RV_2_M229**
2.373	2.745	RV_3_M332
2.436	2.610	RV_1_M143
2.498	2.672	RV_1_M144
2.498	**2.740**	**RV_2_M230**
2.498	2.870	RV_3_M333
2.561	2.735	RV_1_M145
2.623	2.797	RV_1_M146
2.623	**2.865**	**RV_2_M231**
2.623	2.995	RV_3_M334
2.685	2.860	RV_1_M147
2.748	2.922	RV_1_M148
2.748	**2.990**	**RV_2_M232**
2.748	3.120	RV_3_M335
2.811	2.985	RV_1_M149
2.873	**3.115**	**RV_2_M233**
2.873	3.245	RV_3_M336
2.997	**3.239**	**RV_2_M234**
2.997	3.369	RV_3_M337
3.122	**3.364**	**RV_2_M235**
3.122	3.494	RV_3_M338
3.247	**3.489**	**RV_2_M236**
3.247	3.619	RV_3_M339
3.372	3.614	RV_2_M237
3.372	**3.744**	**RV_3_M340**
3.497	3.739	RV_2_M238
3.497	**3.869**	**RV_3_M341**
3.622	3.864	RV_2_M239
3.622	**3.994**	**RV_3_M342**
3.747	3.989	RV_2_M240
3.747	**4.119**	**RV_3_M343**
3.872	4.114	RV_2_M241
3.872	**4.244**	**RV_3_M344**
3.997	4.239	RV_2_M242
3.997	**4.369**	**RV_3_M345**
4.122	4.364	RV_2_M243
4.122	**4.494**	**RV_3_M346**
4.247	4.489	RV_2_M244
4.247	**4.619**	**RV_3_M347**
4.372	4.614	RV_2_M245
4.372	**4.744**	**RV_3_M348**
4.497	4.739	RV_2_M246
4.497	**4.869**	**RV_3_M349**
4.497	4.974	RV_4_M425

d_N	D_1	TSS Part No.
4.622	**5.099**	**RV_4_M426**
4.747	**5.224**	**RV_4_M427**
4.872	**5.349**	**RV_4_M428**
4.997	**5.474**	**RV_4_M429**
5.122	**5.599**	**RV_4_M430**
5.247	**5.724**	**RV_4_M431**
5.372	**5.849**	**RV_4_M432**
5.497	**5.974**	**RV_4_M433**
5.622	**6.099**	**RV_4_M434**
5.747	**6.224**	**RV_4_M435**
5.872	**6.349**	**RV_4_M436**
5.997	**6.474**	**RV_4_M437**
6.247	**6.724**	**RV_4_M438**
6.497	**6.974**	**RV_4_M439**
6.747	**7.224**	**RV_4_M440**
6.997	**7.474**	**RV_4_M441**
7.247	**7.724**	**RV_4_M442**
7.497	**7.974**	**RV_4_M443**
7.747	**8.224**	**RV_4_M444**
7.997	**8.474**	**RV_4_M445**
8.497	**8.974**	**RV_4_M446**
8.997	**9.474**	**RV_4_M447**
9.497	**9.974**	**RV_4_M448**
9.997	**10.474**	**RV_4_M449**
10.497	**10.974**	**RV_4_M450**
10.997	**11.474**	**RV_4_M451**
11.497	**11.974**	**RV_4_M452**
11.997	**12.474**	**RV_4_M453**
12.497	**12.974**	**RV_4_M454**
12.997	**13.474**	**RV_4_M455**
13.497	**13.974**	**RV_4_M456**
13.997	**14.474**	**RV_4_M457**
14.497	**14.974**	**RV_4_M458**
14.997	**15.474**	**RV_4_M459**
15.497	**15.974**	**RV_4_M460**

Figures in **bold** are preferred sizes.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 20: Part Number System for AS4716 Rod Variseal® – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
RVA Variseal M2 **RVC** Variseal M2S **RVE** Variseal H **RVJ** Variseal W2	**AS4716** **0** 0.056 **1** 0.087 **2** 0.122 **3** 0.185 **4** 0.239	**With Notches** **OM**xxx AS4716 Dash # **S**xxxx Rod dia <10.0 Inch (dia x 1000.0) **L**xxxx Rod dia. >= 10.0 (dia x 100.0) **No Notches** **NM**xxx AS4716 Dash # **R**xxxx Rod dia <10.0 Inch (dia x 1000.0) **K**xxxx Rod dia. >= 10.0 (dia x 100.0)	- Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **RVA & RVC** **M** Medium **R** High Clean **RVE** **H** Heavy **RVJ** **M** Medium

ORDERING EXAMPLE 1

R V A	2	N M 2 3 0	A	T 4 0	S M
Design Rod Seal Variseal M2	**Cross-Section** 200 series (0.122 inch)	**Size** Not Notched seal design Leading indicator is NM therefore 230 is an inch dash number	**Class** Aerospace	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

R V J	3	R 3 4 0 0	A	T 4 0	S M
Design Rod Seal Variseal W2	**Cross-Section** 300 series (0.185 Inch)	**Size** Not Notched seal design Leading indicator is R therefore 3400 size number represents a 3.400 inch rod diameter	**Class** Aerospace	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

Installation Recommendations for Piston Seals – Types M2, M2S, W2 and H – Metric

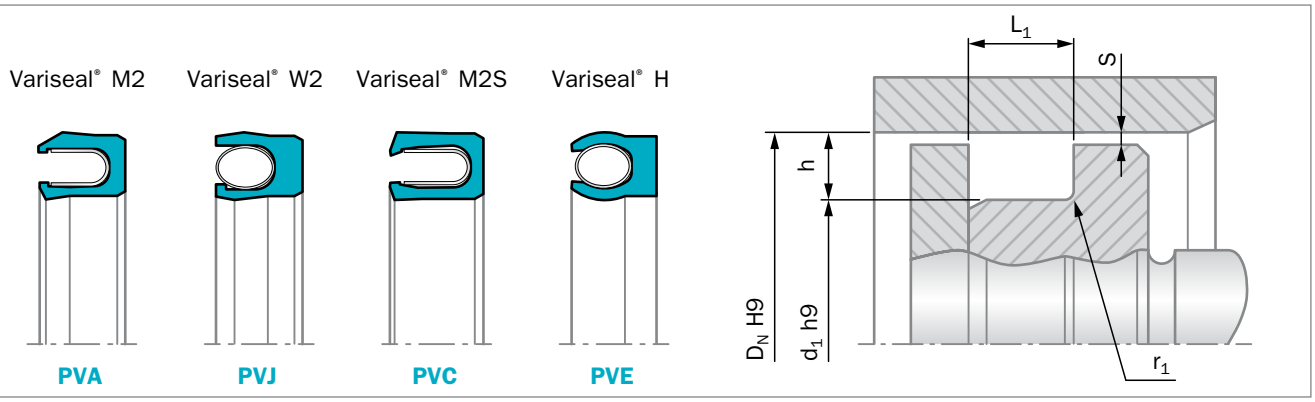


Figure 21: Installation Drawing

Table 21: Installation Dimensions – Metric

Series Number for Types				Bore Diameter D_N H9		h	d_1	L_1	r_1	Radial Clearance S_{max}			
M2	M2S	W2	H	Standard Range	Extended Range	Groove Depth	Groove Diameter h9	Groove Width +0.2	Radius Max	2 MPa	10 MPa	20 MPa	40 MPa
PVA0	PVC0	PVJ0	PVE0	6.0 - 13.9	6.0 - 40.0	1.45	D_N - 2.9	2.4	0.25	0.20	0.10	0.08	0.05
PVA1	PVC1	PVJ1	PVE1	14.0 - 24.9	10.0 - 200.0	2.25	D_N - 4.5	3.6	0.38	0.25	0.15	0.10	0.07
PVA2	PVC2	PVJ2	PVE2	25.0 - 45.9	16.0 - 400.0	3.10	D_N - 6.2	4.8	0.38	0.35	0.20	0.15	0.08
PVA3	PVC3	PVJ3	PVE3	46.0 - 124.9	28.0 - 700.0	4.70	D_N - 9.4	7.1	0.38	0.50	0.25	0.20	0.10
PVA4	PVC4	PVJ4	PVE4	125.0 - 999.9	45.0 - 1600.0	6.10	D_N - 12.2	9.5	0.51	0.60	0.30	0.25	0.12
PVA5	PVC5	PVJ5	PVE5	1000.0 - 2500.0	100.0 - 2500.0	9.50	D_N - 19.0	15.0	0.51	0.90	0.50	0.40	0.20

h9/H9 tolerance dimensions can be found using the ISO Fits & Tolerances App, see page 84.

Table 22: Size Series – Metric

D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.
6.0	3.1	PV_0_0060	48.0	38.6	PV_3_0480	**125.0**	**112.8**	**PV_4_1250**
8.0	**5.1**	**PV_0_0080**	**50.0**	**40.6**	**PV_3_0500**	130.0	117.8	PV_4_1300
10.0	**7.1**	**PV_0_0100**	52.0	42.6	PV_3_0520	135.0	122.8	PV_4_1350
12.0	**9.1**	**PV_0_0120**	55.0	45.6	PV_3_0550	140.0	127.8	PV_4_1400
14.0	9.5	PV_1_0140	60.0	50.6	PV_3_0600	150.0	137.8	PV_4_1500
15.0	10.5	PV_1_0150	**63.0**	**53.6**	**PV_3_0630**	**160.0**	**147.8**	**PV_4_1600**
16.0	**11.5**	**PV_1_0160**	65.0	55.6	PV_3_0650	170.0	157.8	PV_4_1700
18.0	13.5	PV_1_0180	70.0	60.6	PV_3_0700	180.0	167.8	PV_4_1800
20.0	**15.5**	**PV_1_0200**	75.0	65.6	PV_3_0750	190.0	177.8	PV_4_1900
22.0	17.5	PV_1_0220	**80.0**	**70.6**	**PV_3_0800**	**200.0**	**187.8**	**PV_4_2000**
25.0	**18.8**	**PV_2_0250**	85.0	75.6	PV_3_0850	210.0	97.8	PV_4_2100
28.0	21.8	PV_2_0280	90.0	80.6	PV_3_0900	220.0	207.8	PV_4_2200
30.0	23.8	PV_2_0300	95.0	85.6	PV_3_0950	230.0	217.8	PV_4_2300
32.0	**25.8**	**PV_2_0320**	**100.0**	**90.6**	**PV_3_1000**	240.0	227.8	PV_4_2400
35.0	28.8	PV_2_0350	105.0	95.6	PV_3_1050	**250.0**	**237.8**	**PV_4_2500**
40.0	**33.8**	**PV_2_0400**	110.0	100.6	PV_3_1100			
42.0	35.8	PV_2_0420	115.0	105.6	PV_3_1150			
45.0	38.8	PV_2_0450	120.0	110.6	PV_3_1200			

Rod diameters in **bold** type correspond to the recommendations of ISO 3320.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 23: Part Number System for Piston Variseal® – Metric

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
PVA Variseal M2 **PVC** Variseal M2S **PVE** Variseal H **PVJ** Variseal W2	**0** 1.45 **1** 2.25 **2** 3.10 **3** 4.70 **4** 6.10 **5** 9.50	**With Notches** **0**xxxx Bore dia <1000 (dia x 10.0) **X**xxxx Bore dia. >= 1000 (dia x 1.0) **No Notches** **N**xxxx Bore dia <1000 (dia x 10.0) **V**xxxx Bore dia. >= 1000 (dia x 1.0)	**-** Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **PVA & PVC** **M** Medium **R** High Clean **PVE** **H** Heavy **PVJ** **M** Medium

ORDERING EXAMPLE 1

P V A	3	0 0 8 0 0	-	T 4 0	S M
Design Piston Seal Variseal M2	**Cross-Section** 4.70 mm	**Size** Notched seal design Leading indicator is 0 therefore 0800 size number represents a 80.0 mm bore diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

P V E	5	V 1 2 0 0	-	T 4 0	S H
Design Piston Seal Variseal H	**Cross-Section** 9.50 mm	**Size** Not Notched seal design Leading indicator is V therefore 1200 size number represents a 1200.0 inch bore diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Heavy spring load

Installation Recommendation for Piston Seals – Types M2, M2S, W2 and H – Inch

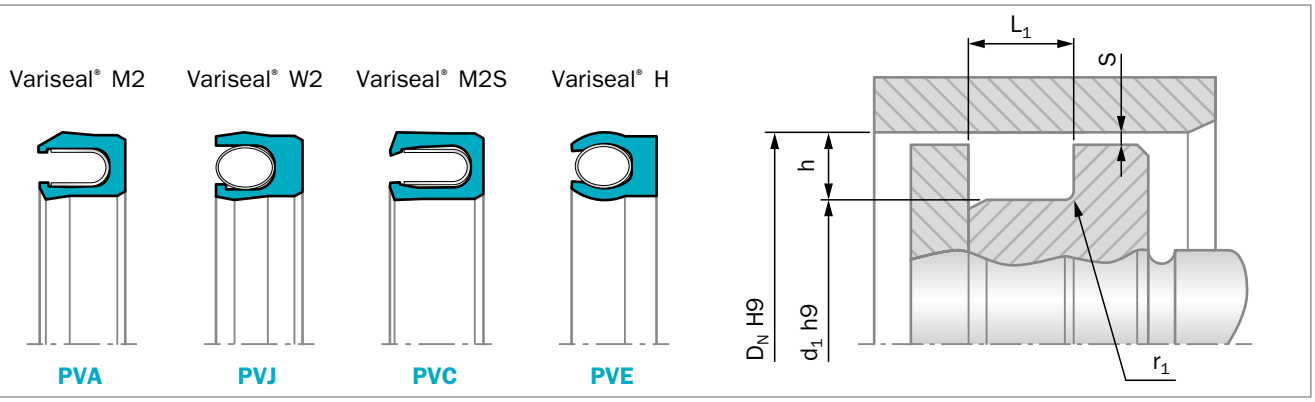


Figure 22: Installation Drawing

Table 24: Installation Dimensions – Inch

Series Number for Types				h	L_1	r_1	Radial Clearance S_{max}			
M2	M2S	W2	H	Groove Depth	Groove Width +0.010	Radius Max	290 psi	1,450 psi	2,900 psi	5,800 psi
PVAA	PVCA	PVJA	PVEA	0.062	0.094	0.010	0.008	0.004	0.003	0.002
PVAB	PVCB	PVJB	PVEB	0.093	0.141	0.015	0.010	0.006	0.004	0.003
PVAC	PVCC	PVJC	PVEC	0.125	0.188	0.015	0.014	0.008	0.006	0.003
PVAD	PVCD	PVJD	PVED	0.187	0.281	0.015	0.020	0.010	0.008	0.004
PVAE	PVCE	PVJE	PVEE	0.250	0.375	0.020	0.024	0.012	0.010	0.005
PVAG	PVAG	PVJG	PVEG	0.375	0.591	0.020	0.030	0.015	0.012	0.006

h9/H9 tolerance dimensions can be found using the ISO Fits & Tolerances App, see page 84.

Table 25: Standard Dash Sizes – Inch

D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.
0.250	**0.125**	**PV_A_B006**	**0.625**	**0.437**	**PV_B_B111**	0.937	0.687	PV_C_B209
0.281	**0.156**	**PV_A_B007**	0.625	0.375	PV_C_B204	1.000	0.875	PV_A_B020
0.312	**0.187**	**PV_A_B008**	0.687	0.562	PV_A_B015	**1.000**	**0.812**	**PV_B_B117**
0.343	**0.218**	**PV_A_B009**	**0.687**	**0.500**	**PV_B_B112**	1.000	0.750	PV_C_B210
0.375	**0.250**	**PV_A_B010**	0.687	0.437	PV_C_B205	1.062	0.937	PV_A_B021
0.375	0.187	PV_B_B106	0.750	0.625	PV_A_B016	**1.062**	**0.875**	**PV_B_B118**
0.406	**0.219**	**PV_B_B107**	**0.750**	**0.562**	**PV_B_B113**	1.062	0.812	PV_C_B211
0.437	0.312	PV_A_B011	0.750	0.500	PV_C_B206	1.125	1.000	PV_A_B022
0.437	**0.250**	**PV_B_B108**	0.812	0.687	PV_A_B017	**1.125**	**0.937**	**PV_B_B119**
0.500	0.375	PV_A_B012	**0.812**	**0.625**	**PV_B_B114**	1.125	0.875	PV_C_B212
0.500	**0.312**	**PV_B_B109**	0.812	0.562	PV_C_B207	1.187	1.062	PV_A_B023
0.500	0.250	PV_C_B202	0.875	0.750	PV_A_B018	**1.187**	**1.000**	**PV_B_B120**
0.562	0.437	PV_A_B013	**0.875**	**0.687**	**PV_B_B115**	1.187	0.937	PV_C_B213
0.562	**0.375**	**PV_B_B110**	0.875	0.625	PV_C_B208	1.250	1.125	PV_A_B024
0.562	0.312	PV_C_B203	0.937	0.812	PV_A_B019	1.250	1.062	PV_B_B121
0.625	0.500	PV_A_B014	**0.937**	**0.750**	**PV_B_B116**	**1.250**	**1.000**	**PV_C_B214**

D_N	d_1	TSS Part No.
1.250	0.875	PV_D_B316
1.312	1.187	PV_A_B025
1.312	1.125	PV_B_B122
1.312	**1.062**	**PV_C_B215**
1.312	0.937	PV_D_B317
1.375	1.250	PV_A_B026
1.375	1.187	PV_B_B123
1.375	**1.125**	**PV_C_B216**
1.375	1.000	PV_D_B318
1.437	1.312	PV_A_B027
1.437	1.250	PV_B_B124
1.437	**1.187**	**PV_C_B217**
1.437	1.062	PV_D_B319
1.500	1.375	PV_A_B028
1.500	1.312	PV_B_B125
1.500	**1.250**	**PV_C_B218**
1.500	1.125	PV_D_B320
1.562	1.375	PV_B_B126
1.562	**1.312**	**PV_C_B219**
1.562	1.187	PV_D_B321
1.625	1.500	PV_A_B029
1.625	1.437	PV_B_B127
1.625	**1.375**	**PV_C_B220**
1.625	1.250	PV_D_B322
1.687	1.500	PV_B_B128
1.687	**1.437**	**PV_C_B221**
1.687	1.312	PV_D_B323
1.750	1.625	PV_A_B030
1.750	1.562	PV_B_B129
1.750	**1.500**	**PV_C_B222**
1.750	1.375	PV_D_B324
1.812	1.625	PV_B_B130
1.875	1.750	PV_A_B031
1.875	1.687	PV_B_B131
1.875	**1.625**	**PV_C_B223**
1.875	1.500	PV_D_B325
1.937	1.750	PV_B_B132
2.000	1.875	PV_A_B032
2.000	1.812	PV_B_B133
2.000	**1.750**	**PV_C_B224**
2.000	1.625	PV_D_B326
2.000	1.500	PV_E_B401
2.062	1.875	PV_B_B134
2.125	2.000	PV_A_B033
2.125	1.937	PV_B_B135
2.125	**1.875**	**PV_C_B225**
2.125	1.750	PV_D_B327
2.125	1.625	PV_E_B402
2.187	2.000	PV_B_B136
2.250	2.125	PV_A_B034
2.250	2.062	PV_B_B137
2.250	**2.000**	**PV_C_B226**
2.250	1.875	PV_D_B328
2.250	1.750	PV_E_B403
2.312	2.125	PV_B_B138
2.375	2.250	PV_A_B035
2.375	2.187	PV_B_B139
2.375	**2.125**	**PV_C_B227**
2.375	2.000	PV_D_B329
2.375	1.875	PV_E_B404
2.437	2.250	PV_B_B140
2.500	2.375	PV_A_B036
2.500	2.312	PV_B_B141
2.500	**2.250**	**PV_C_B228**
2.500	2.125	PV_D_B330
2.500	2.000	PV_E_B405
2.562	2.375	PV_B_B142
2.625	2.500	PV_A_B037
2.625	2.437	PV_B_B143
2.625	**2.375**	**PV_C_B229**
2.625	2.250	PV_D_B331
2.625	2.125	PV_E_B406
2.687	2.500	PV_B_B144
2.750	2.625	PV_A_B038
2.750	2.562	PV_B_B145
2.750	**2.500**	**PV_C_B230**
2.750	2.375	PV_D_B332
2.750	2.250	PV_E_B407
2.812	2.625	PV_B_B146
2.875	2.750	PV_A_B039
2.875	2.687	PV_B_B147
2.875	**2.625**	**PV_C_B231**
2.875	2.500	PV_D_B333
2.875	2.375	PV_E_B408
2.937	2.750	PV_B_B148
3.000	2.875	PV_A_B040
3.000	2.812	PV_B_B149
3.000	**2.750**	**PV_C_B232**
3.000	2.625	PV_D_B334
3.000	2.500	PV_E_B409
3.062	2.875	PV_B_B150
3.125	3.000	PV_A_B041
3.125	**2.875**	**PV_C_B233**
3.125	2.750	PV_D_B335
3.125	2.625	PV_E_B410
3.188	3.000	PV_B_B151
3.250	**3.000**	**PV_C_B234**
3.250	2.875	PV_D_B336
3.250	2.750	PV_E_B411
3.375	3.250	PV_A_B042
3.375	**3.125**	**PV_C_B235**
3.375	3.000	PV_D_B337
3.375	2.875	PV_E_B412
3.437	3.250	PV_B_B152
3.500	**3.250**	**PV_C_B236**
3.500	3.125	PV_D_B338
3.500	3.000	PV_E_B413
3.625	3.500	PV_A_B043
3.625	**3.375**	**PV_C_B237**
3.625	3.250	PV_D_B339
3.625	3.125	PV_E_B414
3.688	3.500	PV_B_B153
3.750	3.500	PV_C_B238
3.750	**3.375**	**PV_D_B340**
3.750	3.250	PV_E_B415
3.875	3.750	PV_A_B044
3.875	3.625	PV_C_B239
3.875	**3.500**	**PV_D_B341**
3.875	3.375	PV_E_B416
3.937	3.750	PV_B_B154
4.000	3.750	PV_C_B240
4.000	**3.625**	**PV_D_B342**
4.000	3.500	PV_E_B417
4.125	4.000	PV_A_B045
4.125	3.875	PV_C_B241
4.125	**3.750**	**PV_D_B343**
4.125	3.625	PV_E_B418
4.187	4.000	PV_B_B155
4.250	4.000	PV_C_B242
4.250	**3.875**	**PV_D_B344**
4.250	3.750	PV_E_B419
4.375	4.125	PV_C_B243
4.375	**4.000**	**PV_D_B345**
4.375	3.875	PV_E_B420
4.437	4.250	PV_B_B156

D_N	d_1	TSS Part No.
4.500	4.250	PV_C_B244
4.500	**4.125**	**PV_D_B346**
4.500	4.000	PV_E_B421
4.625	4.375	PV_C_B245
4.625	**4.250**	**PV_D_B347**
4.625	4.125	PV_E_B422
4.687	4.500	PV_B_B157
4.750	4.500	PV_C_B246
4.750	**4.375**	**PV_D_B348**
4.750	4.250	PV_E_B423
4.875	4.625	PV_C_B247
4.875	**4.500**	**PV_D_B349**
4.875	4.375	PV_E_B424
4.937	4.750	PV_B_B158
5.000	4.750	PV_C_B248
5.000	**4.625**	**PV_D_B350**
5.000	4.500	PV_E_B425
5.125	4.875	PV_C_B249
5.125	**4.750**	**PV_D_B351**
5.125	4.625	PV_E_B426
5.187	5.000	PV_B_B159
5.250	5.000	PV_C_B250
5.250	**4.875**	**PV_D_B352**
5.250	4.750	PV_E_B427
5.375	5.125	PV_C_B251
5.375	**5.000**	**PV_D_B353**
5.375	4.875	PV_E_B428
5.437	5.250	PV_B_B160
5.500	5.250	PV_C_B252
5.500	5.125	PV_D_B354
5.500	**5.000**	**PV_E_B429**
5.625	5.375	PV_C_B253
5.625	5.250	PV_D_B355
5.625	**5.125**	**PV_E_B430**
5.687	5.500	PV_B_B161
5.750	5.500	PV_C_B254
5.750	5.375	PV_D_B356
5.750	**5.250**	**PV_E_B431**
5.875	5.625	PV_C_B255
5.875	5.500	PV_D_B357
5.875	**5.375**	**PV_E_B432**
6.000	5.750	PV_C_B256
6.000	5.625	PV_D_B358
6.000	**5.500**	**PV_E_B433**
6.125	5.875	PV_C_B257
6.125	5.750	PV_D_B359
6.125	**5.625**	**PV_E_B434**
6.250	6.000	PV_C_B258
6.250	5.875	PV_D_B360
6.250	**5.750**	**PV_E_B435**
6.375	6.000	PV_D_B361
6.375	**5.875**	**PV_E_B436**
6.500	6.250	PV_C_B259
6.500	**6.000**	**PV_E_B437**
6.625	6.250	PV_D_B362
6.750	6.500	PV_C_B260
6.750	**6.250**	**PV_E_B438**
6.875	6.500	PV_D_B363
7.000	6.750	PV_C_B261
7.000	**6.500**	**PV_E_B439**
7.125	6.750	PV_D_B364
7.250	7.000	PV_C_B262
7.250	**6.750**	**PV_E_B440**
7.375	7.000	PV_D_B365
7.500	7.250	PV_C_B263
7.500	**7.000**	**PV_E_B441**
7.625	7.250	PV_D_B366
7.750	7.500	PV_C_B264
7.750	**7.250**	**PV_E_B442**
7.875	7.500	PV_D_B367
8.000	7.750	PV_C_B265
8.000	**7.500**	**PV_E_B443**
8.125	7.750	PV_D_B368
8.250	8.000	PV_C_B266
8.250	**7.750**	**PV_E_B444**
8.375	8.000	PV_D_B369
8.500	8.250	PV_C_B267
8.500	**8.000**	**PV_E_B445**
8.625	8.250	PV_D_B370
8.750	8.500	PV_C_B268
8.875	8.500	PV_D_B371
9.000	8.750	PV_C_B269
9.000	**8.500**	**PV_E_B446**
9.125	8.750	PV_D_B372
9.250	9.000	PV_C_B270
9.375	9.000	PV_D_B373
9.500	**9.000**	**PV_E_B447**
9.625	9.250	PV_D_B374
9.875	9.500	PV_D_B375
10.000	**9.500**	**PV_E_B448**
10.125	9.750	PV_D_B376
10.375	10.000	PV_D_B377
10.500	**10.000**	**PV_E_B449**
10.875	10.500	PV_D_B378
11.000	**10.500**	**PV_E_B450**
11.500	**11.000**	**PV_E_B451**
12.000	**11.500**	**PV_E_B452**
12.500	**12.000**	**PV_E_B453**
13.000	**12.500**	**PV_E_B454**
13.500	**13.000**	**PV_E_B455**
14.000	**13.500**	**PV_E_B456**
14.500	**14.000**	**PV_E_B457**
15.000	**14.500**	**PV_E_B458**
15.500	**15.000**	**PV_E_B459**
16.000	**15.500**	**PV_E_B460**

For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 26: Part Number System for Piston Variseal® – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
PVA Variseal M2	**Inch**	**With Notches**	- Industrial	**T01**	**S** Stainless Steel	**Standard load for each design**
PVC Variseal M2S	**A** 0.062	**0B**xxx Inch Dash #	**A** Aerospace	**MF1**	**H** Hastelloy	
PVE Variseal H	**B** 0.093	**S**xxxx Bore dia <10.0 Inch (dia x 1000.0)		**MF4**	**E** Elgiloy	**PVA & PVC**
PVJ Variseal W2	**C** 0.125	**L**xxxx Bore dia. >= 10.0 (dia x 100.0)		**MF6**		**M** Medium
	D 0.187			**T05**		**R** High Clean
	E 0.250	**No Notches**		**T07** See page 7		**PVE**
	G 0.375	**NB**xxx Inch Dash #		**T12** for material		**H** Heavy
		Rxxxx Bore dia <10.0 Inch (dia x 1000.0)		**T24** description		**PVJ**
		Kxxxx Bore dia. >= 10.0 (dia x 100.0)		**T40**		**M** Medium
				M79		
				Z48		
				Z80		

ORDERING EXAMPLE 1

P V A	C	N B 2 3 0	-	T 4 0	S M
Design Piston Seal Variseal M2	**Cross-Section** 200 series (0.125 inch)	**Size** Not Notched seal design Leading indicator is NB therefore 230 is an inch dash number	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

P V J	D	R 3 4 0 0	-	T 4 0	S M
Design Piston Seal Variseal W2	**Cross-Section** 300 series (0.187 inch)	**Size** Not Notched seal design Leading indicator is R therefore 3400 size number represents a 3.400 inch bore diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

Installation Recommendations for AS4716 Piston Seals – Types M2, M2S, W2 and H – Inch

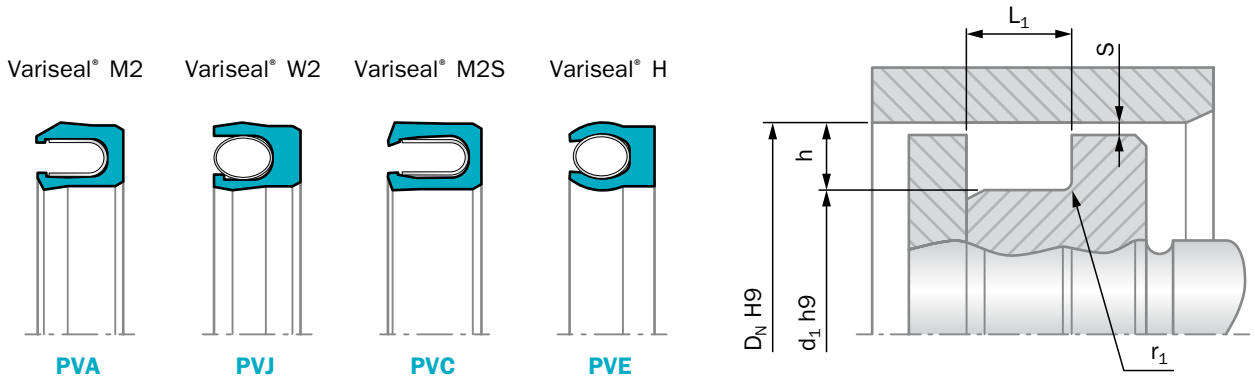


Figure 23: Installation Drawing

Table 27: Installation Dimensions AS4716 – Inch

Series Number for Types				h	L1	r1	Radial Clearance Smax			
M2	M2S	W2	H	Groove Depth	Groove Width	Radius	290 psi	1,450 psi	2,900 psi	5,800 psi
					+0.010	Max				
PVA0	PVC0	PVJ0	PVE0	0.056	0.094	0.010	0.008	0.004	0.003	0.002
PVA1	PVC1	PVJ1	PVE1	0.087	0.141	0.015	0.010	0.006	0.004	0.003
PVA2	PVC2	PVJ2	PVE2	0.122	0.188	0.015	0.014	0.008	0.006	0.003
PVA3	PVC3	PVJ3	PVE3	0.185	0.281	0.015	0.020	0.010	0.008	0.004
PVA4	PVC4	PVJ4	PVE4	0.239	0.375	0.020	0.024	0.012	0.010	0.005

AS4716 states hardware tolerances to h8/H8. However Variseals are suitable with h9/H9 tolerances.
h9/H9 tolerances can be found using the ISO Fits & Tolerances App, see page 84.

Table 28: Standard Dash Sizes AS4716 – Inch

D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.	D_N	d_1	TSS Part No.
0.235	**0.123**	**PV_0_M006**	0.613	0.504	PV_0_M014	**0.991**	**0.817**	**PV_1_M117**
0.266	**0.154**	**PV_0_M007**	**0.613**	**0.441**	**PV_1_M111**	0.991	0.750	PV_2_M210
0.297	**0.189**	**PV_0_M008**	0.675	0.566	PV_0_M015	1.053	0.943	PV_0_M021
0.329	**0.220**	**PV_0_M009**	**0.675**	**0.502**	**PV_1_M112**	**1.053**	**0.879**	**PV_1_M118**
0.360	0.250	PV_0_M010	0.738	0.629	PV_0_M016	1.053	0.812	PV_2_M211
0.360	0.187	PV_1_M106	**0.800**	**0.565**	**PV_1_M113**	1.116	1.006	PV_0_M022
0.391	0.225	PV_1_M107	0.800	0.691	PV_0_M017	**1.116**	**0.942**	**PV_1_M119**
0.422	0.312	PV_0_M011	**0.800**	**0.627**	**PV_1_M114**	1.116	0.874	PV_2_M212
0.422	**0.256**	**PV_1_M108**	0.863	0.753	PV_0_M018	1.178	1.068	PV_0_M023
0.485	0.375	PV_0_M012	**0.863**	**0.689**	**PV_1_M115**	1.178	1.003	PV_1_M120
0.485	**0.308**	**PV_1_M109**	0.925	0.815	PV_0_M019	1.178	0.936	PV_2_M213
0.550	0.441	PV_0_M013	**0.925**	**0.751**	**PV_1_M116**	1.241	1.131	PV_0_M024
0.550	**0.379**	**PV_1_M110**	0.991	0.881	PV_0_M020	1.241	1.066	PV_1_M121

D_N	d_1	TSS Part No.
1.241	**0.999**	**PV_2_M214**
1.303	1.193	PV_0_M025
1.303	1.128	PV_1_M122
1.303	**1.061**	**PV_2_M215**
1.366	1.256	PV_0_M026
1.366	1.191	PV_1_M123
1.366	**1.124**	**PV_2_M216**
1.428	1.318	PV_0_M027
1.428	1.253	PV_1_M124
1.428	**1.186**	**PV_2_M217**
1.491	1.381	PV_0_M028
1.491	1.316	PV_1_M125
1.491	**1.249**	**PV_2_M218**
1.553	1.378	PV_1_M126
1.553	**1.311**	**PV_2_M219**
1.616	1.441	PV_1_M127
1.616	**1.374**	**PV_2_M220**
1.678	1.503	PV_1_M128
1.678	**1.436**	**PV_2_M221**
1.741	1.566	PV_1_M129
1.741	**1.499**	**PV_2_M222**
1.805	1.631	PV_1_M130
1.867	1.693	PV_1_M131
1.867	**1.625**	**PV_2_M223**
1.867	1.495	PV_3_M325
1.930	1.756	PV_1_M132
1.992	1.818	PV_1_M133
1.992	**1.750**	**PV_2_M224**
1.992	1.620	PV_3_M326
2.055	1.881	PV_1_M134
2.118	1.944	PV_1_M135
2.180	**1.876**	**PV_2_M225**
2.180	1.746	PV_3_M327
2.180	2.006	PV_1_M136
2.243	2.069	PV_1_M137
2.243	**2.001**	**PV_2_M226**
2.243	1.871	PV_3_M328
2.305	2.131	PV_1_M138
2.368	2.194	PV_1_M139
2.368	**2.126**	**PV_2_M227**
2.368	1.996	PV_3_M329
2.430	2.256	PV_1_M140
2.493	2.319	PV_1_M141
2.493	**2.251**	**PV_2_M228**
2.493	2.121	PV_3_M330
2.555	2.381	PV_1_M142
2.618	2.444	PV_1_M143
2.618	**2.376**	**PV_2_M229**
2.618	2.246	PV_3_M331
2.680	2.506	PV_1_M144
2.743	2.569	PV_1_M145
2.743	**2.501**	**PV_2_M230**
2.743	2.371	PV_3_M332
2.805	2.631	PV_1_M146
2.867	2.693	PV_1_M147
2.867	**2.626**	**PV_2_M231**
2.867	2.496	PV_3_M333
2.930	2.756	PV_1_M148
2.993	2.819	PV_1_M149
2.993	**2.751**	**PV_2_M232**
2.993	2.621	PV_3_M334
3.118	**2.876**	**PV_2_M233**
3.118	2.746	PV_3_M335
3.243	**3.001**	**PV_2_M234**
3.243	2.871	PV_3_M336
3.368	**3.126**	**PV_2_M235**
3.368	2.996	PV_3_M337
3.493	**3.251**	**PV_2_M236**
3.493	3.121	PV_3_M338
3.618	3.376	PV_2_M237
3.618	3.246	PV_3_M339
3.743	3.501	PV_2_M238
3.743	**3.371**	**PV_3_M340**
3.868	3.626	PV_2_M239
3.868	**3.496**	**PV_3_M341**
3.993	3.751	PV_2_M240
3.993	**3.621**	**PV_3_M342**
4.118	3.876	PV_2_M241
4.118	**3.746**	**PV_3_M343**
4.243	4.001	PV_2_M242
4.243	**3.871**	**PV_3_M344**
4.368	4.126	PV_2_M243
4.368	**3.996**	**PV_3_M345**
4.493	4.251	PV_2_M244
4.493	**4.121**	**PV_3_M346**
4.618	4.376	PV_2_M245
4.618	**4.246**	**PV_3_M347**
4.743	4.501	PV_2_M246
4.743	**4.371**	**PV_3_M348**
4.868	**4.496**	**PV_3_M349**
4.974	4.497	PV_4_M425
5.099	**4.622**	**PV_4_M426**
5.224	**4.747**	**PV_4_M427**
5.349	**4.872**	**PV_4_M428**
5.474	**4.997**	**PV_4_M429**
5.599	**5.122**	**PV_4_M430**
5.724	**5.247**	**PV_4_M431**
5.849	**5.372**	**PV_4_M432**
5.974	**5.497**	**PV_4_M433**
6.099	**5.622**	**PV_4_M434**
6.224	**5.747**	**PV_4_M435**
6.349	**5.872**	**PV_4_M436**
6.474	**5.997**	**PV_4_M437**
6.724	**6.247**	**PV_4_M438**
6.974	**6.497**	**PV_4_M439**
7.224	**6.747**	**PV_4_M440**
7.474	**6.997**	**PV_4_M441**
7.724	**7.247**	**PV_4_M442**
7.974	**7.497**	**PV_4_M443**
8.224	**7.747**	**PV_4_M444**
8.474	**7.997**	**PV_4_M445**
8.974	**8.497**	**PV_4_M446**
9.474	**8.997**	**PV_4_M447**
9.974	**9.497**	**PV_4_M448**
10.474	**9.997**	**PV_4_M449**
10.974	**10.497**	**PV_4_M450**
11.474	**10.997**	**PV_4_M451**
11.974	**11.497**	**PV_4_M452**
12.474	**11.997**	**PV_4_M453**
12.974	**12.497**	**PV_4_M454**
13.474	**12.997**	**PV_4_M455**
13.974	**13.497**	**PV_4_M456**
14.474	**13.997**	**PV_4_M457**
14.974	**14.497**	**PV_4_M458**
15.474	**14.997**	**PV_4_M459**
15.974	**15.497**	**PV_4_M460**

Figures in **bold** are preferred sizes.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 29: Part Number System for Piston Variseal® – Inch / AS4716

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
PVA Variseal M2 **PVC** Variseal M2S **PVE** Variseal H **PVJ** Variseal W2	**AS4716** **0** 0.056 **1** 0.087 **2** 0.122 **3** 0.185 **4** 0.239	**With Notches** **0M**xxx AS4716 Dash # **S**xxxx Bore dia <10.0 Inch (dia x 1000.0) **L**xxxx Bore dia. >= 10.0 (dia x 100.0) **No Notches** **NM**xxx AS4716 Dash # **R**xxxx Bore dia <10.0 Inch (dia x 1000.0) **K**xxxx Bore dia. >= 10.0 (dia x 100.0)	- Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **PVA & PVC** **M** Medium **R** High Clean **PVE** **H** Heavy **PVJ** **M** Medium

ORDERING EXAMPLE 1

P V A	2	N M 2 3 0	A	T 4 0	S M
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Piston Seal Variseal M2	200 series (0.122 inch)	Not Notched seal design Leading indicator is NM therefore 230 is an inch dash number	Aerospace	T40	Stainless steel Medium spring load

ORDERING EXAMPLE 2

P V J	3	R 3 4 0 0	A	T 4 0	S M
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Piston Seal Variseal W2	300 series (0.185 inch)	Not Notched seal design Leading indicator is R therefore 3400 size number represents a 3.400 inch bore diameter	Aerospace	T40	Stainless steel Medium spring load

■ Turcon® Variseal® HF

DESCRIPTION

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

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

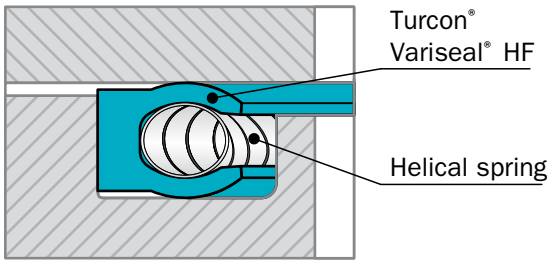


Figure 24: Turcon® Variseal® HF

AREAS OF APPLICATION

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

TECHNICAL DATA

Operating pressure:	Maximum static load: 60 MPa / 8,702 psi Maximum dynamic load: 20 MPa / 2,900 psi (207 MPa / 30,000 psi with Back-up Ring)
Speed:	Static to slow rotating or pivoting movements
Operating temperature:	-150 °C to +200 °C / -238 °F to +392 °F
Media compatibility:	Virtually all fluids, chemicals compatibility: and gases

IMPORTANT NOTE

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

■ Installation Recommendations for Internal Face Seals – Type HF – Metric

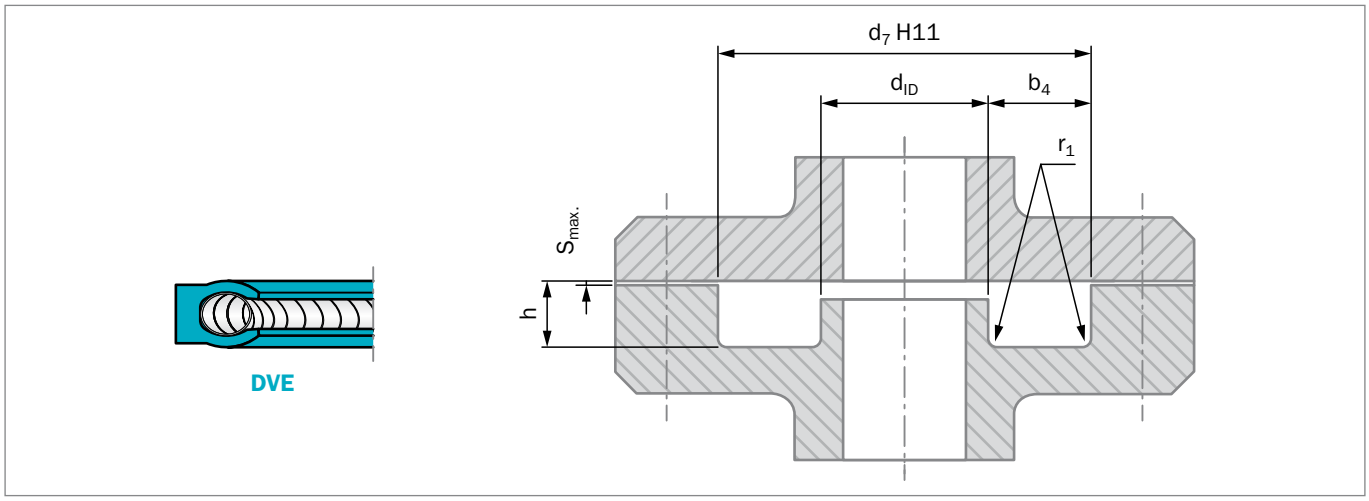


Figure 25: Installation Drawing

Table 30: Installation Dimensions – Metric

Series No.	Groove Outside Diameter d_7 H11		h		b_4	r_1	Axial Clearance S_{max}			
			Groove Depth		Groove Width	Radius	2 MPa	10 MPa	20 MPa	40 MPa
	Standard Range	Extended Range[1)]			Min	Max				
DVE0	10.0 - 13.9	10.0 - 40.0	1.45	+0.03	2.40	0.25	0.20	0.10	0.08	0.05
DVE1	14 .0 - 24.9	13.0 - 200.0	2.25	+0.05	3.60	0.38	0.25	0.15	0.10	0.07
DVE2	25.0 - 45.9	18.0 - 400.0	3.10	+0.08	4.80	0.38	0.35	0.20	0.15	0.08
DVE3	46 .0 - 124.9	28.0 - 700.0*	4.70	+0.10	7.10*	0.38	0.50	0.25	0.20	0.10
DVE4	125.0 - 999.9**	45.0 - 1000.0**	6.10	+0.15	9.50**	0.51	0.60	0.30	0.25	0.12
DVE5	1000.0 - 2500.0***	110.0 - 2500.0***	9.50	+0.20	15.00***	0.51	0.90	0.50	0.40	0.20

* For diameters above 700 mm b4 min. = 8.0 mm
** For diameters above 700 mm b4 min. = 11.0 mm
*** For diameters above 1000 mm b4 min. = 18.0 mm

1) Available on request
H11 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 31: Size Series – Metric

d_7	$d_{ID\ max}$	TSS Part No.	d_7	$d_{ID\ max}$	TSS Part No.	d_7	$d_{ID\ max}$	TSS Part No.
10.0	5.2	DVE000100	45.0	35.4	DVE200450	105.0	90.8	DVE301050
12.0	7.2	DVE000120	48.0	33.8	DVE300480	110.0	95.8	DVE301100
14.0	6.8	DVE100140	50.0	35.8	DVE300500	115.0	100.8	DVE301150
15.0	7.8	DVE100150	52.0	37.8	DVE300520	120.0	105.8	DVE301200
16.0	8.8	DVE100160	55.0	40.8	DVE300550	122.0	107.8	DVE301220
18.0	10.8	DVE100180	56.0	41.8	DVE300560	125.0	106.0	DVE401250
20.0	12.8	DVE100200	60.0	45.8	DVE300600	130.0	111.0	DVE401300
22.0	14.8	DVE100220	63.0	48.8	DVE300630	135.0	116.0	DVE401350
25.0	15.4	DVE200250	65.0	50.8	DVE300650	140.0	121.0	DVE401400
28.0	18.4	DVE200280	70.0	55.8	DVE300700	150.0	131.0	DVE401500
30.0	20.4	DVE200300	75.0	60.8	DVE300750	160.0	141.0	DVE401600
32.0	22.4	DVE200320	80.0	65.8	DVE300800	170.0	151.0	DVE401700
35.0	25.4	DVE200350	85.0	70.8	DVE300850	180.0	161.0	DVE401800
36.0	26.4	DVE200360	90.0	75.8	DVE300900			
40.0	30.4	DVE200400	95.0	80.8	DVE300950			
42.0	32.4	DVE200420	100.0	85.8	DVE301000			

For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 32: Part Number Systems for Internal Face Seals – Metric

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
DVE Variseal HF (Internal)	**0** 1.45 **1** 2.25 **2** 3.10 **3** 4.70 **4** 6.10 **5** 9.50	**0**xxxx Groove OD <1000 (dia x 10.0) **X**xxxx Groove OD >= 1000 (dia x 1.0)	**-** Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **H** Heavy

ORDERING EXAMPLE 1

D V E	3	0 0 8 0 0	-	T 0 5	S H
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Internal Face Seal Variseal HF	4.70 mm	Leading indicator is 0 therefore 0800 size number represents a 80.0 mm Groove OD	Industrial	T05	Stainless steel Heavy spring load

ORDERING EXAMPLE 2

D V E	5	X 1 2 0 0	-	T 0 5	S H
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Internal Face Seal Variseal HF	9.50 mm	Leading indicator is X therefore 1200 size number represents a 1200.0 mm Groove OD	Industrial	T05	Stainless steel Heavy spring load

■ Installation Recommendations for Internal Face Seals – Type HF – Inch

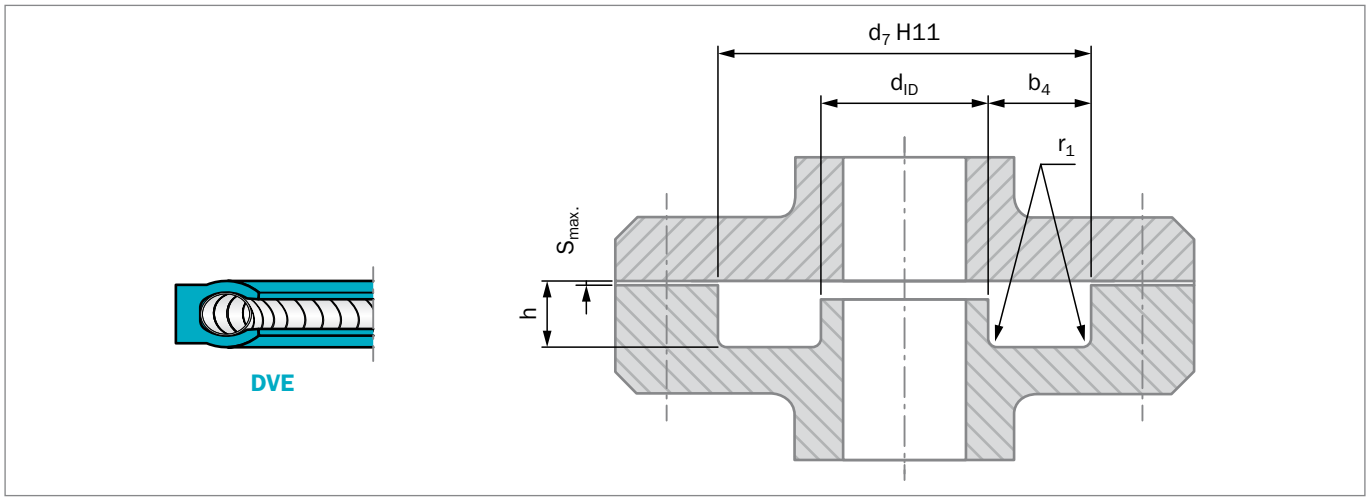


Figure 26: Installation Drawing

Table 33: Installation Dimensions – Inch

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

H11 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 34: Standard Dash Sizes – Inch

d_7	$d_{ID\ max}$	TSS Part No.	d_7	$d_{ID\ max}$	TSS Part No.	d_7	$d_{ID\ max}$	TSS Part No.
0.500	**0.313**	**DVE00M012**	1.250	0.688	DVE30M316	1.750	1.188	DVE30M324
0.625	**0.438**	**DVE00M014**	1.375	1.188	DVE00M026	1.875	1.688	DVE00M031
0.750	0.563	DVE00M016	1.375	1.093	DVE10M123	1.875	1.593	DVE10M131
0.750	**0.468**	**DVE10M113**	**1.375**	**1.000**	**DVE20M216**	**1.875**	**1.500**	**DVE20M223**
0.875	0.688	DVE00M018	1.375	0.813	DVE30M318	1.875	1.313	DVE30M325
0.875	**0.593**	**DVE10M115**	1.500	1.313	DVE00M028	2.000	1.813	DVE00M032
0.875	0.500	DVE20M208	1.500	1.218	DVE10M125	2.000	1.718	DVE10M133
1.000	0.813	DVE00M020	**1.500**	**1.125**	**DVE20M218**	**2.000**	**1.625**	**DVE20M224**
1.000	**0.718**	**DVE10M117**	1.500	0.938	DVE30M320	2.000	1.438	DVE30M326
1.000	0.625	DVE20M210	1.625	1.438	DVE00M029	2.000	1.250	DVE40M401
1.125	0.938	DVE00M022	1.625	1.343	DVE10M127	2.125	1.938	DVE00M033
1.125	**0.843**	**DVE10M119**	**1.625**	**1.250**	**DVE20M220**	2.125	1.843	DVE10M135
1.125	0.750	DVE20M212	1.625	1.063	DVE30M322	**2.125**	**1.750**	**DVE20M225**
1.250	1.063	DVE00M024	1.750	1.563	DVE00M030	2.125	1.563	DVE30M327
1.250	0.968	DVE10M121	1.750	1.468	DVE10M129	2.125	1.375	DVE40M402
1.250	**0.875**	**DVE20M214**	**1.750**	**1.375**	**DVE20M222**	2.250	2.063	DVE00M034

d_7	$d_{ID\ max}$	TSS Part No.
2.250	1.968	DVE10M137
2.250	**1.875**	**DVE20M226**
2.250	1.688	DVE30M328
2.250	1.500	DVE40M403
2.375	2.188	DVE00M035
2.375	2.093	DVE10M139
2.375	**2.000**	**DVE20M227**
2.375	1.813	DVE30M329
2.375	1.625	DVE40M404
2.500	2.313	DVE00M036
2.500	2.218	DVE10M141
2.500	**2.125**	**DVE20M228**
2.500	1.938	DVE30M330
2.500	1.750	DVE40M405
2.625	2.438	DVE00M037
2.625	2.343	DVE10M143
2.625	**2.250**	**DVE20M229**
2.625	2.063	DVE30M331
2.625	1.875	DVE40M406
2.750	2.563	DVE00M038
2.750	2.468	DVE10M145
2.750	**2.375**	**DVE20M230**
2.750	2.188	DVE30M332
2.750	2.000	DVE40M407
2.875	2.688	DVE00M039
2.875	2.593	DVE10M147
2.875	**2.500**	**DVE20M231**
2.875	2.313	DVE30M333
2.875	2.125	DVE40M408
3.000	2.813	DVE00M040
3.000	2.718	DVE10M149
3.000	**2.625**	**DVE20M232**
3.000	2.438	DVE30M334
3.000	2.250	DVE40M409
3.125	2.938	DVE00M041
3.125	**2.750**	**DVE20M233**
3.125	2.563	DVE30M335
3.125	2.375	DVE40M410
3.250	**2.875**	**DVE20M234**
3.250	2.688	DVE30M336
3.250	2.500	DVE40M411
3.375	3.188	DVE00M042
3.375	**3.000**	**DVE20M235**
3.375	2.813	DVE30M337
3.375	2.625	DVE40M412
3.500	**3.125**	**DVE20M236**
3.500	2.938	DVE30M338
3.500	2.750	DVE40M413

d_7	$d_{ID\ max}$	TSS Part No.
3.625	3.438	DVE00M043
3.625	3.250	DVE20M237
3.625	3.063	DVE30M339
3.625	2.875	DVE40M414
3.750	3.375	DVE20M238
3.750	**3.188**	**DVE30M340**
3.750	3.000	DVE40M415
3.875	3.688	DVE00M044
3.875	3.500	DVE20M239
3.875	**3.313**	**DVE30M341**
3.875	3.125	DVE40M416
4.000	3.625	DVE20M240
4.000	**3.438**	**DVE30M342**
4.000	3.250	DVE40M417
4.125	3.938	DVE00M045
4.125	3.750	DVE20M241
4.125	**3.563**	**DVE30M343**
4.125	3.375	DVE40M418
4.250	3.875	DVE20M242
4.250	3.688	DVE30M344
4.250	3.500	DVE40M419
4.375	4.000	DVE20M243
4.375	**3.813**	**DVE30M345**
4.375	3.625	DVE40M420
4.500	4.125	DVE20M244
4.500	**3.938**	**DVE30M346**
4.500	3.750	DVE40M421
4.625	4.250	DVE20M245
4.625	**4.063**	**DVE30M347**
4.625	3.875	DVE40M422
4.750	4.375	DVE20M246
4.750	**4.188**	**DVE30M348**
4.750	4.000	DVE40M423
4.875	4.500	DVE20M247
4.875	**4.313**	**DVE30M349**
4.875	4.125	DVE40M424
5.000	4.625	DVE20M248
5.000	**4.438**	**DVE30M350**
5.000	4.250	DVE40M425
5.250	4.875	DVE20M250
5.250	**4.688**	**DVE30M352**
5.250	4.500	DVE40M427
5.500	5.125	DVE20M252
5.500	4.938	DVE30M354
5.500	4.750	DVE40M429
5.750	5.375	DVE20M254
5.750	5.188	DVE30M356
5.750	**5.000**	**DVE40M431**

d_7	$d_{ID\ max}$	TSS Part No.
6.000	5.625	DVE20M256
6.000	5.438	DVE30M358
6.000	**5.250**	**DVE40M433**
6.250	5.875	DVE20M258
6.250	5.688	DVE30M360
6.250	**5.500**	**DVE40M435**
6.500	6.125	DVE20M259
6.500	**5.750**	**DVE40M437**
6.750	6.375	DVE20M260
6.750	**6.000**	**DVE40M438**
7.000	6.625	DVE20M261
7.000	**6.250**	**DVE40M439**
7.250	6.875	DVE20M262
7.250	**6.500**	**DVE40M440**
7.500	7.125	DVE20M263
7.500	**6.750**	**DVE40M441**
7.750	7.375	DVE20M264
7.750	**7.000**	**DVE40M442**
8.000	7.625	DVE20M265
8.000	**7.250**	**DVE40M443**
8.250	7.875	DVE20M266
8.250	**7.500**	**DVE40M444**
8.500	8.125	DVE20M267
8.500	7.750	DVE40M445
9.000	8.625	DVE20M269
9.000	**8.250**	**DVE40M446**
9.500	**8.750**	**DVE40M447**
10.000	**9.250**	**DVE40M448**
10.500	**9.750**	**DVE40M449**
11.000	**10.250**	**DVE40M450**
11.500	**10.750**	**DVE40M451**
12.000	**11.250**	**DVE40M452**
12.500	**11.750**	**DVE40M453**
13.000	**12.250**	**DVE40M454**
13.500	**12.750**	**DVE40M455**
14.000	**13.250**	**DVE40M456**
14.500	**13.750**	**DVE40M457**
15.000	**14.250**	**DVE40M458**
15.500	**14.750**	**DVE40M459**
16.000	**15.250**	**DVE40M460**

Figures in **bold** are preferred sizes.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 35: Part Number Systems for Internal Face Seals – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
DVE Variseal HF (Internal)	**0** 0.056 **1** 0.089 **2** 0.122 **3** 0.186 **4** 0.239 **5** 0.375	**0M**xxx Dash # **S**xxxx Groove OD < 10.0 Inch (dia x 1000.0) **L**xxxx Groove OD >= 10.0 (dia x 100.0)	**-** Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** See page 7 **T07** for material **T12** description **T24** **T40** **M 79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **H** Heavy

ORDERING EXAMPLE 1

D V E	2	0 M 2 3 0	-	T 0 5	S H
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Internal Face Seal Variseal HF	200 series (0.122 inch)	Leading indicator is 0M therefore 230 is an inch dash number	Industrial	T05	Stainless steel Heavy spring load

ORDERING EXAMPLE 2

D V E	3	S 3 4 0 0	-	T 0 5	S H
Design	**Cross-Section**	**Size**	**Class**	**Jacket Material**	**Spring Material**
Internal Face Seal Variseal HF	300 series (0.186 inch)	Leading indicator is S therefore 3400 size number represents a 3.400 inch groove OD	Industrial	T05	Stainless steel Heavy spring load

■ Installation Recommendations for External Face Seals – Type HF – Metric

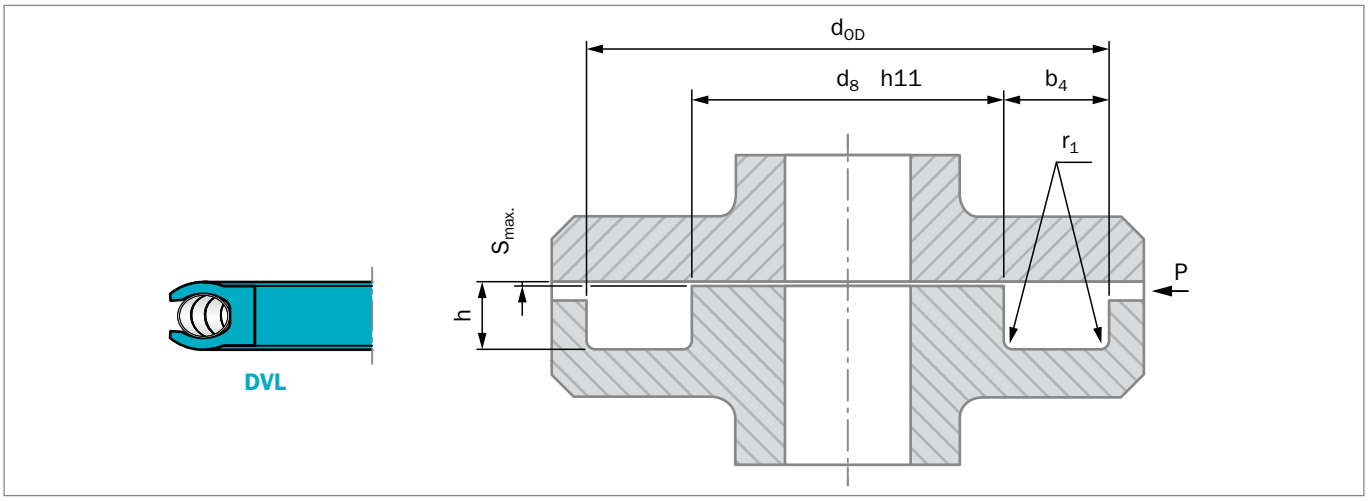


Figure 27: Installation Drawing

Table 36: Installation Dimensions – Metric

Series Number	Groove Inside Diameter d_8 h11		h		b_4	r_1	Axial Clearance S_{max}			
	Standard Range	Extended Range[1)]	Groove Depth		Groove Width Min	Radius Max	2 MPa	10 MPa	20 MPa	40 MPa
DVL0	3.0 - 9.9	3.0 - 40.0	1.45	+0.03	2.40	0.25	0.20	0.10	0.08	0.05
DVL1	10.0 - 19.9	8.0 - 200.0	2.25	+0.05	3.60	0.38	0.25	0.15	0.10	0.07
DVL2	20.0 - 39.9	12.0 - 400.0	3.10	+0.08	4.80	0.38	0.35	0.20	0.15	0.08
DVL3	40.0 - 119.9	20.0 - 700.0*	4.70	+0.10	7.10*	0.38	0.50	0.25	0.20	0.10
DVL4	120.0 - 999.9**	35.0 - 1600.0**	6.10	+0.15	9.50**	0.51	0.60	0.30	0.25	0.12
DVL5	1000.0 - 2500.9***	80.0 - 2500.0***	9.50	+0.20	15.00***	0.51	0.90	0.50	0.40	0.20

* For diameters above 700 mm b4 min. = 8.0 mm
** For diameters above 700 mm b4 min. = 11.0 mm
*** For diameters above 1000 mm b4 min. = 18.0 mm

1) Available on request
h11 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 37: Size Series – Metric

d_8	d_{OD} Min	TSS Part No.	d_8	d_{OD} Min	TSS Part No.	d_8	d_{OD} Min	TSS Part No.
4.0	8.8	DVL000040	35.0	44.6	DVL200350	85.0	99.2	DVL300850
5.0	9.8	DVL000050	36.0	45.6	DVL200360	90.0	104.2	DVL300900
6.0	10.8	DVL000060	40.0	54.2	DVL300400	95.0	109.2	DVL300950
8.0	12.8	DVL000080	42.0	56.2	DVL300420	100.0	114.2	DVL301000
10.0	17.2	DVL100100	45.0	59.2	DVL300450	105.0	119.2	DVL301050
12.0	19.2	DVL100120	48.0	62.2	DVL300480	110.0	124.2	DVL301100
14.0	21.2	DVL100140	50.0	64.2	DVL300500	115.0	129.2	DVL301150
15.0	22.2	DVL100150	52.0	66.2	DVL300520	120.0	139.0	DVL401200
16.0	23.2	DVL100160	55.0	69.2	DVL300550	125.0	144.0	DVL401250
18.0	25.2	DVL100180	56.0	70.2	DVL300560	130.0	149.0	DVL401300
20.0	29.6	DVL200200	60.0	74.2	DVL300600	135.0	154.0	DVL401350
22.0	31.6	DVL200220	63.0	77.2	DVL300630	140.0	159.0	DVL401400
25.0	34.6	DVL200250	65.0	79.2	DVL300650	150.0	169.0	DVL401500
28.0	37.6	DVL200280	70.0	84.2	DVL300700	160.0	179.0	DVL401600
30.0	39.6	DVL200300	75.0	89.2	DVL300750	170.0	189.0	DVL401700
32.0	41.6	DVL200320	80.0	94.2	DVL300800	180.0	199.00	DVL401800

For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 38: Part Number System for External Face Seals – Metric

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
DVL Variseal HF (External)	**0** 1.45 **1** 2.25 **2** 3.10 **3** 4.70 **4** 6.10 **5** 9.50	**0**xxxx Groove ID <1000 (dia x 10.0) **X**xxxx Groove ID >= 1000 (dia x 1.0)	**-** Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T24** for material **T40** description **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **H** Heavy

ORDERING EXAMPLE 1

D V L	3	0 0 8 0 0	-	T 0 5	S H
Design External Face Seal Variseal HF	**Cross-Section** 4.70 mm	**Size** Leading indicator is 0 therefore 0800 size number represents a 80.0 mm Groove ID	**Class** Industrial	**Jacket Material** T05	**Spring Material** Stainless steel Heavy spring load

ORDERING EXAMPLE 2

D V L	5	X 1 2 0 0	-	T 0 5	S H
Design External Face Seal Variseal HF	**Cross-Section** 9.50 mm	**Size** Leading indicator is X therefore 1200 size number represents a 1200.0 mm Groove ID	**Class** Industrial	**Jacket Material** T05	**Spring Material** Stainless steel Heavy spring load

■ Installation Recommendations for External Face Seals – Type HF – Inch

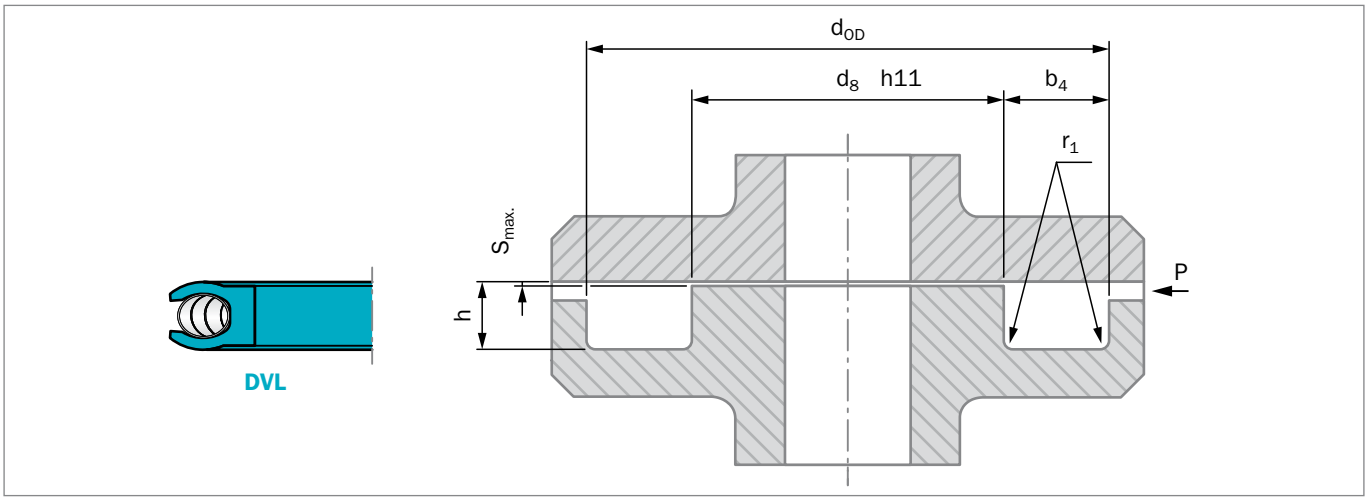


Figure 28: Installation Drawing

Table 39: Installation Dimensions – Inch

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

h11 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 40: Standard Dash Sizes – Inch

d_8	d_{OD} Min	TSS Part No.	d_8	d_{OD} Min	TSS Part No.	d_8	d_{OD} Min	TSS Part No.
0.125	**0.312**	**DVL00M006**	**0.875**	**1.157**	**DVL10M118**	1.250	1.812	DVL30M322
0.187	**0.375**	DVL00M008	0.875	1.250	DVL20M212	1.375	1.562	DVL00M028
0.250	**0.437**	**DVL00M010**	0.875	1.437	DVL30M316	1.375	1.657	DVL10M126
0.375	0.562	DVL00M012	1.000	1.187	DVL00M022	**1.375**	**1.750**	**DVL20M220**
0.375	**0.657**	**DVL10M110**	1.000	1.282	DVL10M120	1.375	1.937	DVL30M324
0.500	0.687	DVL00M014	**1.000**	**1.375**	**DVL20M214**	1.500	1.687	DVL00M029
0.500	**0.782**	**DVL10M112**	1.000	1.562	DVL30M318	1.500	1.782	DVL10M128
0.625	0.812	DVL00M016	1.125	1.312	DVL00M024	**1.500**	**1.875**	DVL20M222
0.625	**0.907**	**DVL10M114**	1.125	1.407	DVL10M122	1.500	2.062	DVL30M325
0.625	1.000	DVL20M208	**1.125**	**1.500**	**DVL20M216**	1.500	2.250	DVL40M401
0.750	0.937	DVL00M018	1.125	1.687	DVL30M320	1.625	1.812	DVL00M030
0.750	**1.032**	**DVL10M116**	1.250	1.437	DVL00M026	1.625	1.907	DVL10M130
0.750	1.125	DVL20M210	1.250	1.532	DVL10M124	**1.625**	**2.000**	**DVL20M223**
0.875	1.062	DVL00M020	**1.250**	**1.625**	**DVL20M218**	1.625	2.187	DVL30M326

d_8	$d_{OD\ Min}$	TSS Part No.
1.625	2.375	DVL40M402
1.750	1.937	DVL00M031
1.750	2.032	DVL10M132
1.750	**2.125**	**DVL20M224**
1.750	2.312	DVL30M327
1.750	2.500	DVL40M403
1.875	2.062	DVL00M032
1.875	2.157	DVL10M134
1.875	**2.250**	**DVL20M225**
1.875	2.437	DVL30M328
1.875	2.625	DVL40M404
2.000	2.187	DVL00M033
2.000	2.282	DVL10M136
2.000	**2.375**	**DVL20M226**
2.000	2.562	DVL30M329
2.000	2.750	DVL40M405
2.125	2.312	DVL00M034
2.125	2.407	DVL10M138
2.125	**2.500**	**DVL20M227**
2.125	2.687	DVL30M330
2.125	2.875	DVL40M406
2.250	2.437	DVL00M035
2.250	2.532	DVL10M140
2.250	**2.625**	**DVL20M228**
2.250	2.812	DVL30M331
2.250	3.000	DVL40M407
2.375	2.562	DVL00M036
2.375	2.657	DVL10M142
2.375	**2.750**	**DVL20M229**
2.375	2.937	DVL30M332
2.375	3.125	DVL40M408
2.500	2.687	DVL00M037
2.500	2.782	DVL10M144
2.500	**2.875**	**DVL20M230**
2.500	3.062	DVL30M333
2.500	3.250	DVL40M409
2.625	2.812	DVL00M038
2.625	2.907	DVL10M146
2.625	**3.000**	**DVL20M231**
2.625	3.187	DVL30M334
2.625	3.375	DVL40M410
2.750	2.937	DVL00M039
2.750	3.032	DVL10M148
2.750	**3.125**	**DVL20M232**
2.750	3.312	DVL30M335
2.750	3.500	DVL40M411
2.875	3.062	DVL00M040
2.875	3.157	DVL10M150
2.875	**3.250**	**DVL20M233**
2.875	3.437	DVL30M336
2.875	3.625	DVL40M412
3.000	3.187	DVL00M041
3.000	3.282	DVL10M151
3.000	**3.375**	**DVL20M234**
3.000	3.562	DVL30M337
3.000	3.750	DVL40M413
3.125	**3.500**	**DVL20M235**
3.125	3.687	DVL30M338
3.125	3.875	DVL40M414
3.250	3.437	DVL00M042
3.250	3.532	DVL10M152
3.250	**3.625**	**DVL20M236**
3.250	3.812	DVL30M339
3.250	4.000	DVL40M415
3.375	3.750	DVL20M237
3.375	**3.937**	**DVL30M340**
3.375	4.125	DVL40M416
3.500	3.687	DVL00M043
3.500	3.782	DVL10M153
3.500	3.875	DVL20M238
3.500	**4.062**	**DVL30M341**
3.500	4.250	DVL40M417
3.625	4.000	DVL20M239
3.625	**4.187**	**DVL30M342**
3.625	4.375	DVL40M418
3.750	3.937	DVL00M044
3.750	4.032	DVL10M154
3.750	4.125	DVL20M240
3.750	**4.312**	**DVL30M343**
3.750	4.500	DVL40M419
3.875	4.250	DVL20M241
3.875	**4.437**	**DVL30M344**
3.875	4.625	DVL40M420
4.000	4.187	DVL00M045
4.000	4.282	DVL10M155
4.000	4.375	DVL20M242
4.000	**4.562**	**DVL30M345**
4.000	4.750	DVL40M421
4.250	4.532	DVL10M156
4.250	4.625	DVL20M244
4.250	**4.812**	**DVL30M347**
4.250	5.000	DVL40M423
4.500	4.782	DVL10M157
4.500	4.875	DVL20M246
4.500	**5.062**	**DVL30M349**
4.500	5.250	DVL40M425
4.750	5.032	DVL10M158
4.750	5.125	DVL20M248
4.750	**5.312**	**DVL30M351**
4.750	5.500	DVL40M427
5.000	5.282	DVL10M159
5.000	5.375	DVL20M250
5.000	**5.562**	**DVL30M353**
5.000	5.750	DVL40M429
5.250	5.532	DVL10M160
5.250	5.625	DVL20M252
5.250	5.812	DVL30M355
5.250	**6.000**	**DVL40M431**
5.500	5.782	DVL10M161
5.500	5.875	DVL20M254
5.500	6.062	DVL30M357
5.500	**6.250**	**DVL40M433**
5.750	6.125	DVL20M256
5.750	6.312	DVL30M359
5.750	**6.500**	**DVL40M435**
6.000	6.375	DVL20M258
6.000	6.562	DVL30M361
6.000	**6.750**	**DVL40M437**
6.250	6.625	DVL20M259
6.250	6.812	DVL30M362
6.250	**7.000**	**DVL40M438**
6.500	6.875	DVL20M260
6.500	7.062	DVL30M363
6.500	**7.250**	**DVL40M439**
6.750	7.125	DVL20M261
6.750	7.312	DVL30M364
6.750	**7.500**	**DVL40M440**
7.000	7.375	DVL20M262
7.000	7.562	DVL30M365
7.000	**7.750**	**DVL40M441**
7.500	7.875	DVL20M264
7.500	8.062	DVL30M367

d_8	$d_{OD\ Min}$	TSS Part No.
7.500	**8.250**	**DVL40M443**
8.000	8.375	DVL20M266
8.000	8.562	DVL30M369
8.000	**8.750**	**DVL40M445**
9.000	9.375	DVL20M270
9.000	9.562	DVL30M373
9.000	**9.750**	**DVL40M447**

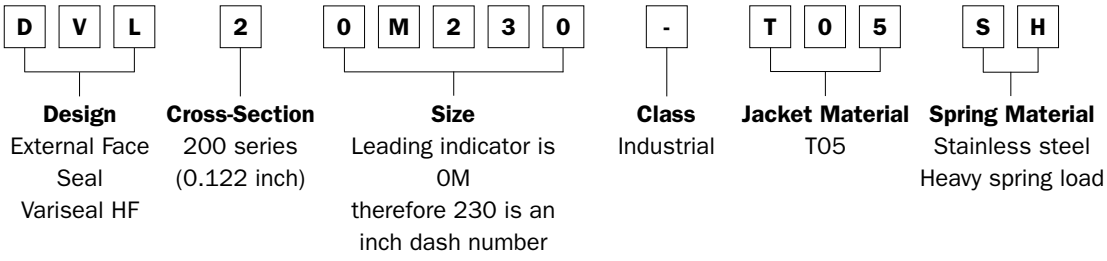
d_8	$d_{OD\ Min}$	TSS Part No.
10.000	10.562	DVL30M377
10.000	**10.750**	**DVL40M449**
11.000	**11.750**	**DVL40M451**
12.000	**12.750**	**DVL40M453**
13.000	**13.750**	**DVL40M455**
14.000	**14.750**	**DVL40M457**
15.000	**15.750**	**DVL40M459**

Figures in **bold** are preferred sizes.
For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

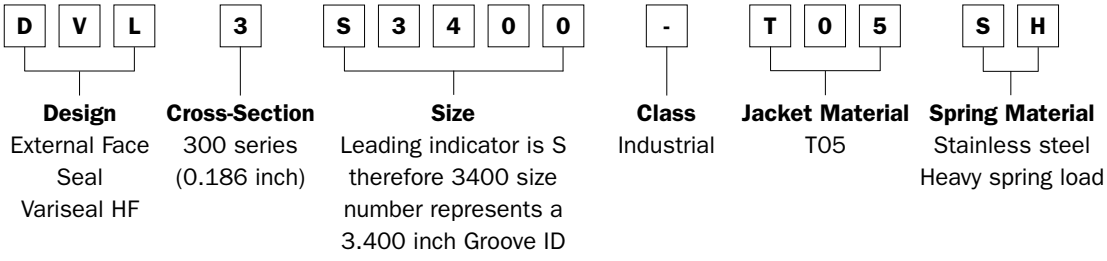
Table 41: Part Number System for External Face Seals – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
DVL Variseal HF (External)	**0** 0.056 **1** 0.089 **2** 0.122 **3** 0.186 **4** 0.239 **5** 0.375	**0M**xxx Dash # **S**xxxx Groove ID < 10.0 Inch (dia x 1000.0) **L**xxxx Groove ID >= 10.0 (dia x 100.0)	**-** Industrial **A** Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **H** Heavy

ORDERING EXAMPLE 1



ORDERING EXAMPLE 2



■ 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.

The standard Variseal® for rotary applications, Turcon® Roto Variseal® is a single acting seal consisting of a U-shaped jacket and a V-shaped corrosion resistant spring.

Turcon® Roto Variseal® has a flanged heel, which prevents the seal from rotating in the groove and a short heavy dynamic lip that reduces friction. This gives a long service life and good scraping ability, even in media of high viscosity.

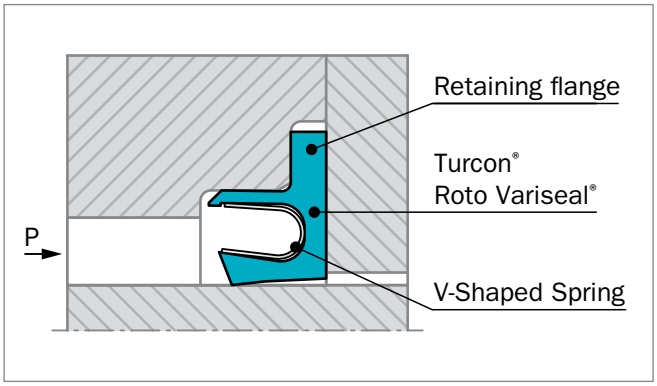


Figure 29: Turcon® Roto Variseal®

TECHNICAL DATA

Operating Pressure:	Maximum dynamic load: 20 MPa / 2,900 psi Maximum static load: 25 MPa / 3,626 psi
Speed:	Reciprocating up to 10 m/s / 1,980 fpm, Rotating up to 2 m/s / 390 fpm
Temperature:	-70 °C to +300 °C / -94 °F to +572 °F
Media compatibility:	Virtually all fluids, chemicals and gases

IMPORTANT NOTE

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

AREAS OF APPLICATION

- Rotary shafts on general hydraulic applications
- Plastic injection molding machines
- Rotating and pivoting arms
- Gearbox shafts

FRICTIONAL FORCE

Indicative values for frictional force are included in figure below. Frictional force is given as a function of sliding speed and operating pressure for a shaft diameter of 2 in / 50 mm at an oil temperature of +140 °F / +60 °C. The operating limits are lower at higher temperatures.

Indicative values for other shaft diameters can be calculated from the formula:

$$P \cong P_{50} \times \left(\frac{d}{50\ mm}\right) \quad [W]$$

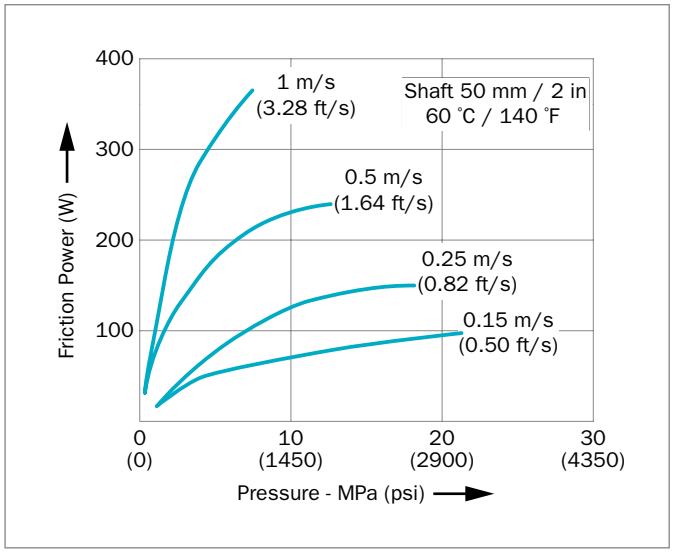


Figure 30: Frictional Force for Turcon® Roto Variseal®

The indicative values apply for constant operating conditions. Changes in these, such as pressure fluctuations or direction of rotation, can result in significantly higher frictional values.

APPLICATION LIMITS

The maximum operating limits for temperature, pressure and speed are dependent upon one another and therefore cannot all apply at the same time.

The lubrication properties of the media to be sealed and heat dissipation must also be taken into consideration.

The following PV values can be used as general guidelines:

Poor lubrication up to PV = 2 MPa x m/s (950 psi x ft/s)
Good lubrication up to PV = 5 MPa x m/s (2375 psi x ft/s)
Very good cooling up to PV = 8 MPa x m/s (3800 psi x ft/s)

These values are lower for diameters < 50 mm / 2 inches. Tests of these characteristics are recommended to establish application limits.

MATING SURFACE MATERIALS

Sealing of applications with rotating movements require very good mating surfaces. A minimum hardness 55 HRC is recommended to a hardening depth of at least 0.3 mm / 0.01 inch.

Particular attention must be paid to coated surfaces and good heat dissipation through the coating is required.

Table 42: Permissible Eccentricity for Turcon® Roto Variseal®

TSS Series No.	Max. allowable deviation mm	Max. allowable deviation inch
TVM1	0.05	0.002
TVM2	0.10	0.004
TVM3	0.15	0.006
TVM4	0.20	0.008

■ Installation Recommendations for Roto Variseal® – Type TVM – Metric

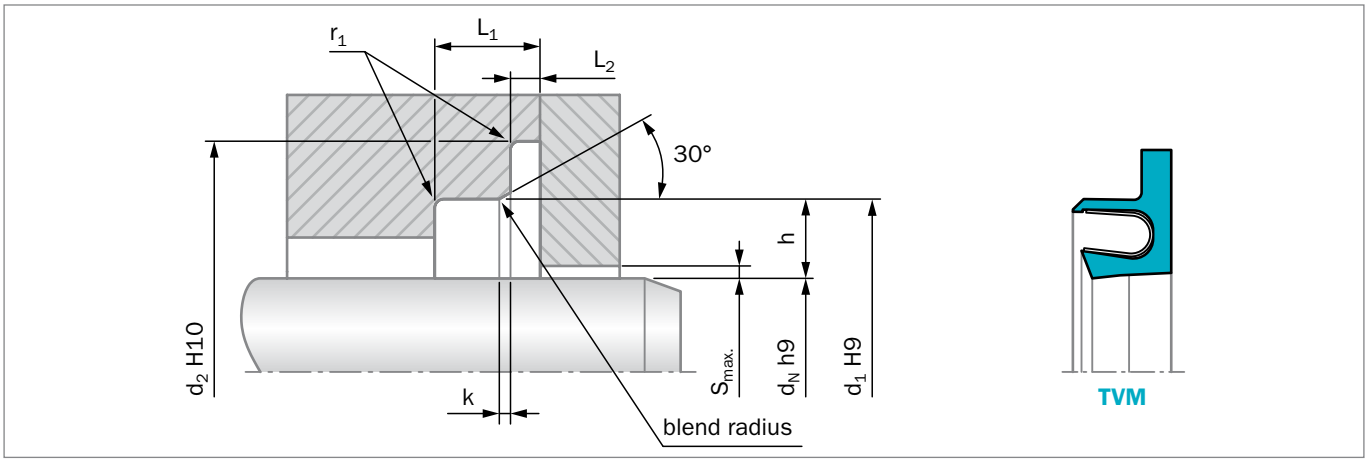


Figure 31: Installation Drawing

Table 43: Installation Dimensions – Metric

Series No.	Shaft Diameter d_N h9		d_1	h	d_2	L_1	L_2		k	r_1	Radial Clearance S_{max}		
	Standard Range	Extended Range	Groove Diameter	Groove Depth	Flange Diameter	Groove Width	Flange Groove Width		Lead-in Chamfer	Radius	2 MPa	10 MPa	20 MPa
			H9		H10	Min				Max			
TVM1	5.0 - 19.9	5.0 - 200.0	d_N + 5.0	2.50	d_N + 9.0	3.6	0.85	+0/-0.10	0.8	0.38	0.25	0.15	0.10
TVM2	20.0 - 39.9	10.0 - 400.0	d_N + 7.0	3.50	d_N + 12.5	4.8	1.35	+0/-0.15	1.1	0.38	0.35	0.20	0.15
TVM3	40.0 - 399.9	20.0 - 700.0	d_N + 10.5	5.25	d_N + 17.5	7.1	1.80	+0/-0.20	1.4	0.38	0.50	0.25	0.20
TVM4	400.0 - 999.9	35.0 - 999.9	d_N + 14.0	7.00	d_N + 22.0	9.5	2.80	+0/-0.20	1.6	0.51	0.60	0.30	0.25

h9/H9 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 44: Size Series – Metric

d_N	d_1	d_2	TSS Part No.	d_N	d_1	d_2	TSS Part No.	d_N	d_1	d_2	TSS Part No.
5.0	10.0	14.0	TVM100050	42.0	52.5	59.5	TVM300420	110.0	120.5	127.5	TVM301100
6.0	11.0	15.0	TVM100060	45.0	55.5	62.5	TVM300450	115.0	125.5	132.5	TVM301150
8.0	13.0	17.0	TVM100080	48.0	58.5	65.5	TVM300480	120.0	130.5	137.5	TVM301200
10.0	15.0	19.0	TVM100100	50.0	60.5	67.5	TVM300500	125.0	135.5	142.5	TVM301250
12.0	17.0	21.0	TVM100120	52.0	62.5	69.5	TVM300520	130.0	140.5	147.5	TVM301300
14.0	19.0	23.0	TVM100140	55.0	65.5	72.5	TVM300550	135.0	145.5	152.5	TVM301350
15.0	20.0	24.0	TVM100150	56.0	66.5	73.5	TVM300560	140.0	150.5	157.5	TVM301400
16.0	21.0	25.0	TVM100160	60.0	70.5	77.5	TVM300600	150.0	160.5	167.5	TVM301500
18.0	23.0	27.0	TVM100180	63.0	73.5	80.5	TVM300630	160.0	170.5	177.5	TVM301600
20.0	27.0	32.5	TVM200200	65.0	75.5	82.5	TVM300650	170.0	180.5	187.5	TVM301700
22.0	29.0	34.5	TVM200220	70.0	80.5	87.5	TVM300700	180.0	190.5	197.5	TVM301800
25.0	32.0	37.5	TVM200250	75.0	85.5	92.5	TVM300750	190.0	200.5	207.5	TVM301900
28.0	35.0	40.5	TVM200280	80.0	90.5	97.5	TVM300800	200.0	210.5	217.5	TVM302000
30.0	37.0	42.5	TVM200300	85.0	95.5	102.5	TVM300850	210.0	220.5	227.5	TVM302100
32.0	39.0	44.5	TVM200320	90.0	100.5	107.5	TVM300900	220.0	230.5	237.5	TVM302200
35.0	42.0	47.5	TVM200350	95.0	105.5	112.5	TVM300950	230.0	240.5	247.5	TVM302300
36.0	43.0	48.5	TVM200360	100.0	110.5	117.5	TVM301000	240.0	250.5	257.5	TVM302400
40.0	50.5	57.5	TVM300400	105.0	115.5	122.5	TVM301050	250.0	260.5	267.5	TVM302500

Table 45: Part Number System for Roto Variseal® – Metric

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
TVM Roto Variseal	**1** 2.50 **2** 3.50 **3** 5.25 **4** 7.00	**0**xxxx Shaft dia. <1000 (dia x 10.0) **X**xxxx Shaft dia. >= 1000 (dia x 1.0)	**-** Industrial A Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T25** **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **M** Medium **R** Hi Clean

ORDERING EXAMPLE 1

T V M	3	0 0 8 0 0	-	T 4 0	S M
Design Rotary Seal Roto Variseal	**Cross-Section** 5.25 mm	**Size** Leading indicator is 0 therefore 0800 size number represents a 80.0 mm shaft diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

T V M	4	X 1 2 0 0	-	T 4 0	S M
Design Rotary Seal Roto Variseal	**Cross-Section** 7.00 mm	**Size** Leading indicator is X therefore 1200 size number represents a 1200.0 mm shaft diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

■ Installation Recommendations for Roto Variseal® – Type TVM – Inch

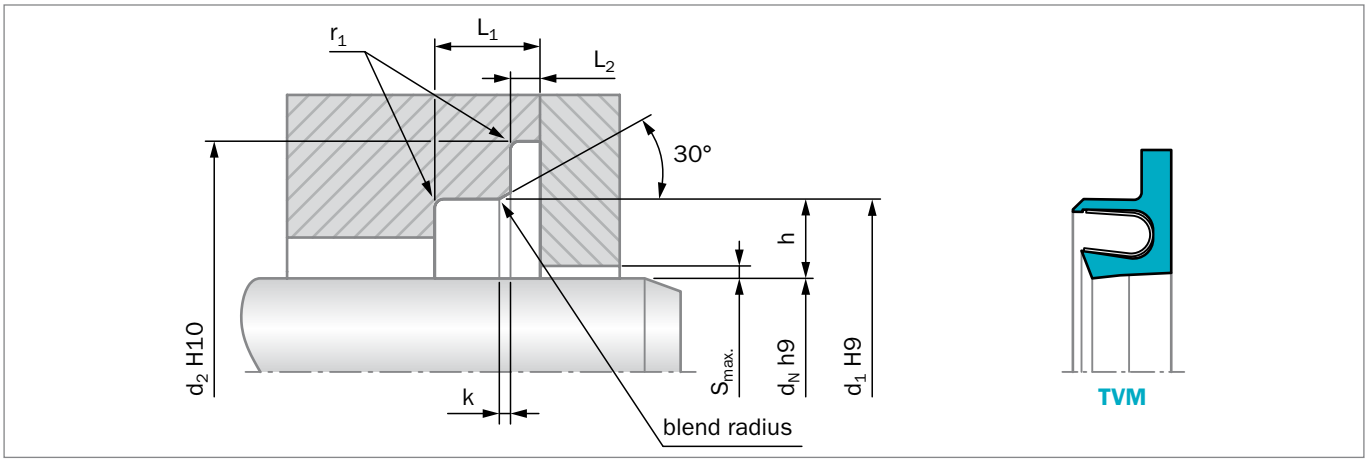


Figure 32: Installation Drawing

Table 46: Installation Dimensions – Inch

Series No.	Shaft Diameter d_N h9		d_1	d_2	L_1	L_2		k	r_1	Radial Clearance S_{max}		
	Standard Range	Extended Range	Groove Diameter	Flange Depth	Groove Width	Flange Groove Width		Lead-in Chamfer	Radius	2 MPa	10 MPa	20 MPa
			H9	H10	Min				Max			
TVM1	0.187 - 0.749	0.187 - 8.000	d_N + 0.197	d_N + 0.354	0.141	0.033	+0/-0.004	0.031	0.015	0.010	0.006	0.004
TVM2	0.750 - 1.499	0.375 - 16.000	d_N + 0.276	d_N + 0.492	0.189	0.053	+0/-0.006	0.043	0.015	0.014	0.008	0.006
TVM3	1.500 - 14.999	0.750 - 28.000	d_N + 0.413	d_N + 0.689	0.280	0.071	+0/-0.008	0.055	0.015	0.020	0.010	0.008
TVM4	15.000 - 39.999	1.500 - 33.999	d_N + 0.551	d_N + 0.866	0.374	0.110	+0/-0.008	0.063	0.020	0.024	0.012	0.010

h9/H9 tolerance can be found using the ISO Fits & Tolerance App, see page 84.

Table 47: Size Series – Inch

d_N	d_1	d_2	TSS Part No.
0.187	0.384	0.541	TVM1S0187
0.250	0.447	0.604	TVM1S0250
0.312	0.509	0.666	TVM1S0312
0.375	0.572	0.729	TVM1S0375
0.437	0.634	0.791	TVM1S0437
0.500	0.697	0.854	TVM1S0500
0.562	0.759	0.916	TVM1S0562
0.625	0.822	0.979	TVM1S0625
0.687	0.884	1.041	TVM1S0687
0.750	1.026	1.242	TVM2S0750
0.875	1.151	1.367	TVM2S0875
1.000	1.276	1.492	TVM2S1000
1.125	1.401	1.617	TVM2S1125
1.250	1.526	1.742	TVM2S1250
1.375	1.651	1.867	TVM2S1375
1.500	1.776	1.992	TVM2S1500
1.625	2.038	2.314	TVM3S1625
1.750	2.163	2.439	TVM3S1750
1.875	2.288	2.564	TVM3S1875
2.000	2.413	2.689	TVM3S2000
2.125	2.538	2.814	TVM3S2125
2.250	2.663	2.939	TVM3S2250
2.375	2.788	3.064	TVM3S2375
2.500	2.913	3.189	TVM3S2500
2.625	3.038	3.314	TVM3S2625
2.750	3.163	3.439	TVM3S2750
2.875	3.288	3.564	TVM3S2875
3.000	3.413	3.689	TVM3S3000
3.125	3.538	3.814	TVM3S3125
3.250	3.663	3.939	TVM3S3250
3.375	3.788	4.064	TVM3S3375
3.500	3.913	4.189	TVM3S3500
3.625	4.038	4.314	TVM3S3625
3.750	4.163	4.439	TVM3S3750
3.875	4.288	4.564	TVM3S3875
4.000	4.413	4.689	TVM3S4000
4.250	4.663	4.939	TVM3S4250
4.500	4.913	5.189	TVM3S4500
4.750	5.163	5.439	TVM3S4750
5.000	5.413	5.689	TVM3S5000
5.250	5.663	5.939	TVM3S5250
5.500	5.913	6.189	TVM3S5500
5.750	6.163	6.439	TVM3S5750
6.000	6.413	6.689	TVM3S6000
6.250	6.663	6.939	TVM3S6250
6.500	6.913	7.189	TVM3S6500
7.000	7.413	7.689	TVM3S7000
7.500	7.913	8.189	TVM3S7500
8.000	8.413	8.689	TVM3S8000
8.500	8.913	9.189	TVM3S8500
9.000	9.413	9.689	TVM3S9000
9.500	9.913	10.189	TVM3S9500

For additional size and part number details please contact your local Trelleborg Sealing Solutions Marketing company.

Table 48: Part Number System for Roto Variseal® – Inch

Article Code	Cross-Section	Size	Class	Seal Material	Spring Material	Spring Load
TVM Roto Variseal	**1** 0.098 **2** 0.138 **3** 0.207 **4** 0.276	**S**xxxx Shaft dia. < 10.0 (dia x 1000.0) **L**xxxx Shaft dia. >= 10.0 (dia x 100.0)	**-** Industrial A Aerospace	**T01** **MF1** **MF4** **MF6** **T05** **T07** See page 7 **T12** for material **T24** description **T25** **T40** **M79** **Z48** **Z80**	**S** Stainless Steel **H** Hastelloy **E** Elgiloy	**Standard load for each design** **M** Medium **R** Hi Clean

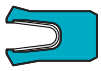
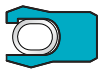
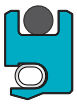
ORDERING EXAMPLE 1

T V M	3	S 2 5 0 0	-	T 4 0	S M
Design Rotary Seal Roto Variseal	**Cross-Section** 0.207 inch	**Size** Leading indicator is S therefore 2500 size number represents a 2.500 inch shaft diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

ORDERING EXAMPLE 2

T V M	4	L 1 1 5 0	-	T 4 0	S M
Design Rotary Seal Roto Variseal	**Cross-Section** 0.276 inch	**Size** Leading indicator is L therefore 1150 size number represents a 11.500 inch shaft diameter	**Class** Industrial	**Jacket Material** T40	**Spring Material** Stainless steel Medium spring load

Table 49: Non-Catalog Standard Seal Design

Seal	Application			Technical Data									
Type	Type of Application			Maximum Pressure				Working Temperature		Maximum Speed				Comments
	Static	Reciprocating	Rotary	Dynamic		Static		°C	° F	Recip.		Rotary		
				MPa		MPa				m/s	fpm	m/s	fpm	
				Bar	psi	Bar	psi							
W2S 	C	A	C	20		40		-70 to +300	-94 to +572	15	1954	1.27	250	A wiper for those applications that require close control of friction or torque, or with wider hardware tolerance or eccentricities.
				200	2900	400	5800							
M2 with Ext Heel 	C	A	B	40		52		-70 to +300	-94 to +572	15	1954	1.27	250	For greater extrusion resistance in applications with high pressures and/or temperatures.
				400	5800	520	7500							
W2 with Ext Heel 	C	A	B	40		52		-70 to +300	-94 to +572	15	1954	1.27	250	Same as above but with a Slantcoil® spring load. The Slantcoil spring handles more sideloading without taking a compression set.
				400	5800	520	7500							
MF 	A	-	C	n/a		60		-100 to +200	-148 to +392	n/a		n/a		For static, slow rotary, or oscillating service sealing between two faces.
						600	8702							
WF 	A	-	C	n/a		60		-150 to +200	-238 to +392	n/a		n/a		Same as above except with Slantcoil® use for greater flexibility in small diameters and crosssections.
						600	8702							
FM 	B	B	A	20		25		-70 to +300	-94 to +572	15	1954	2.00	360	The flange on the O.D. of the seal is clamped axially in the housing, preventing rotation of the seal with the shaft.
				200	2900	250	3626							
FW 	B	B	A	20		25		-70 to +300	-94 to +572	15	1954	2.00	360	The Slantcoil® spring provides closer control of torque values for low friction applications, and to reduce heat generation in general.
				200	2900	250	3626							
PM 	B	B	A	20		25		-54 to +204	-65 to +400	15	1954	2.00	360	The O-Ring in the seal's O.D. groove acts to prevent rotation with the shaft and to provide a positive static seal on the O.D.
				200	2900	250	3626							
PW 	B	B	A	20		25		-54 to +204	-65 to +400	15	1954	2.00	360	For applications similar to above but require close control of friction or torque and for wider hardware tolerances or eccentricities.
				200	2900	250	3626							
CM 	B	B	A	20		25		-70 to +300	-94 to +572	15	1954	2.00	360	A metal encased version of the Variseal PW. The metal provides the most reliable anti-rotation feature of all the rotary seals listed above.
				200	2900	250	3626							
CW 	B	B	A	20		25		-70 to +300	-94 to +572	15	1954	2.00	360	Similar to Variseal CM, this design is energized with a Slantcoil spring which provides lower friction and closer control of torque values.
				200	2900	250	3626							

Special Types

TURCON® VARISEAL® HI-CLEAN

Turcon® Variseal® M2, M2S and Roto Variseal® are available with the spring groove filled with high temperature silicone. Extremely important in food and pharmaceutical processing, this minimizes the trapping of contaminants within the seal, making it easier to clean.

ADVANTAGES

- Significantly reduced dead space
- Can be sterilized easily
- Silicone compound increases sealing pressure

When ordering Variseal® Hi-Clean, change the last digit to the letter R.

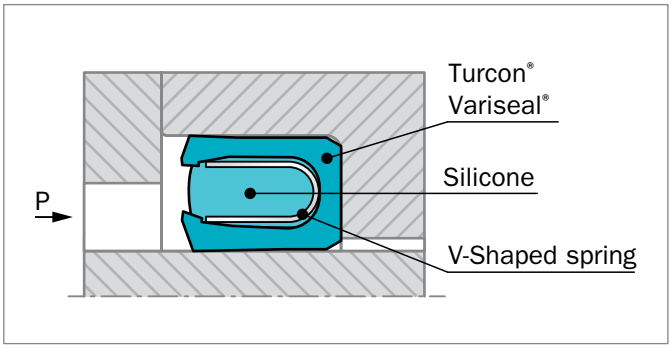


Figure 34: Turcon® Variseal® Hi-Clean

TSS ARTICLE NUMBER EXAMPLE

RVC2N0350 - T40SR

This version is also recommended for high-pressure applications or when the extrusion gap is larger than prescribed.

TURCON® VARISEAL® WITH EXTENDED HEEL

All Turcon® Variseal® types except the Turcon® Roto Variseal® can be supplied with an extended heel as an alternative to existing O-Ring groove versions, with or without back-up ring (Figure 33 and Figure 35).

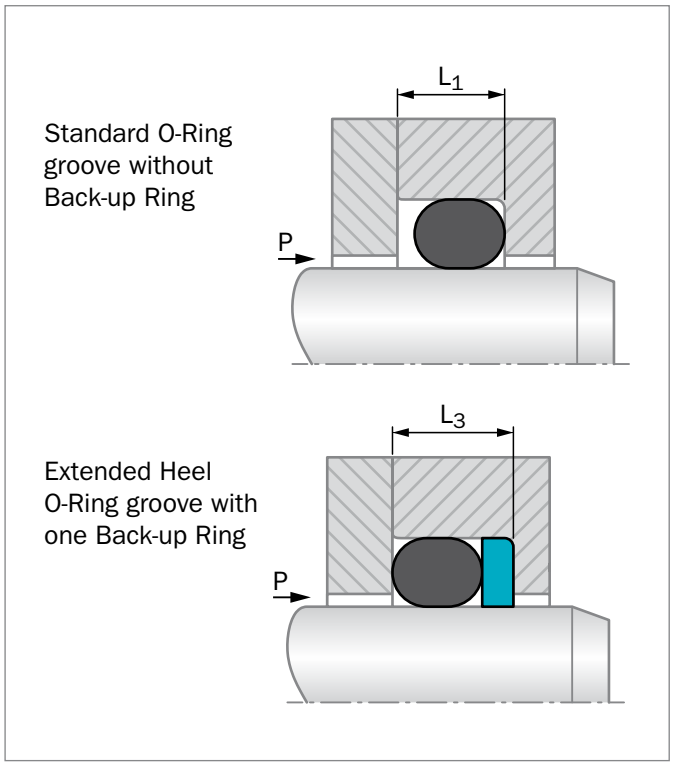


Figure 33: Standard O-Ring groove with and without Back-up Ring

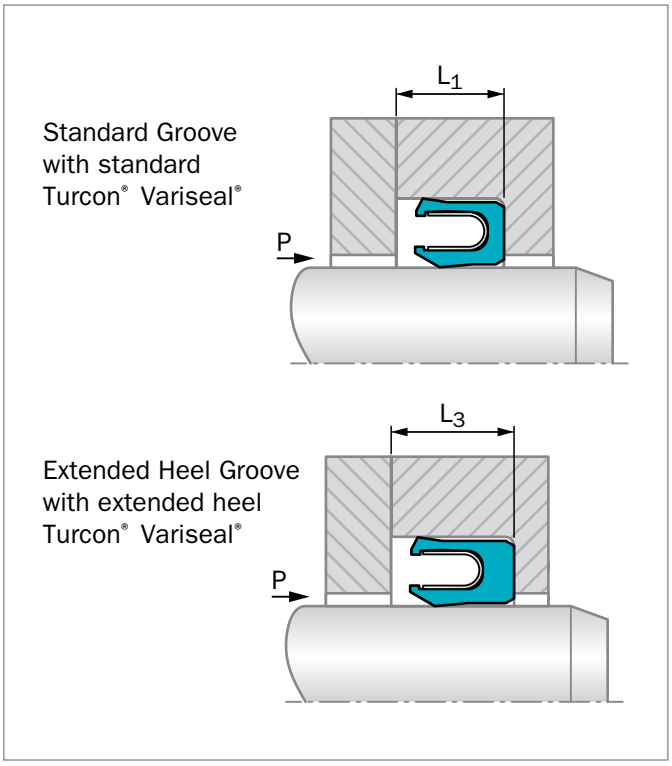


Figure 35: Standard Turcon® Variseal® and Turcon® Variseal® with extended heel

Table 50: Groove Widths

Series No.				Groove Width mm (inch)	
Rod		Piston		L_1	L_3
RV_0	RV_A	PV_0	PV_A	2.40 (0.094)	3.80 (0.149)
RV_1	RV_B	PV_1	PV_B	3.60 (0.141)	4.65 (0.183)
RV_2	RV_C	PV_2	PV_C	4.80 (0.188)	5.70 (0.235)
RV_3	RV_D	PV_3	PV_D	7.10 (0.281)	8.50 (0.334)
RV_4	RV_E	PV_4	PV_E	9.50 (0.375)	11.20 (0.475)
RV_5	RV_G	PV_5	PV_G	15.00 (0.591)	20.00 (0.757)

Groove widths for standard grooves L_1 and grooves with one Back-up Ring to L_3.

A wide range of special and customized Variseal® designs are available. These may be slight modification to standard designs or a completely new configuration if required.

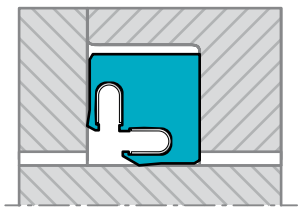
Table 51: Determining the TSS Article Number

Turcon Variseal® Types	Standard Rod/Piston	Extended Heel Rod/Piston
Turcon Variseal® M2	RVA/PVA	RV**B**/PV**B**
Turcon Variseal® M2S	RVC/PVC	RV**D**/PV**D**
Turcon Variseal® W2	RVJ/PVJ	RV**L**/PV**L**
Turcon Variseal® H	RVE/PVE	RV**F**/PV**F**

When ordering the above seal types, use the first two letters of the standard TSS Article Number and replace the third letter as shown in table.

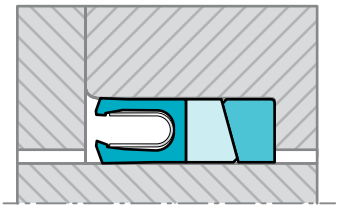
TSS ARTICLE NUMBER EXAMPLE

RVB2N0350-T40SM



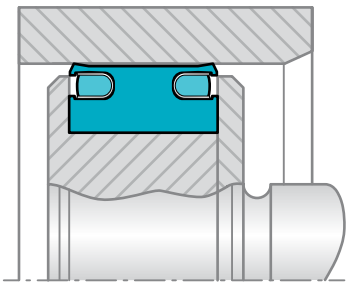
Rod/Face Seal

Low pressure seal to overcome large eccentricity



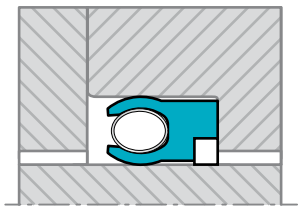
High Pressure System

Sealing system for extreme high pressure



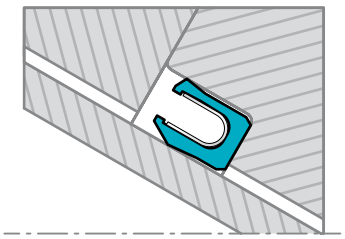
Double Acting Piston Seal

Hi-Clean version



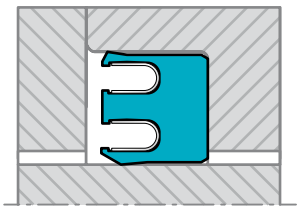
Turcon® Variseal® with Corner Reinforcement

Variseal® with high modulus corner reinforcement for high temperatures in combination with high pressure or large extrusion gap



Conical Seal

Variseal® produced in conical arrangement to seal against angled faces



Double Decker

Can be adopted to most groove dimension

Figure 36: Customized Designs

Storage Instructions

If seals and bearings are stored, the following guidelines should be followed to optimize their storage life.

- Do not store seals in a deformed condition
- Store dry under normal atmospheric conditions (65% relative moisture ±10%)
- Ideal temperature for storage is between +5 °C and +25 °C (+41 °F and +77 °F)
- Exposure to heat, moisture, light, oxygen, ozone and liquids can have a detrimental effect on performance characteristics of some materials
- Direct contact with heat sources should be avoided
- Ensure seals cannot be physically damaged by anything within the storage area
- Keep in the original sealed packaging

General Quality Criteria

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

Certification of our production plants in accordance with international standards QS 9000/ISO 9000 meets the specific requirements for quality control and management of purchasing, production and marketing functions.

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

All testing of materials and products is performed in accordance with accepted test standards and specifications, e.g. random sample testing in accordance with ISO 2859-1:2004-01 AQL 1,0 general inspection level II, normal inspection.

Inspection specifications correspond to standards applicable to individual product groups (e.g. for O-Rings: ISO 3601). Our sealing materials are produced free of chlorofluori-nated hydrocarbons and carcinogenic elements.

Guidelines for the Storage of Polymer Products Based on ISO 2230

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Visual inspection
Inspect each of the items for the following:
1. Permanent distortions, such as creases or flats.
2. Mechanical damage, such as cuts, tears, abraded areas or delaminated plies.
3. Surface cracking when viewed under a microscope at x10 magnification.
4. Changes in surface condition, such as hardening, softening or tackiness.

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

Table 52: Initial and extended storage periods for unassembled components

Material group	Initial storage period	Extended storage period
AU, EU, NR, SBR	5 years	2 years
ACM, AEM, CR, ECO, HNBR, IIR, NBR	7 years	3 years
CSM, EPDM, FKM, FMQ, FVMQ	10 years	5 years
FFKM e.g. Isolast®	20 years	5 years
Zurcon®	10 years	5 years
Turcon®	unlimited	

Note 1: If the storage temperature is over or under +25 °C this will influence the storage time. Storage at 10 °C higher will reduce the storage time by about 50 %. Storage at 10 °C lower will increase the storage time by around 100 %.
Note 2: In application areas such as aerospace the storage periods can differ from this specification. These specific storage conditions have to be agreed between the supplier and the buyer.

Table 53: SI - Basic Units

Measures	Units	Symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s
Electric current	Ampere	A
Temperature	Kelvin	K
Luminous intensity	Candela	cd
Amount of substance	Mol	mol

Table 54: Length

	inch	foot	yard	mm	metre
1 inch =		0.0833	0.0278	25.4	0.0254
1 foot =	12		0.333	304.8	0.3048
1 yard =	36	3		914.4	0.9144
1 mm =	0.03937	0.0033	0.00109		0.001
1 metre =	39.37	3.2808	1.0936	1,000	

Table 55: Torque

	inch-ounce	inch-pound	foot-pound	kg-metre	Newton-metre
1 inch-ounce =		0.0625	0.0052	$7.2x10^{-4}$	$7.06x10^{-3}$
1 inch-pound =	16		0.0833	$1.152x10^{-2}$	0.1130
1 foot-pound =	192	12		0.1383	1.356
1 kg-metre =	1,388.7	86.796	7.233		9.80665
1 Newton-metre =	141.6	8.850	0.7375	0.1020	

Table 56: Area

	$inch^2$	$foot^2$	$yard^2$	mm^2	m^2
1 $inch^2$ =		0.0069	0.00077	645.16	$6.45x10^{-4}$
1 $foot^2$ =	144		0.111	92,903	0.0929
1 $yard^2$ =	1,296	9		836,100	0.8361
1 mm^2 =	0.0016	$1.0764x10^{-5}$	$1.196x10^{-6}$		10-6
1 m^2 =	1,550	10.764	1.196	106	

Table 57: Volume

	$inch^3$	US quart	imp. gallon	$foot^3$	US gallon	liter
1 $inch^3$ =		0.0173	0.0036	0.00058	0.0043	0.0164
1 US quart =	57.75		0.2082	0.0334	0.25	0.9464
1 imp. gallon =	277	4.8		0.1604	1.2	4.546
1 $foot^3$ =	1,728	29.922	6.23		7.48	28.317
1 US gallon =	231	4	0.8327	0.1337		3.785
1 liter =	61.024	1.0567	0.220	0.0353	0.264	

Table 58: Temperature

	°K (Kelvin)	°C	°F
°K =		°C + 273.15	(°F - 459.67) 5/9
°C =	°K - 273.15		(°F - 32) 5/9
°F =	°K 9/5 - 459.67	°C 9/5 + 32	

Table 59: Density

	ounce/$inch^3$	pound/$foot^3$	g/cm^3
1 ounce/$inch^3$ =		108	1.73
1 pound/$foot^3$ =	0.0092		0.016
1 g/cm^3 =	0.578	62.43	

Table 60: Force

	Newton (N)	kilopond (kp)	pound force
1 Newton (N) =		0.10197	0.22481
1 kilopond (kp) =	9.80665		2.20463
1 pound force =	4.4482	0.45359	

Table 61: Velocity (Speed)

	foot/s	foot/min	mile/hour	metre/s	km/hour
1 foot/s =		60	0.6818	0.3048	1.097
1 ft/min =	0.017		0.0114	0.00508	0.01829
1 mile/hour =	1.4667	88		0.447	1.609
1 metre/s =	3.280	196.848	2.237		3.6
1 km/h =	0.9113	54.68	0.6214	0.278	

Table 62: Mass

	ounce	pound	kg
1 ounce =		0.0625	0.0283
1 pound =	16		0.4536
1 kg =	35.274	2.2046	

Table 63: Pressure

	inch Hg	psi	atmosphere	torr	mm Hg	bar	MPa	kg/cm^2
1 inch Hg =		0.491	0.0334	25.4	25.4	0.0339	0.00339	0.0345
1 psi =	2.036		0.0680	51.715	51.715	0.0689	0.00689	0.0703
1 atmosphere =	29.921	14.696		760	760	1.0133	0.10133	1.0332
1 torr =	0.0394	0.0193	0.0013		1	0.0013	0.00013	0.00136
1 mm Hg =	0.0394	0.0193	0.0013	1		0.0013	0.00013	0.00136
1 bar =	29.53	14.504	0.987	749.87	749.87		0.1	1.020
1 MPa =	295.3	145.04	9.869	7498.7	7498.7	10		10.2
1 kg/cm^2 =	28.950	14.22	0.968	735.35	735.35	0.980	0.098	

Your Partner for Sealing Technology

“We build long term partnerships with customers and suppliers by providing leading technology and excellent service.”

OUR MISSION

We will be the supply partner of first choice within our chosen markets, working globally through our local teams. We will build long-term partnerships with customers and suppliers by providing leading technology and excellent service.
We are determined to be different.

SEALING TECHNOLOGY

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

A WORLDWIDE PRESENCE

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

- Over 80 facilities worldwide
- More than 20 manufacturing sites
- Seven strategically positioned material and development laboratories
- Internationally linked design and application centers

COMMITMENT – TO CUSTOMERS' NEEDS LONG-TERM

The aim of Trelleborg Sealing Solutions is to facilitate customers in achieving cost-effective, durable solutions that match their specific business requirements and needs. We are one of the world's foremost experts in polymer sealing technology.
We develop, manufacture and supply safety-critical polymer-based precision seals, bearings and molded components.

THE TRELLEBORG GROUP

Trelleborg Coated Systems
Leading global supplier of unique customer solutions for polymer-coated fabrics deployed in a variety of industrial applications.

Trelleborg Industrial Solutions
Market leader in such industrial application areas as hose systems, industrial antivibration solutions and selected industrial sealing systems.

Trelleborg Offshore & Construction
Leading global supplier of polymer-based critical solutions for deployment in highly demanding environments.

Trelleborg Wheel Systems
Leading global supplier of tires and complete wheels for agricultural and forestry machines, forklift trucks and other materials handling vehicles.

Trelleborg Sealing Solutions
One of the world's leading developers, manufacturers and suppliers of precision seals. It supports its aerospace, industrial and automotive customers through over 20 production facilities and more than 50 marketing companies globally.

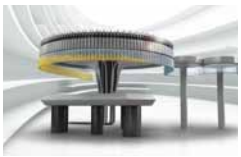
Trelleborg Sealing Solutions Key Industries


Aerospace

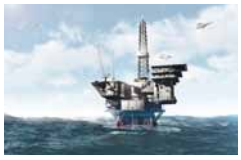

Automotive


Machine Tools & Fluid Power


Off-Highway, Agriculture, Construction


Food & Beverage, Chemical Processing


Life Sciences and Pharmaceutical


Oil & Gas


Mining


Alternative Energy


Marine

Our Global Resources

Americas

- 2 R&D Centers
- 18 Marketing Companies
- 1 Logistics Centers SCM
- 6 Manufacturing Sites
- Damping Solutions
- 2 Automotive Hubs
- 4 Aerospace Hubs

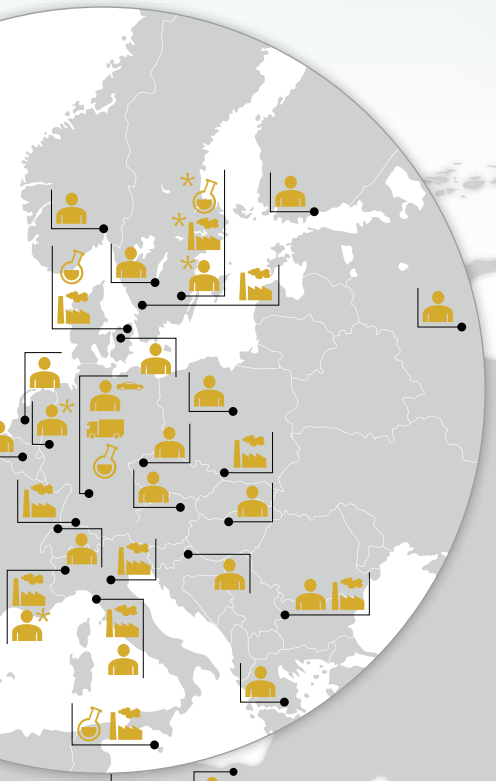
TRELLEBORG

8	Research & Development Centers
54	Marketing Companies
4	Logistics Centers
24	Manufacturing Sites
	Damping Solutions
5	Automotive Hubs
8	Aerospace Hubs

5,300
employees

82
worldwide locations

More than
2,000
proprietary material formulations



Europe

- 5 R&D Centers
- 21 Marketing Companies
- 1 Logistics Centers SCM
- 14 Manufacturing Sites
- Damping Solutions
- 1 Automotive Hubs
- 2 Aerospace Hubs

Asia

- 1 R&D Centers
- 15 Marketing Companies
- 2 Logistics Centers SCM
- 4 Manufacturing Sites
- Damping Solutions
- 2 Automotive Hubs
- 2 Aerospace Hubs

Products, Brands and Materials

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

WORLD RENOWNED NAMES UNITED

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

- **American Variseal**
- **Busak+Shamban**
- **Dowty Seals**
- **Chase Walton**
- **Forsheda**
- **GNL**
- **Impervia**
- **Nordex**
- **Orkot**
- **Palmer Chenard**
- **Polypac**
- **SF Medical**
- **Shamban**
- **Silcofab**
- **Silcotech**
- **Skega**
- **Stefa**
- **Wills**

PROPRIETARY MATERIALS

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

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

OUR PIONEERING PRODUCTS

Trelleborg Sealing Solutions is pioneering and is continuously developing innovative products.

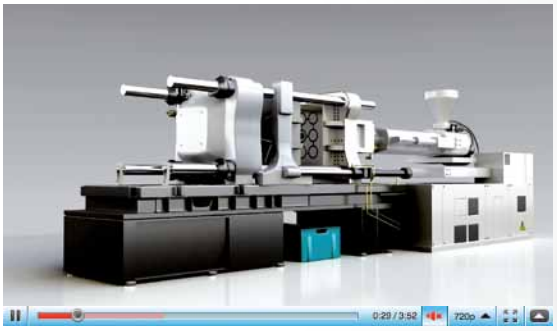
- **Turcon® AQ Seal®**
- **D-A-S Compact Seal®**
- **Turcon® Double Delta®**
- **Turcon® Excluder®**
- **Turcon® Glyd Ring® T**
- **Turcon® Hatseal**
- **Zurcon® L-Cup®**
- **Turcite® Slydring®**
- **Turcite® B-Slydway®**
- **Turcon® Stepseal® 2K**
- **V-Ring®**
- **Turcon® Varilip® PDR**
- **Turcon® Variseal®**
- **Turcon® VL-Seal™**
- **Turcon® Wedgpak®**
- **Wills Rings®**
- **Zurcon® Wynseal®**

To design a solution for your specific needs, contact your local Trelleborg Sealing Solutions marketing company.

Films and Animations

SEEING IS BELIEVING

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



View at
YouTube.com/trelleborgseals
YouTube

View at
tss.trelleborg.com/films

Online 24-7
A range of films specific to different industries and products are available to view on the Trelleborg Sealing Solutions website or via YouTube.


Turcon® Roto L
Energy saving with no friction

Digital Services

ONLINE TOOLS MAKE LIFE EASIER

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

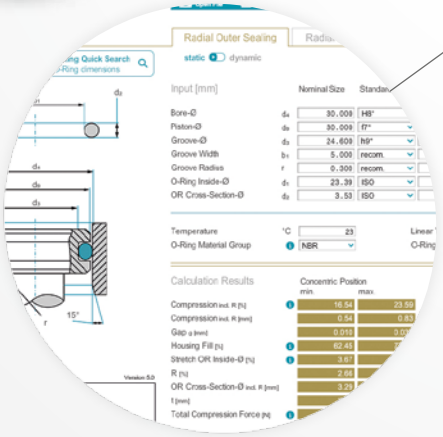
There is also a continually increasing range of innovative engineering apps available for smartphones, both for iOS and Android devices. Just search for "Trelleborg" in the App Store or GooglePlay to find the tools to optimize your daily productivity.

Materials Search and Chemical Compatibility Check

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

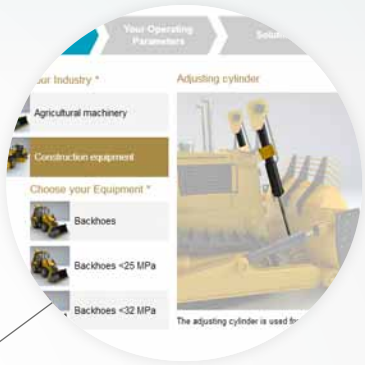
O-Ring Calculator

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



Versatile CAD Service

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

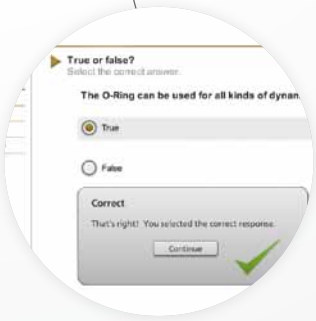


Sealing Solutions Configurator

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

Powerful Electronic Catalog

Search through over 100,000 seals by item number or their properties and access comprehensive and detailed information plus an interactive quote facility.



E-Learning on sealing technology

Trelleborg Sealing Solutions has a number of e-Learning modules available on several aspects of sealing technology.

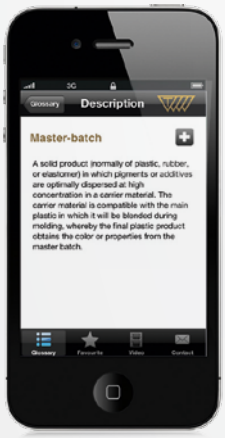
For more information
www.tss.trelleborg.com

Mobile Apps and Services

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

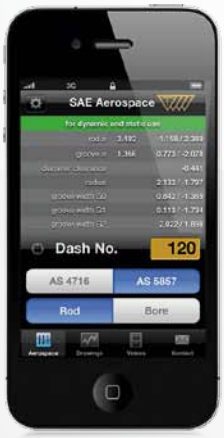
ISO Fits & Tolerances App

Simply enter the nominal diameter and select the tolerance classes for bore and shaft to find the complete ISO fits definition with all relevant values including type of fit, with handy graphs to illustrate the classes by bore and shaft.



Technical Glossary App

This app provides definitions of more than 2,000 terms from the world of sealing technology and engineering.



Aerospace Groove Selector App

This app covers two of the most important SAE aerospace groove standards for hydraulic systems, AS4716 Rev B and AS5857 Rev A, making it really easy to find the size of grooves and hardware needed.

Installation Instructions App

Videos demonstrate the best practice methods for installing seals, providing all relevant documentation within the interface, guiding you to a successful installation of Radial Oil Seals and Turcon® and Zurcon® rod and piston seals.

Unit & Hardness Converter App

Intuitive and very easy to use, simply select the dimension and enter the value for conversion. The app offers a wide range of engineering and scientific units for each dimension.

For more information
www.tss.trelleborg.com

Android App on
Google Play

MANY MORE APPS available

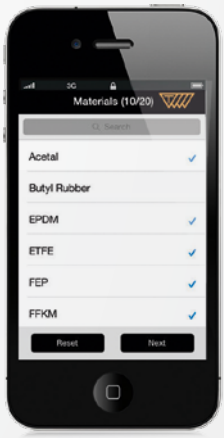
Available on the
APP STORE

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

O-Ring Calculator App
When a user enters installation specifications into the O-Ring Calculator app, such as the bore or rod/shaft diameter, the app quickly calculates O-Ring and housing dimensions in both metric and inch.

Hydraulic Cylinder Calculator
Quickly calculate areas and volumes in cylinders, extraction and retraction forces, time velocity and outflow by entering the requisite dimensions and parameters of the cylinder. In compliance with ISO 3320, ISO 3321 and ISO 4393.

Tubing and Hose App
Developed specially for life sciences engineers, this app helps you to easily choose the correct tubing and hose based on material, pressure and dimensions, removing the need to search through catalogs.



Material Compability App
Cross reference a wide variety of different materials with chemical environments to find the most effective compounds for your application. Select up to 20 materials at once to produce an easy to read compatibility chart with recommendations for use.

Notes

LOCAL CONTACTS

EUROPE

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Czech Republic - Rakovnik (Slovakia)
+420 313 529 111
Denmark – Copenhagen
+45 48 22 80 80
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The Netherlands - Rotterdam
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Norway – Oslo
+47 22 64 60 80
Poland – Warsaw (Lithuania)
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Russia – Moscow
+7 495 627 57 22
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Canada West – Langley, BC
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USA, Midwest - Schaumburg, IL
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USA, Northern California - Fresno, CA
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USA, Northwest - Portland, OR
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USA, Southwest - Houston, TX
+1 713 461 3495

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Aerospace Hub Distribution & Engineering
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Aerospace Hub East
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Aerospace Hub West
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Automotive Hub South America
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AFRICA, CENTRAL ASIA AND MIDDLE EAST

Details available at **www.tss.trelleborg.com**

TRELLEBORG

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative engineered solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has local presence in over 40 countries around the world.

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