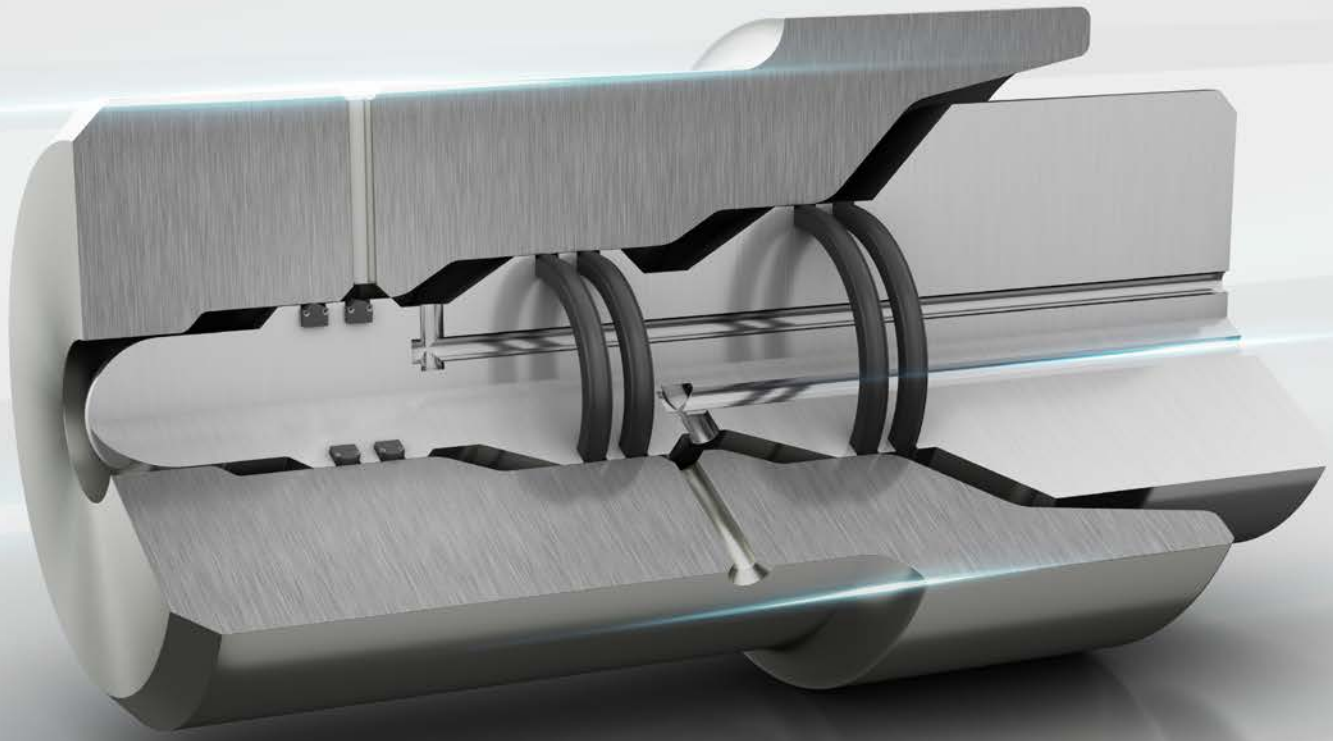
XploR™ S-Seal

HIGH INTEGRITY SEALING FOR EXTREME PRESSURES AND TEMPERATURES



Protecting the Essential

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

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

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

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

ISO 9001

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■ XploR™ S-Seal

DESCRIPTION

XploR™ S-Seal, also known as Spring Seals, offer unrivaled high temperature, high pressure (HTHP) sealing integrity in static Oil & Gas applications. Using innovative, flexible anti-extrusion support elements in the corners of the seal ensures robust and high performance sealing in challenging energy application conditions.

Leak-tight sealing is achieved by controlled deformation of the elastomer element. Extrusion resistance is provided by the specially designed springs that support the elastomer element, yet are flexible enough to allow straightforward installation.

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

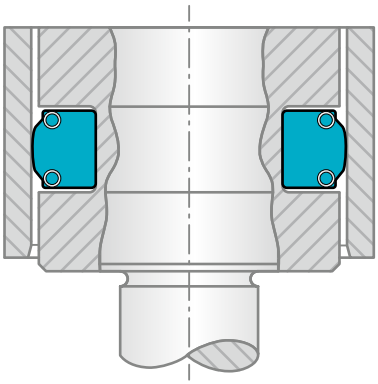


Figure 1: XploR™ S-Seal

FEATURES AND BENEFITS

- Withstands pressures up to 15,000 psi / 103.4 MPa and temperatures up to +500 °F / +260 °C
- Withstands pressures up to 30,000 psi / 207 MPa at ambient temperatures
- Bi-directional, leak-tight sealing even with relatively rough surface finishes
- High extrusion resistance from integrally molded helical springs
- Designed to fit international standard O-Ring grooves
- Single piece for ease of handling
- Flexible and stretchable for simple installation in closed grooves
- Symmetrical design eliminates installation errors
- RGD-resistant XploR™ materials compliant to NORSOK, NACE, API and Total standards for demanding downhole environments Anti-extrusion elements available in materials to suit almost all customer requirements

APPLICATION EXAMPLES

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

OPERATING CONDITIONS

Pressure:	Up to 15,000 psi / 103.4 MPa
Temperature:	-50 °F to +500 °F / -45 °C to +260 °C (depending on elastomer material)
Media Compatibility:	Mineral oil, synthetic fluids, water-based hydraulic fluids, downhole fluids, H_2S, acids, and other media depending on elastomer material selection.

IMPORTANT NOTE

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

TECHNICAL EXPERTISE

Our engineering teams are available to support your design requirements. The XploR™ S-Seal has been designed using Finite Element Analysis (FEA) to optimize squeeze, volume fill and other parameters, ensuring optimal performance and service life. Our engineers have created a fully populated material database, modeling elastomers across key temperature ranges to account for glass transition characteristics, thermal expansion effects and other material properties. Accurate material models are paramount to guiding our customers to the most appropriate solution.

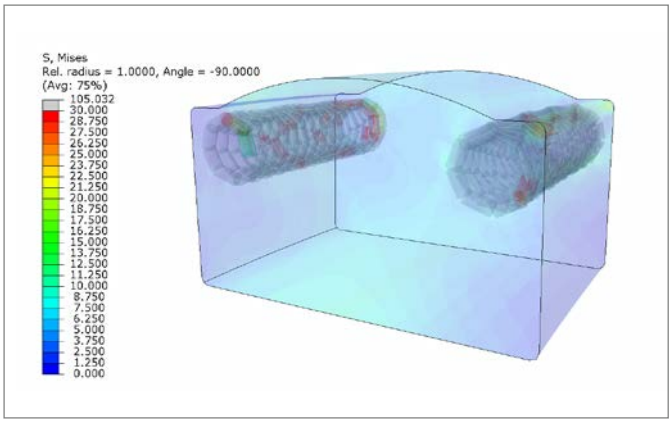


Figure 2: FEA for XploR™ S-Seal showing anti-extrusion elements

FULLY TESTED AND API READY

XploR™ S-Seal has been internally tested to the ISO 10423 (API-6A) Annex F PR2 test profile as shown in Figure 3. This testing profile subjects the seals and equipment to varying pressure and temperature combinations over several days to ensure they survive as a unit and will operate as intended.

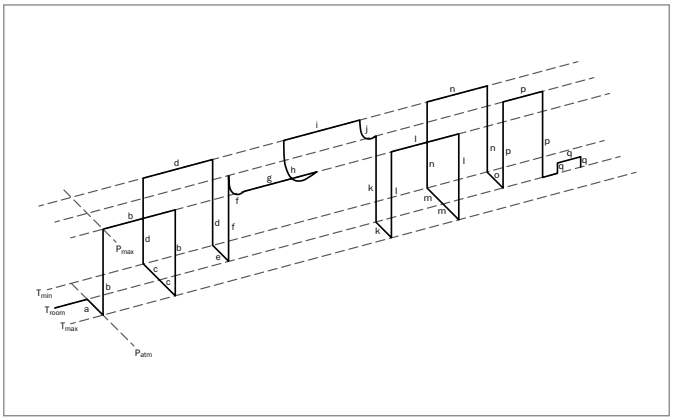


Figure 3: ISO 10423 testing profile

The ISO 10423 specification also dictates several equipment temperature classes relating to expected field conditions. Two ISO temperature classes were chosen – Class U and Class V – as shown in Table 1. The details of the test pressures are shown in Table 2.

Table 1: ISO 10423 temperature classes

Temperature Classification	Operating Range (°F)		Operating Range (°C)	
	Min.	Max.	Min.	Max.
K	-75	180	-60	82
L	-50	180	-46	82
N	-50	140	-46	60
P	-20	180	-29	82
S	0	140	-18	60
T	0	180	-18	82
U	0	250	-18	121
V	35	250	2	121
X*	0	350	-18	176
Y*	0	650	-18	343

* Removed from API-6A / ISO 10423 in 2013

Table 2: Trelleborg Sealing Solutions test parameters

Temperature Class	Temperature	Pressure
Class U	0 °F to +250 °F / -18 °C to +121 °C	10,000 psi / 69 MPa
Class V	+35 °F to +250 °F / +2 °C to +121 °C	15,000 psi / 103.4 MPa

The internal test was performed with two 5.5 inch / 140 mm piston configuration XploR™ S-Seal located on the ends of a piston with pressure applied between the seals as shown in Figure 4.

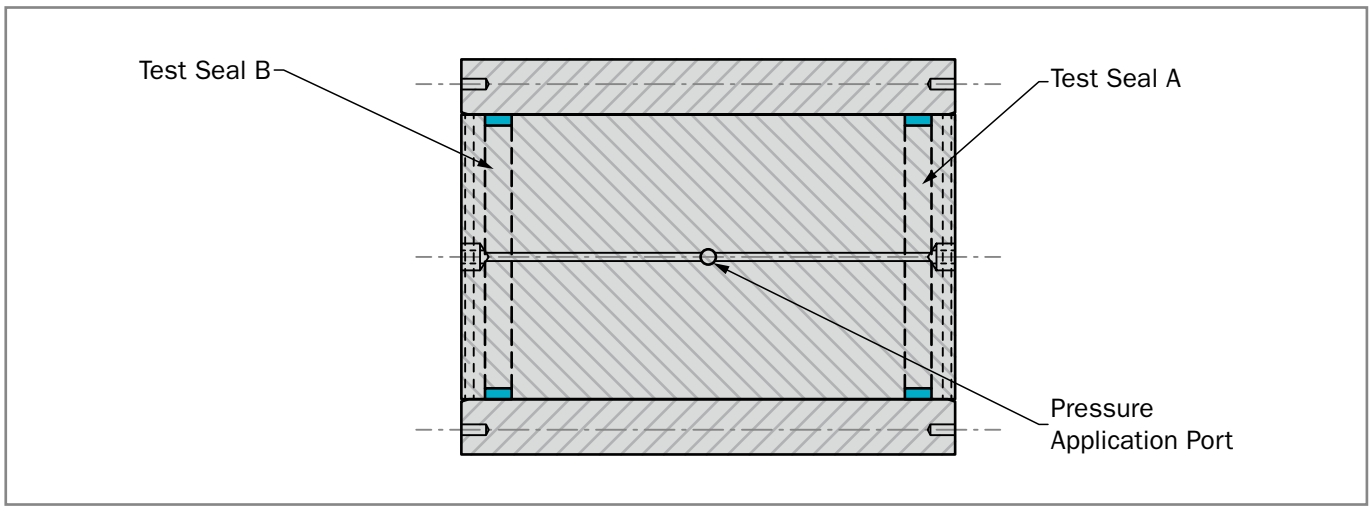


Figure 4: Schematic of test vessel

The surface finish of mating metal components is very important to overall system performance. Typically, the better the surface finish, the better the seal performance. The surface finish of the tested bore was recorded and found to be in good condition as shown in Table 3. For more information on the meaning and importance of each surface finish parameter, please contact your local Trelleborg Sealing Solutions Customer Solution Center.

Table 3: Surface finish analysis of test vessel bore

ISO 4287		
Amplitude parameters - Roughness profile		
R_a	6.59 µin / 0.16 µm	Gaussian filter, 31.5 mil
R_q	9.17 µin / 0.23 µm	Gaussian filter, 31.5 mil
R_{sk}	-1.37 µin / -0.03 µm	Gaussian filter, 31.5 mil
R_z	57.10 µin / 1.45 µm	Gaussian filter, 31.5 mil
R_c	18.20 µin / 0.46 µm	Gaussian filter, 31.5 mil, ISO 4287 w/o amendment 2
R_t	85.80 µin / 2.18 µm	Gaussian filter, 31.5 mil
R_v	42.00 µin / 1.07 µm	Gaussian filter, 31.5 mil
R_p	15.20 µin / 0.38 µm	Gaussian filter, 31.5 mil
Material Ratio parameters - Roughness profile		
R_{mr}	78.60 %	c=14.5 µin / 0.37 µm under the ref, 5%, Gaussian filter, 31.5 mil

The preferred material for these API classes is XploR™ V9T82 due to its broad temperature range and industry compliance. Results verify that XploR™ S-Seal is compliant with the specification and no pressure drop is observed after system stabilization. The ISO 10423 specification does allow for a 5% or 500 psi / 3.4 MPa pressure decay (whichever is less) but it was not observed in the testing. Testing was performed three times with new seals at each temperature class to confirm repeatability. In each test, no pressure decay was observed.

MATERIAL EXPERTISE

Trelleborg Sealing Solutions has the most comprehensive material portfolio that is compliant with industry standards in the sealing world. Certifications include:

- API-6A (ISO 10423) Annex F Class FF/HH (10% Hydrogen Sulfide {H_2S})
- NORSOK M-710 sour immersion and Rapid Gas Decompression
- API-16C
- SHELL and TOTAL Rapid Gas Decompression standards
- NACE TM0296
- NACE TM0187

Even though they are compliant with industry standards, care should be taken to select the proper material for your application. Please contact your local Customer Solution Center for material compatibility guidance. Commonly specified elastomer materials are listed in Table 4.

Table 4: Commonly specified elastomer materials for XploR™ S-Seal

ASTM Material Type	Shore A Hardness ASTM 2240	Full Material Code	Description	Continuous Service Temperature Range	Tensile Strength ASTM D412	Elongation ASTM D412	100% Modulus ASTM 1414	Compression Set ASTM D395	Short Code for Part Number*
NBR	70	N7T30	General purpose Shore 70A NBR for applications not requiring industry-approved materials or RGD resistance	-22 °F to +212 °F / -30 °C to +100 °C	2,030 psi / 14 MPa min.	250% min.	360 psi / 2.5 MPa min.	25% max at 22 hours and +212 °F / +100 °C	N7
NBR	90	N9T30	General purpose Shore 90A NBR for applications not requiring industry-approved materials or RGD resistance	-31 °F to +212 °F / -35 °C to +100 °C	2,030 psi / 14 MPa min.	125% min.	1300 psi / 9 MPa min.	25% max at 22 hours and +212 °F / +100 °C	N9
HNBR	**90**	**XploR™ H9T20**	**Premium Shore 90A HNBR with superior extrusion resistance and full compliance with NORSOK, NACE MR0187 & MR0296 and API-6A & 16C specifications**	**-13 °F to +320 °F / -25 °C to +160 °C**	**4,000 psi / 27.8 MPa min.**	**150% min.**	**1,920 psi / 13.3 MPa min.**	**38% max at 72 hours and +302 °F / +150 °C 48% max at 168 hours and +302 °F / +150 °C**	**X3**

Materials in **bold** are preferred materials, carrying industry certifications and proven for use in-application.

ASTM Material Type	Shore A Hardness ASTM 2240	Full Material Code	Description	Continuous Service Temperature Range	Tensile Strength ASTM D412	Elongation ASTM D412	100% Modulus ASTM 1414	Compression Set ASTM D395	Short Code for Part Number*
HNBR	**90**	**XploR™ H9T21**	**Premium Shore 90A low temperature HNBR with superior extrusion resistance and NORSOK RGD and NACE MR0187 & MR0296 compliance**	**-31 °F to +320 °F / -35 °C to +160 °C**	**2,150 psi / 14.8 MPa min.**	**150% min.**	**1,450 psi / 10 MPa min.**	**50% max at 72 hours and +302 °F / +150 °C 60% max at 168 hours and +302 °F / +150 °C**	**X5**
HNBR	90	XploR™ H9T80	Low temperature Shore 90A HNBR for general use and compliance to NACE MR0187 & MR0296 and API-16C industry standards	-67 °F to +300 °F / -55 °C to +150 °C	2,610 psi / 18 MPa min.	120% min.	1,750 psi / 12 MPa min.	30% max at 22 hours and +302 °F / +150 °C	H2
HNBR	90	XploR™ H9T81	Low compression set Shore 90A HNBR with API-16C compliance and intended for general use in other applications that do not require compliance to industry standards	-13 °F to +320 °F / -25 °C to +160 °C	3,000 psi / 20.5 MPa min.	100% min.	1740 psi / 12 MPa min.	25% max at 22 hours and +350 °F / +177 °C	H3
FKM	75	VCT33	General purpose Shore 75A FKM for applications not requiring industry-approved materials or RGD resistance	+5 °F to +437 °F / -15 °C to +225 °C	1,450 psi / 10 MPa min.	150% min.	650 psi / 4.5 MPa min.	20% max at 22 hours and +392 °F / +200 °C	VG
FKM	**90**	**XploR™ V9T20**	**Premium Shore 90A FKM with superior extrusion resistance and full compliance to NORSOK and API-6A & 16C immersion specifications**	**-4 °F to +392 °F / -20 °C to +200 °C**	**3,000 psi / 20.5 MPa min.**	**150% min.**	**1,500 psi / 10.5 MPa min.**	**30% max at 24 hours and +392 °F / +200 °C**	**X2**

Materials in **bold** are preferred materials, carrying industry certifications and proven for use in-application.

ASTM Material Type	Shore A Hard-ness ASTM 2240	Full Material Code	Description	Continuous Service Temperature Range	Tensile Strength ASTM D412	Elongation ASTM D412	100% Modulus ASTM 1414	Compression Set ASTM D395	Short Code for Part Number*
FKM	90	XploR™ V9T22	**High temperature Shore 90A FKM with full compliance to NORSOK and API-6A & 16C specifications**	-22 °F to +446 °F / -30 °C to +230 °C	2,500 psi / 17.1 MPa min.	130% min.	1,650 psi / 11.3 MPa min.	30% max at 72 hours and +392 °F / +200 °C 35% max at 168 hours and +392 °F / +200 °C	X4
FKM	**90**	**XploR™ V9T82**	**Best all-round performance Shore 90A FKM low temperature compound with full compliance to NORSOK, NACE MR0187 & MR0296 and API-6A & 16C immersion specifications**	**-40 °F to +400 °F / -40 °C to +205 °C**	**2,030 psi / 14 MPa min.**	**100% min.**	**1740 psi / 12 MPa min.**	**25% max at 24 hours and +392 °F / +200 °C**	**X6**
FFKM	**95**	**Isolast® J9513**	**High temperature Shore 90A FFKM with full compliance to NORSOK and API-6A & 16C immersion specifications**	**+14 °F to +500 °F / -10 °C to +260 °C**	**2,175 psi / 15 MPa min.**	**75% min.**	**N/A**	**30% max at 72 hours and +392 °F / +200 °C 35% max at 168 hours and +392 °F / +200 °C**	**JX**
FFKM	**90**	**Isolast® J9523**	**Best all-round performance Shore 90A FFKM low temperature compound with full compliance to NORSOK and API-6A & 16C immersion specifications**	**-40 °F to +464 °F / -40 °C to +240 °C**	**2,000 psi / 13.7 MPa min.**	**175% min.**	**800 psi / 5.6 MPa min.**	**25% max at 72 hours and 392 °F / +200 °C**	**J2**

Materials in **bold** are preferred materials, carrying industry certifications and proven for use in-application.

* See Part Number System and Ordering Examples on page 27.

Using elastomers at low temperatures and high pressures can adversely affect the glass transition temperature (Tg) of a polymer. As pressure is applied to an elastomer, the Tg has a tendency to shift upwards, resulting in a higher value for a given material. The resultant Tg is a function of the pressure applied and type of polymer. The exact phenomenon is not entirely understood but seal and equipment designers must take the Tg shift into account when attempting to seal at low temperatures and high pressures.

Changes in the glass transition temperature of two different FFKM materials under pressures up to 30,000 psi at room temperature is shown in Figure 5. The top line represents the shift in Tg of Isolast® J9513, with leakage observed at around 21,000 psi at room temperature. When switching to low temperature Isolast® J9523 FFKM, the Tg shift represented in the bottom line still occurs but initiates at a lower temperature, resulting in bubble tight sealing up to 30,000 psi at room temperature.

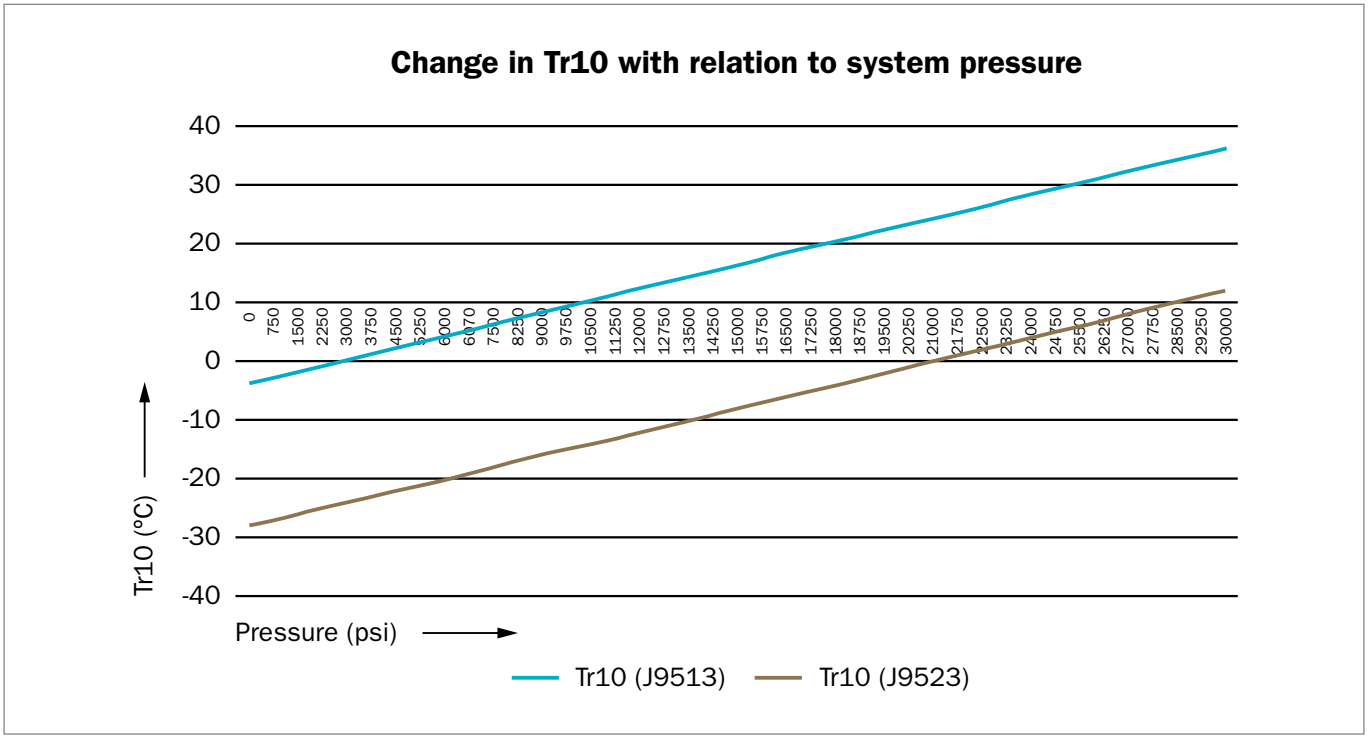


Figure 5: Change in Tr10 values of Isolast® J9513 and Isolast® J9523 FFKM materials in relation to system pressure

ANTI-EXTRUSION ELEMENTS

Figure 6: Spring types, left to right – Stainless Steel, PEEK, Helical Flat Coil Carbon Fiber and Helical Flat Coil Metallic

When choosing the correct spring material, it is important to consider the long term effects of the interaction between the seal, spring and mating hardware. Metallic springs are the most cost-effective and robust solution, but can damage the mating hardware surfaces under higher pressures (see Figure 7). Available spring materials are shown in Table 5.

Table 5: Spring material options

Material	Material Type	Material Code
Stainless Steel	**SS302**	**GS1**
Stainless Steel	SS316	GS2
Special CRA	Inconel® 600	GS6
Special CRA	Elgiloy® (NACE MR-1075)	GSE
Special CRA	Elgiloy® (NACE MR-1075)	GSX
Thermoplastic	Virgin PEEK	GSP
Thermoplastic	Helical Flat Coil Carbon Fiber	GSF

Inconel® is a registered trademark of Special Metals Corporation. Elgiloy® is a trademark of Elgiloy Speciality Metals.

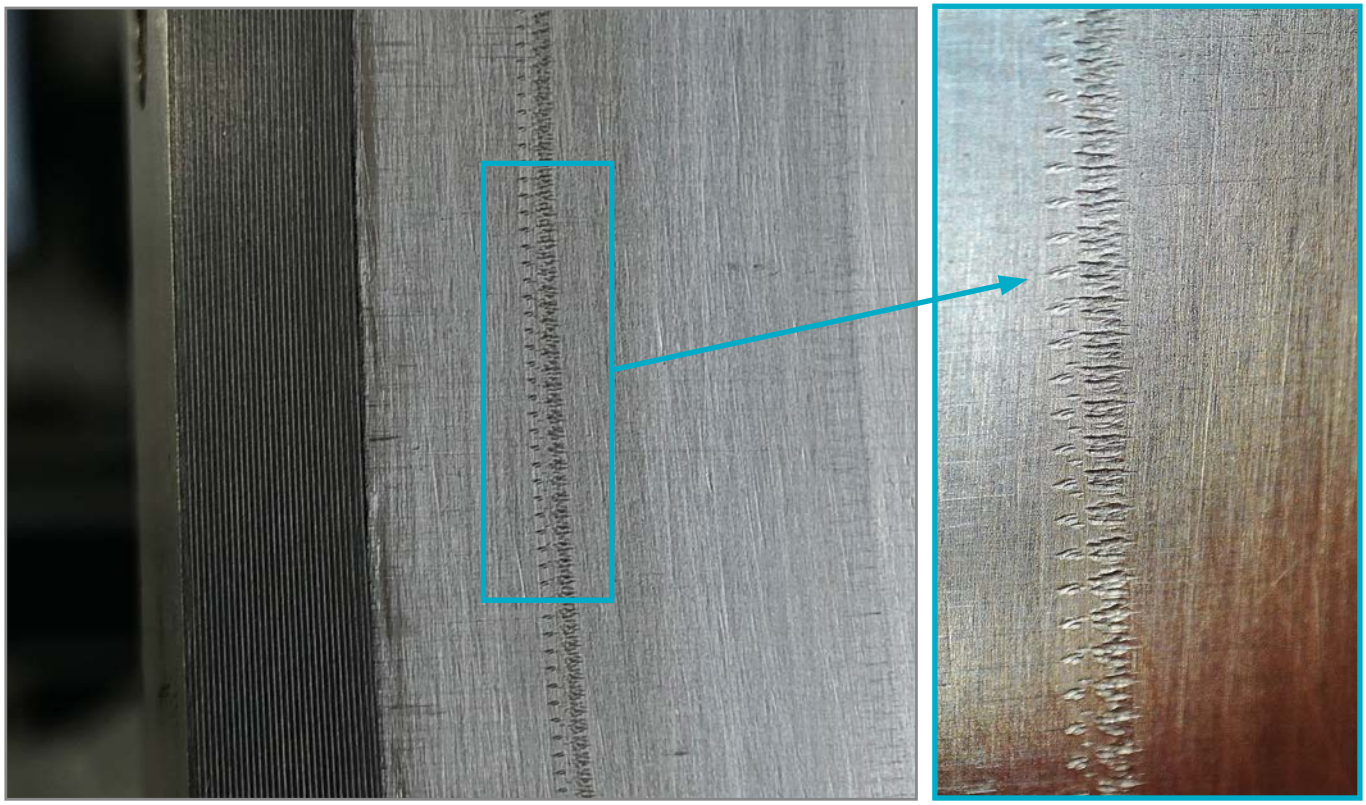


Figure 7: Damage to the mating surface caused by stainless steel springs at high pressures.

Alleviation of hardware damage can be achieved by using a PEEK or carbon fiber composite spring. PEEK springs only leave a witness mark on the hardware, but chemical compatibility must be considered when choosing this for a spring material. The relative cost of PEEK springs is also higher than metal. Carbon fiber springs offer the best performance with respect to minimizing hardware damage and maximizing chemical compatibility. The relative cost is higher than PEEK springs.

XploR™ S-Seal II

DESCRIPTION

Combining the benefits of integral anti-extrusion components with the flexibility of an elastomeric seal, XploR™ S-Seal II offers maximum extrusion resistance in demanding high-pressure and high-temperature sealing environments with slow linear dynamic movement.

XploR™ S-Seal II demonstrates that an 'S-Seal' style product design operates effectively in dynamic conditions. Trelleborg Sealing Solutions has developed specialized spring designs fabricated from innovative materials to ensure leak-tight performance.

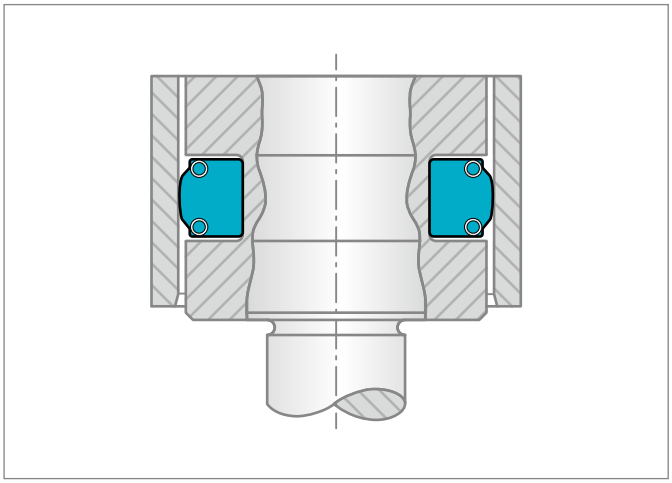


Figure 8: XploR™ S-Seal II

FEATURES AND BENEFITS

- Same bidirectional single-piece design as the XploR™ S-Seal for high-pressure/ high-temperature (HPHT) applications
- Capable of slow linear dynamic movement while exposed to high temperature and pressure conditions
- Integrally molded flat coil springs provide a high level of extrusion resistance with larger e-gaps up to 0.010 inches (0.25 mm) with dynamic movement
- Identical flexibility as the S-Seal allows installation in closed grooves
- Available with flat coil Elgiloy® spring for the highest HPHT capability or flat coil carbon fiber spring for best hardware compatibility
- Elastomer sealing element provides leak tightness against sub-optimal mating surface finishes
- Available in standard O-Ring dash sizes or custom-engineered to fit existing hardware
- Materials certified to NORSOK, NACE, API and Total standards for demanding energy environments
- Successfully tested to 20,000 psi / 138 MPa and +300 °F / +150 °C dynamically up to 200 six-inch (152 mm) strokes
- Statically withstand pressures up to 30,000 psi / 207 MPa at lower temperatures

APPLICATION EXAMPLES

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

OPERATING CONDITIONS

Pressure:	Up to 20,000 psi / 138 MPa dynamic (30,000 psi / 207 MPa static)
Temperature:	-50 °F to +300 °F / -45 °C to +150 °C (depending on elastomer material)
Media Compatibility:	Mineral oil, synthetic fluids, water-based hydraulic fluids, downhole fluids, H_2S, acids, and other media depending on elastomer material selection.

IMPORTANT NOTE

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

SPRING DESIGNS

Two different spring designs are available for linear dynamic movement. Each spring is a helically wound flat coil spring with an integrated stainless steel garter spring inside to add stability and extrusion resistance between the helical spring coils. The different spring designs offer unique capabilities based on the requirements of the application:

Carbon Fiber Composite Helically Wound Flat Coil Spring
Offers excellent chemical compatibility with minimal adverse hardware effects during stroking. The maximum temperature and pressure capabilities are reduced slightly versus a metallic spring.

Elgiloy™ Helically Wound Flat Coil Spring
Offers the highest temperature and pressure resistance, but potentially adverse hardware compatibility during stroking needs attention.

The stroke life of XploR™ S-Seal II is dependent upon the pressure, temperature, and spring material. Figure 11 illustrates that the higher the temperature at a given pressure, the lower the stroke life generally is. Likewise, at a given temperature, a higher pressure will reduce stroke life.

TESTING

XploR™ S-Seal II was tested in dynamic conditions using a 2 inch (50 mm) diameter rod and 6 inch (127 mm) stroke length in one direction. The rod was continuously stroked slowly at 1 inch/sec (0.025 m/s) under the specified temperature and pressure for up to 200 repetitions. The helically wound flat coil spring caused witness marks on the rod as shown in Figure 9. Though this type of spring can achieve higher temperature and pressure values, the impact of witness marks on the rod should be assessed on a case-by-case basis to ensure hardware maintenance cycles and longevity goals will be met.

Figure 9: Witness marks on rod after testing with metallic spring

The carbon fiber spring version reached a lower temperature and pressure, but the rod was not marked as shown in Figure 10. The non-metallic spring material is less detrimental to the mating hardware surfaces and should be considered as the first choice to protect hardware and lengthen maintenance cycles.

Figure 10: Undamaged rod after testing with carbon fiber spring

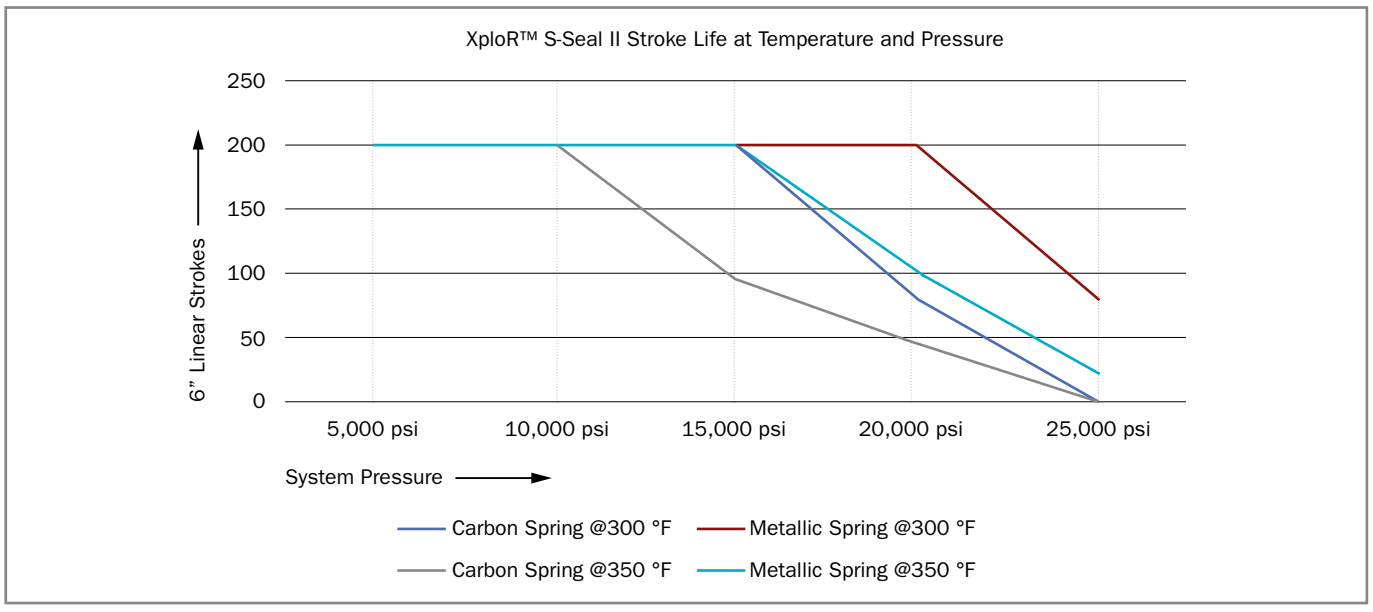


Figure 11: XploR™ S-Seal II stroke life at specific temperatures with varying pressures

■ XploR™ S-Seal and S-Seal II Installation Recommendations

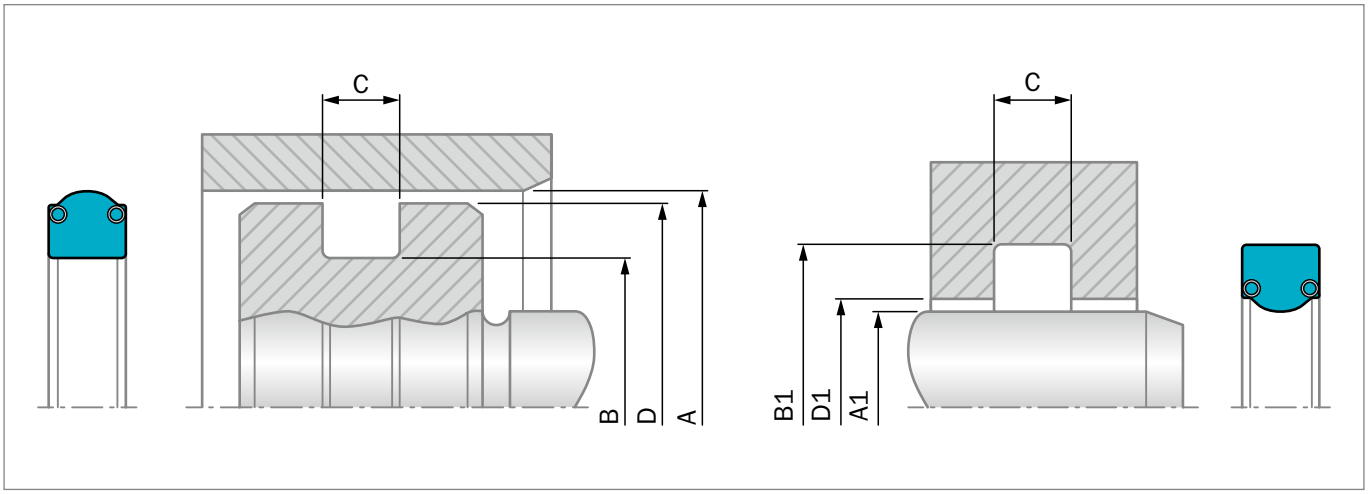


Figure 12: Installation drawing

HARDWARE GROOVE INFORMATION

The primary groove standards in the Oil & Gas industry for O-Rings are centered around ISO 3601-2 and the Parker O-Ring standard. Given their prevalence, Trelleborg Sealing Solutions has standardized their designs to match these groove dimensions. Smaller cross-section grooves, such as the -000 and -100 series, are not supported due to a lack of space to include an anti-extrusion element. Supported sizes are shown on the following pages. For any sizes outside the ISO 3601-2 and Parker O-Ring standards, please contact your local Customer Solution Center for assistance.

Table 6: Standard ISO 3601-2 Style XploR™ S-Seal Installation Dimensions – Inch

S-Seal Size	Piston Seal			Rod Seal			C Groove Width	
	A Bore Dia.	B Groove Dia.	D Piston Dia. (Min.)	A1 Rod Dia.	B1 Groove Dia.	D1 Throat Dia. (Max)	Intermediate Groove Width	Wide Groove Width
ISO3601-2	+.002/-.000	+.000/-.004	+.000/-.002	+.000/-.002	+.004/-.000	+.002/-.000	+.008/-.000	+.008/-.000
325	1.875	1.503	1.859	1.500	1.872	1.516	0.346	0.417
325A	1.938	1.566	1.922	1.562	1.934	1.578	0.346	0.417
326	2.000	1.628	1.984	1.625	1.997	1.641	0.346	0.417
326A	2.063	1.691	2.047	1.688	2.060	1.704	0.346	0.417
327	2.125	1.753	2.109	1.750	2.122	1.766	0.346	0.417
327A	2.188	1.816	2.172	1.813	2.185	1.829	0.346	0.417
328	2.250	1.878	2.234	1.875	2.247	1.891	0.346	0.417
328A	2.313	1.941	2.297	1.938	2.310	1.954	0.346	0.417
329	2.375	2.003	2.359	2.000	2.372	2.016	0.346	0.417
329A	2.438	2.066	2.422	2.063	2.435	2.079	0.346	0.417
330	2.500	2.128	2.484	2.125	2.497	2.141	0.346	0.417
330A	2.563	2.191	2.547	2.188	2.560	2.204	0.346	0.417
331	2.625	2.253	2.609	2.250	2.622	2.266	0.346	0.417
331A	2.688	2.316	2.672	2.313	2.685	2.329	0.346	0.417

S-Seal Size	Piston Seal			Rod Seal			C Groove Width	
	A Bore Dia.	B Groove Dia.	D Piston Dia. (Min.)	A1 Rod Dia.	B1 Groove Dia.	D1 Throat Dia. (Max)	Intermediate Groove Width	Wide Groove Width
ISO3601-2	+.002/-.000	+.000/-.004	+.000/-.002	+.000/-.002	+.004/-.000	+.002/-.000	+.008/-.000	+.008/-.000
332	2.750	2.378	2.734	2.375	2.747	2.391	0.346	0.417
332A	2.813	2.441	2.797	2.438	2.810	2.454	0.346	0.417
333	2.875	2.503	2.859	2.500	2.872	2.516	0.346	0.417
333A	2.938	2.566	2.922	2.563	2.935	2.579	0.346	0.417
334	3.000	2.628	2.984	2.625	2.997	2.641	0.346	0.417
334A	3.063	2.691	3.047	2.688	3.060	2.704	0.346	0.417
335	3.125	2.753	3.109	2.750	3.122	2.766	0.346	0.417
335A	3.188	2.816	3.172	2.813	3.185	2.829	0.346	0.417
336	3.250	2.878	3.234	2.875	3.247	2.891	0.346	0.417
336A	3.313	2.941	3.297	2.938	3.310	2.954	0.346	0.417
337	3.375	3.003	3.359	3.000	3.372	3.016	0.346	0.417
337A	3.438	3.066	3.422	3.063	3.435	3.079	0.346	0.417
338	3.500	3.128	3.484	3.125	3.497	3.141	0.346	0.417
338A	3.563	3.191	3.547	3.188	3.560	3.204	0.346	0.417
339	3.625	3.253	3.609	3.250	3.622	3.266	0.346	0.417
339A	3.688	3.316	3.672	3.313	3.685	3.329	0.346	0.417
340	3.750	3.378	3.734	3.375	3.747	3.391	0.346	0.417
340A	3.813	3.441	3.797	3.438	3.810	3.454	0.346	0.417
341	3.875	3.503	3.859	3.500	3.872	3.516	0.346	0.417
341A	3.938	3.566	3.922	3.563	3.935	3.579	0.346	0.417
342	4.000	3.628	3.984	3.625	3.997	3.641	0.346	0.417
342A	4.063	3.691	4.047	3.688	4.060	3.704	0.346	0.417
343	4.125	3.753	4.109	3.750	4.122	3.766	0.346	0.417
343A	4.188	3.816	4.172	3.813	4.185	3.829	0.346	0.417
344	4.250	3.878	4.234	3.875	4.247	3.891	0.346	0.417
344A	4.313	3.941	4.297	3.938	4.310	3.954	0.346	0.417
345	4.375	4.003	4.359	4.000	4.372	4.016	0.346	0.417
345A	4.438	4.066	4.422	4.063	4.435	4.079	0.346	0.417
346	4.500	4.128	4.484	4.125	4.497	4.141	0.346	0.417
346A	4.563	4.191	4.547	4.188	4.560	4.204	0.346	0.417
347	4.625	4.253	4.609	4.250	4.622	4.266	0.346	0.417
347A	4.688	4.316	4.672	4.313	4.685	4.329	0.346	0.417
348	4.750	4.378	4.734	4.375	4.747	4.391	0.346	0.417
348A	4.813	4.441	4.797	4.438	4.810	4.454	0.346	0.417
349	4.875	4.503	4.859	4.500	4.872	4.516	0.346	0.417
349A	4.938	4.566	4.922	4.563	4.935	4.579	0.346	0.417
350	5.000	4.628	4.984	4.625	4.997	4.641	0.346	0.417
350A	5.063	4.691	5.047	4.688	5.060	4.704	0.346	0.417
351	5.125	4.753	5.109	4.750	5.122	4.766	0.346	0.417
861	5.188	4.816	5.172	4.813	5.185	4.829	0.346	0.417

S-Seal Size	Piston Seal			Rod Seal			C Groove Width	
	A Bore Dia.	B Groove Dia.	D Piston Dia. (Min.)	A1 Rod Dia.	B1 Groove Dia.	D1 Throat Dia. (Max)	Intermediate Groove Width	Wide Groove Width
ISO3601-2	+.002/-.000	+.000/-.004	+.000/-.002	+.000/-.002	+.004/-.000	+.002/-.000	+.008/-.000	+.008/-.000
352	5.250	4.878	5.234	4.875	5.247	4.891	0.346	0.417
862	5.313	4.941	5.297	4.938	5.310	4.954	0.346	0.417
353	5.375	5.003	5.359	5.000	5.372	5.016	0.346	0.417
863	5.438	5.066	5.422	5.063	5.435	5.079	0.346	0.417
354	5.500	5.128	5.484	5.125	5.497	5.141	0.346	0.417
864	5.563	5.191	5.547	5.188	5.560	5.204	0.346	0.417
355	5.625	5.253	5.609	5.250	5.622	5.266	0.346	0.417
865	5.688	5.316	5.672	5.313	5.685	5.329	0.346	0.417
356	5.750	5.378	5.734	5.375	5.747	5.391	0.346	0.417
866	5.813	5.441	5.797	5.438	5.810	5.454	0.346	0.417
357	5.875	5.503	5.859	5.500	5.872	5.516	0.346	0.417
867	5.938	5.566	5.922	5.563	5.935	5.579	0.346	0.417
358	6.000	5.628	5.984	5.625	5.997	5.641	0.346	0.417
868	6.063	5.691	6.047	5.688	6.060	5.704	0.346	0.417
359	6.125	5.753	6.109	5.750	6.122	5.766	0.346	0.417
869	6.188	5.816	6.172	5.813	6.185	5.829	0.346	0.417
360	6.250	5.878	6.234	5.875	6.247	5.891	0.346	0.417
870	6.313	5.941	6.297	5.938	6.310	5.954	0.346	0.417
361	6.375	6.003	6.359	6.000	6.372	6.016	0.346	0.417
644	6.500	6.128	6.484	6.125	6.497	6.141	0.346	0.417
362	6.625	6.253	6.609	6.250	6.622	6.266	0.346	0.417
645	6.750	6.378	6.734	6.375	6.747	6.391	0.346	0.417
363	6.875	6.503	6.859	6.500	6.872	6.516	0.346	0.417
646	7.000	6.628	6.984	6.625	6.997	6.641	0.346	0.417
364	7.125	6.753	7.109	6.750	7.122	6.766	0.346	0.417
647	7.250	6.878	7.234	6.875	7.247	6.891	0.346	0.417
365	7.375	7.003	7.359	7.000	7.372	7.016	0.346	0.417
366	7.625	7.253	7.609	7.250	7.622	7.266	0.346	0.417
367	7.875	7.503	7.859	7.500	7.872	7.516	0.346	0.417
368	8.125	7.753	8.109	7.750	8.122	7.766	0.346	0.417
369	8.375	8.003	8.359	8.000	8.372	8.016	0.346	0.417
425	5.000	4.505	4.977	4.500	4.995	4.523	0.472	0.575
426	5.125	4.630	5.102	4.625	5.120	4.648	0.472	0.575
427	5.250	4.755	5.227	4.750	5.245	4.773	0.472	0.575
428	5.375	4.880	5.352	4.875	5.370	4.898	0.472	0.575
429	5.500	5.005	5.477	5.000	5.495	5.023	0.472	0.575
430	5.625	5.130	5.602	5.125	5.620	5.148	0.472	0.575
431	5.750	5.255	5.727	5.250	5.745	5.273	0.472	0.575
432	5.875	5.380	5.852	5.375	5.870	5.398	0.472	0.575
433	6.000	5.505	5.977	5.500	5.995	5.523	0.472	0.575

S-Seal Size	Piston Seal			Rod Seal			C Groove Width	
	A Bore Dia.	B Groove Dia.	D Piston Dia. (Min.)	A1 Rod Dia.	B1 Groove Dia.	D1 Throat Dia. (Max)	Intermediate Groove Width	Wide Groove Width
ISO3601-2	+.002/-.000	+.000/-.004	+.000/-.002	+.000/-.002	+.004/-.000	+.002/-.000	+.008/-.000	+.008/-.000
434	6.125	5.630	6.102	5.625	6.120	5.648	0.472	0.575
435	6.250	5.755	6.227	5.750	6.245	5.773	0.472	0.575
436	6.375	5.880	6.352	5.875	6.370	5.898	0.472	0.575
437	6.500	6.005	6.477	6.000	6.495	6.023	0.472	0.575
872	6.625	6.130	6.602	6.125	6.620	6.148	0.472	0.575
438	6.750	6.255	6.727	6.250	6.745	6.273	0.472	0.575
874	6.875	6.380	6.852	6.375	6.870	6.398	0.472	0.575
439	7.000	6.505	6.977	6.500	6.995	6.523	0.472	0.575
876	7.125	6.630	7.102	6.625	7.120	6.648	0.472	0.575
440	7.250	6.755	7.227	6.750	7.245	6.773	0.472	0.575
878	7.375	6.880	7.352	6.875	7.370	6.898	0.472	0.575
441	7.500	7.005	7.477	7.000	7.495	7.023	0.472	0.575
880	7.625	7.130	7.602	7.125	7.620	7.148	0.472	0.575
442	7.750	7.255	7.727	7.250	7.745	7.273	0.472	0.575
882	7.625	7.130	7.602	7.375	7.870	7.398	0.472	0.575
443	8.000	7.505	7.977	7.500	7.995	7.523	0.472	0.575
884	8.125	7.630	8.102	7.625	8.120	7.648	0.472	0.575
444	8.250	7.755	8.227	7.750	8.245	7.773	0.472	0.575
886	8.375	7.880	8.352	7.375	7.870	7.398	0.472	0.575
445	8.500	8.005	8.477	8.000	8.495	8.023	0.472	0.575
445A	8.750	8.255	8.727	8.250	8.745	8.273	0.472	0.575
446	9.000	8.505	8.977	8.500	8.995	8.523	0.472	0.575
446M	9.125	8.630	9.102	8.625	9.120	8.648	0.472	0.575
446A	9.250	8.755	9.227	8.750	9.245	8.773	0.472	0.575
446B	9.375	8.880	9.352	8.875	9.370	8.898	0.472	0.575
447	9.500	9.005	9.477	9.000	9.495	9.023	0.472	0.575
447M	9.625	9.130	9.602	9.125	9.620	9.148	0.472	0.575
447A	9.750	9.255	9.727	9.250	9.745	9.273	0.472	0.575
447B	9.875	9.380	9.852	9.375	9.870	9.398	0.472	0.575
448	10.000	9.505	9.977	9.500	9.995	9.523	0.472	0.575
448A	10.250	9.755	10.227	9.750	10.245	9.773	0.472	0.575
449	10.500	10.005	10.477	10.000	10.495	10.023	0.472	0.575
449A	10.750	10.255	10.727	10.250	10.745	10.273	0.472	0.575
450	11.000	10.505	10.977	10.500	10.995	10.523	0.472	0.575
450A	11.250	10.755	11.227	10.750	11.245	10.773	0.472	0.575
451	11.500	11.005	11.477	11.000	11.495	11.023	0.472	0.575
451A	11.750	11.255	11.727	11.250	11.745	11.273	0.472	0.575
452	12.000	11.505	11.977	11.500	11.995	11.523	0.472	0.575
452A	12.250	11.755	12.227	11.750	12.245	11.773	0.472	0.575
453	12.500	12.005	12.477	12.000	12.495	12.023	0.472	0.575

S-Seal Size	Piston Seal			Rod Seal			C Groove Width	
	A Bore Dia.	B Groove Dia.	D Piston Dia. (Min.)	A1 Rod Dia.	B1 Groove Dia.	D1 Throat Dia. (Max)	Intermediate Groove Width	Wide Groove Width
ISO3601-2	+.002/-.000	+.000/-.004	+.000/-.002	+.000/-.002	+.004/-.000	+.002/-.000	+.008/-.000	+.008/-.000
648	12.750	12.255	12.727	12.250	12.745	12.273	0.472	0.575
454	13.000	12.505	12.977	12.500	12.995	12.523	0.472	0.575
649	13.250	12.755	13.227	12.750	13.245	12.773	0.472	0.575
455	13.500	13.005	13.477	13.000	13.495	13.023	0.472	0.575
650	13.750	13.255	13.727	13.250	13.745	13.273	0.472	0.575
456	14.000	13.505	13.977	13.500	13.995	13.523	0.472	0.575
456A	14.250	13.755	14.227	13.750	14.245	13.773	0.472	0.575
457	14.500	14.005	14.477	14.000	14.495	14.023	0.472	0.575
457A	14.750	14.255	14.727	14.250	14.745	14.273	0.472	0.575
458	15.000	14.505	14.977	14.500	14.995	14.523	0.472	0.575
458A	15.250	14.755	15.227	14.750	15.245	14.773	0.472	0.575
459	15.500	15.005	15.477	15.000	15.495	15.023	0.472	0.575
459M	15.750	15.255	15.727	15.250	15.745	15.273	0.472	0.575
460	16.000	15.505	15.977	15.500	15.995	15.523	0.472	0.575
460A	16.250	15.755	16.227	15.750	16.245	15.773	0.472	0.575
461	16.500	16.005	16.477	16.000	16.495	16.023	0.472	0.575
461M	16.750	16.255	16.727	16.250	16.745	16.273	0.472	0.575
462	17.000	16.505	16.977	16.500	16.995	16.523	0.472	0.575
463	17.500	17.005	17.477	17.000	17.495	17.023	0.472	0.575
464	18.000	17.505	17.977	17.500	17.995	17.523	0.472	0.575
465	18.500	18.005	18.477	18.000	18.495	18.023	0.472	0.575
466	19.000	18.505	18.977	18.500	18.995	18.523	0.472	0.575
467	19.500	19.005	19.477	19.000	19.495	19.023	0.472	0.575
468	20.000	19.505	19.977	19.500	19.995	19.523	0.472	0.575
469	20.500	20.005	20.477	20.000	20.495	20.023	0.472	0.575
470	21.500	21.005	21.477	21.000	21.495	21.023	0.472	0.575
471	22.500	22.005	22.477	22.000	22.495	22.023	0.472	0.575
472	23.500	23.005	23.477	23.000	23.495	23.023	0.472	0.575
473	24.500	24.005	24.477	24.000	24.495	24.023	0.472	0.575
474	25.500	25.005	25.477	25.000	25.495	25.023	0.472	0.575
475	26.500	26.005	26.477	26.000	26.495	26.023	0.472	0.575

■ Industrial Static Seal Glands

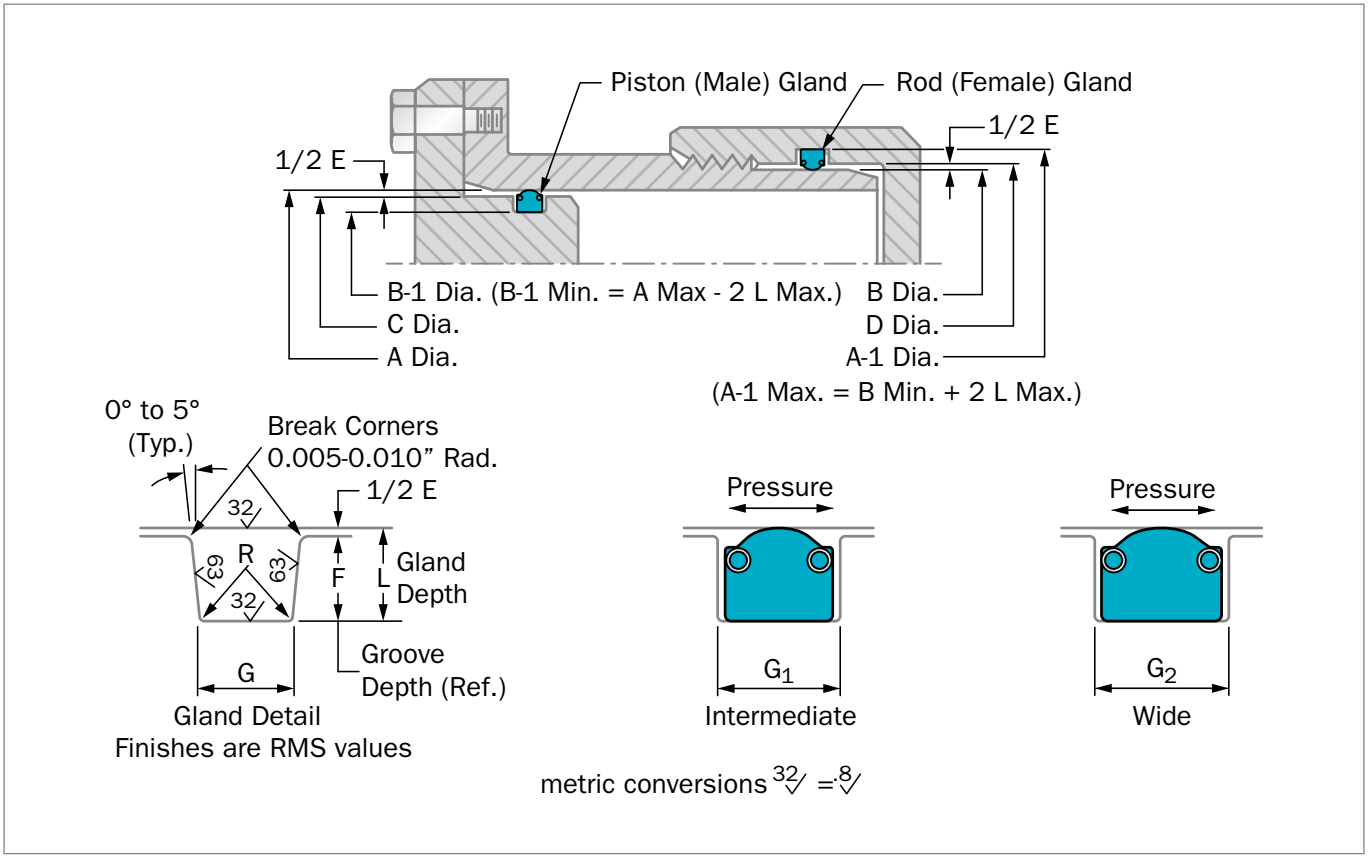


Figure 13: Industrial Static Seal Glands

Table 7: Industrial O-Ring Static Seal Glands – Inch

Dash Size	L Gland Depth	E Diametral Clearance	G - Groove Width		R Groove Radius
			Intermediate (G_1)	Wide (G_2)	
201* through 284	.111 to .113	.003 to .006	.208 to .213	.275 to .280	.010 to .025
309 through 395	.170 to .173	.003 to .006	.311 to .316	.410 to .415	.020 to .035
425 through 475	.226 to .229	.004 to .007	.408 to .413	.538 to .543	.020 to .035

* Consult your local Customer Solution Center for 200 series groove widths to confirm the desired spring option will fit.

Table 8: Gland Dimensions for Industrial O-Ring Static Seals

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
201*	.437	.409		.187	.215		.434	.190	
202*	.500	.472		.250	.278		.497	.253	
203*	.562	.534		.312	.340		.559	.315	
204	.625	.597		.375	.403		.622	.378	
205	.687	.659		.437	.465		.684	.440	
206	.750	.722		.500	.528		.747	.503	
207	.812	.784		.562	.590		.809	.565	
208	.875	.847		.625	.653		.872	.628	
209	.937	.909		.687	.715		.934	.690	
210	1.000	.972		.750	.778		.997	.753	
211	1.062	1.034		.812	.840		1.059	.815	
212	1.125	1.097		.875	.903		1.122	.878	
213	1.187	1.159		.937	.965		1.184	.940	
214	1.250	1.222		1.000	1.028		1.247	1.003	
215	1.312	1.284		1.062	1.090		1.309	1.065	
216	1.375	1.347		1.125	1.153		1.372	1.128	
217	1.437	1.409		1.187	1.215		1.434	1.190	
218	1.500	1.472	.002	1.250	1.278	.002	1.497	1.253	.275
219	1.562	1.534		1.312	1.340		1.559	1.315	
220	1.625	1.597		1.375	1.403		1.622	1.378	
221	1.687	1.659		1.437	1.465		1.684	1.440	
222	1.750	1.722		1.500	1.528		1.747	1.503	
223	1.875	1.847		1.625	1.653		1.872	1.628	
224	2.000	1.972		1.750	1.778		1.997	1.753	
225	2.125	2.097		1.875	1.903		2.122	1.878	
226	2.250	2.222		2.000	2.028		2.247	2.003	
227	2.375	2.347		2.125	2.153		2.372	2.128	
228	2.500	2.472		2.250	2.278		2.497	2.253	
229	2.625	2.597		2.375	2.403		2.622	2.378	
230	2.750	2.722		2.500	2.528		2.747	2.503	
231	2.875	2.847		2.625	2.653		2.872	2.628	
232	3.000	2.972		2.750	2.778		2.997	2.753	
233	3.125	3.097		2.875	2.903		3.122	2.878	
234	3.250	3.222		3.000	3.028		3.247	3.003	
235	3.375	3.347		3.125	3.153		3.372	3.128	
236	3.500	3.472		3.250	3.278		3.497	3.253	

* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
237	3.625	3.597		3.375	3.403		3.622	3.378	
238	3.750	3.722		3.500	3.528		3.747	3.503	
239	3.875	3.847		3.625	3.653		3.872	3.628	
240	4.000	3.972		3.750	3.778		3.997	3.753	
241	4.125	4.097		3.875	3.903		4.122	3.878	
242	4.250	4.222		4.000	4.028		4.247	4.003	
243	4.375	4.347		4.125	4.153		4.372	4.128	
244	4.500	4.472		4.250	4.278		4.497	4.253	
245	4.625	4.597		4.375	4.403		4.622	4.378	
246	4.750	4.722		4.500	4.528		4.747	4.503	
247	4.875	4.847		4.625	4.653		4.872	4.628	
248	5.000	4.972		4.750	4.778		4.997	4.753	
249	5.125	5.097		4.875	4.903		5.122	4.878	
250	5.250	5.222		5.000	5.028		5.247	5.003	
251	5.375	5.347		5.125	5.153		5.372	5.128	
252	5.500	5.472		5.250	5.278		5.497	5.253	
253	5.625	5.597		5.375	5.403		5.622	5.378	
254	5.750	5.722	.002	5.500	5.528	.002	5.747	5.503	.275
255	5.875	5.847		5.625	5.653		5.872	5.628	
256	6.000	5.972		5.750	5.778		5.997	5.753	
257	6.125	6.097		5.875	5.903		6.122	5.878	
258	6.250	6.222		6.000	6.028		6.247	6.003	
259	6.500	6.472		6.250	6.278		6.497	6.253	
260	6.750	6.722		6.500	6.528		6.747	6.503	
261	7.000	6.972		6.750	6.778		6.997	6.753	
262	7.250	7.222		7.000	7.028		7.247	7.003	
263	7.500	7.472		7.250	7.278		7.497	7.253	
264	7.750	7.722		7.500	7.528		7.747	7.503	
265	8.000	7.972		7.750	7.778		7.997	7.753	
266	8.250	8.222		8.000	8.028		8.247	8.003	
267	8.500	8.472		8.250	8.278		8.497	8.253	
268	8.750	8.722		8.500	8.528		8.747	8.503	
269	9.000	8.972		8.750	8.778		8.997	8.753	
270	9.250	9.222		9.000	9.028		9.247	9.003	
271	9.500	9.472		9.250	9.278		9.497	9.253	
272	9.750	9.722		9.500	9.528		9.747	9.503	

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
273	10.000	9.972	.002	9.750	9.778	.002	9.997	9.753	.275
274	10.250	10.222		10.000	10.028		10.247	10.003	
275	10.750	10.722		10.500	10.528		10.747	10.503	
276	11.250	11.222		11.000	11.028		11.247	11.003	
277	11.750	11.722		11.500	11.528		11.747	11.503	
278	12.250	12.222		12.000	12.028		12.247	12.003	
279	13.250	13.222		13.000	13.028		13.247	13.003	
280	14.250	14.222		14.000	14.028		14.247	14.003	
281	15.250	15.222		15.000	15.028		15.247	15.003	
282	16.250	16.222		16.000	16.028		16.247	16.003	
283	17.250	17.222		17.000	17.028		17.247	17.003	
284	18.250	18.222		18.000	18.028		18.247	18.003	
309*	.812	.777	.004	.437	.472	.004	.809	.440	.410
310*	.875	.840		.500	.535		.872	.503	
311*	.937	.902		.562	.597		.934	.565	
312	1.000	.965		.625	.660		.997	.628	
313	1.062	1.027		.687	.722		1.059	.690	
314	1.125	1.090		.750	.785		1.122	.753	
315	1.187	1.152		.812	.847		1.184	.815	
316	1.250	1.215		.875	.910		1.247	.878	
317	1.312	1.277		.937	.972		1.309	.940	
318	1.375	1.340		1.000	1.035		1.372	1.003	
319	1.437	1.402		1.062	1.097		1.434	1.065	
320	1.500	1.465		1.125	1.160		1.497	1.128	
321	1.562	1.527		1.187	1.222		1.559	1.190	
322	1.625	1.590		1.250	1.285		1.622	1.253	
323	1.687	1.652		1.312	1.347		1.684	1.315	
324	1.750	1.715		1.375	1.410		1.747	1.378	
325	1.875	1.840		1.500	1.535		1.872	1.503	
326	2.000	1.965		1.625	1.660		1.997	1.628	
327	2.125	2.090		1.750	1.785		2.122	1.753	
328	2.250	2.215		1.875	1.910		2.247	1.878	
329	2.375	2.340		2.000	2.035		2.372	2.003	
330	2.500	2.465		2.125	2.160		2.497	2.128	
331	2.625	2.590		2.250	2.285		2.622	2.253	
332	2.750	2.715		2.375	2.410		2.747	2.378	
333	2.875	2.840		2.500	2.535		2.872	2.503	
334	3.000	2.965		2.625	2.660		2.997	2.628	

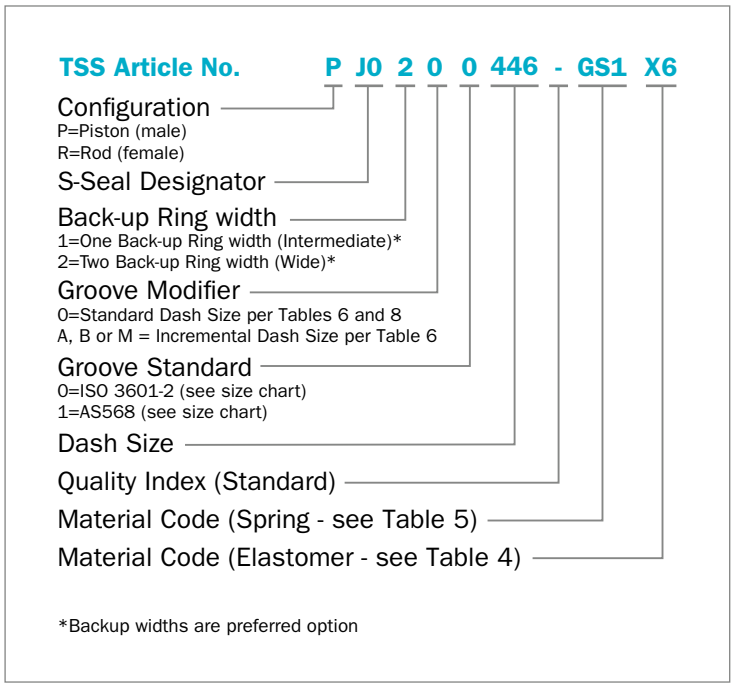
* These designs require considerable installation stretch. If assembly breakage is incurred, use a compound having higher elongation or use a two-piece piston.

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
335	3.125	3.090		2.750	2.785		3.122	2.753	
336	3.250	3.215		2.875	2.910		3.247	2.878	
337	3.375	3.340		3.000	3.035		3.372	3.003	
338	3.500	3.465		3.125	3.160		3.497	3.128	
339	3.625	3.590		3.250	3.285		3.622	3.253	
340	3.750	3.715		3.375	3.410		3.747	3.378	
341	3.875	3.840		3.500	3.535		3.872	3.502	
342	4.000	3.965		3.625	3.660		3.997	3.628	
343	4.125	4.090		3.750	3.785		4.122	3.753	
344	4.250	4.215		3.875	3.910		4.247	3.878	
345	4.375	4.340		4.000	4.035		4.372	4.003	
346	4.500	4.465		4.125	4.160		4.497	4.128	
347	4.625	4.590		4.250	4.285		4.622	4.253	
348	4.750	4.717		4.375	4.410		4.747	4.378	
349	4.875	4.840		4.500	4.535		4.872	4.503	
350	5.000	4.965		4.625	4.660		4.997	4.628	
351	5.125	5.090		4.750	4.785		5.122	4.753	
352	5.250	5.215		4.875	4.910		5.247	4.878	
353	5.375	5.340	.004	5.000	5.035	.004	5.372	5.003	.410
354	5.500	5.465		5.125	5.160		5.497	5.128	
355	5.625	5.590		5.250	5.285		5.622	5.253	
356	5.750	5.715		5.375	5.410		5.747	5.378	
357	5.875	5.840		5.500	5.535		5.872	5.503	
358	6.000	5.965		5.625	5.660		5.997	5.628	
359	6.125	6.090		5.750	5.785		6.122	5.753	
360	6.250	6.215		5.875	5.910		6.247	5.878	
361	6.375	6.340		6.000	6.035		6.372	6.003	
362	6.625	6.590		6.250	6.285		6.622	6.253	
363	6.875	6.840		6.500	6.535		6.872	6.503	
364	7.125	7.090		6.750	6.785		7.122	6.753	
365	7.375	7.340		7.000	7.035		7.372	7.003	
366	7.625	7.590		7.250	7.285		7.622	7.253	
367	7.875	7.840		7.500	7.535		7.872	7.503	
368	8.125	8.090		7.750	7.785		8.122	7.753	
369	8.375	8.340		8.000	8.035		8.372	8.003	
370	8.625	8.590		8.250	8.285		8.622	8.253	
371	8.875	8.840		8.500	8.535		8.872	8.503	
372	9.125	9.090		8.750	8.785		9.122	8.753	

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
373	9.375	9.340		9.000	9.035		9.372	9.003	
374	9.625	9.590		9.250	9.285		9.622	9.253	
375	9.875	9.840		9.500	9.535		9.872	9.503	
376	10.125	10.090		9.750	9.785		10.122	9.753	
377	10.375	10.340		10.000	10.035		10.372	10.003	
378	10.875	10.840		10.500	10.535		10.872	10.503	
379	11.375	11.340		11.000	11.035		11.372	11.003	
380	11.875	11.840		11.500	11.535		11.872	11.503	
381	12.375	12.340		12.000	12.035		12.372	12.003	
382	13.375	13.340		13.000	13.035		13.372	13.003	
383	14.375	14.340		14.000	14.035		14.372	14.003	
384	15.375	15.340	.004	15.000	15.035	.004	15.372	15.003	.410
385	16.375	16.340		16.000	16.035		16.372	16.003	
386	17.375	17.340		17.000	17.035		17.372	17.003	
387	18.375	18.340		18.000	18.035		18.372	18.003	
388	19.375	19.340		19.000	19.035		19.372	19.003	
389	20.375	20.340		20.000	20.035		20.372	20.003	
390	21.375	21.340		21.000	21.035		21.372	21.003	
391	22.375	22.340		22.000	22.035		22.372	22.003	
392	23.375	23.340		23.000	23.035		23.372	23.003	
393	24.375	24.340		24.000	24.035		24.372	24.003	
394	25.375	25.340		25.000	25.035		25.372	25.003	
395	26.375	26.340		26.000	26.035		26.372	26.003	
425	5.000	4.952		4.500	4.548		4.996	4.504	
426	5.125	5.077		4.625	4.673		5.121	4.629	
427	5.250	5.202		4.750	4.798		5.246	4.754	
428	5.375	5.327		4.875	4.923		5.371	4.879	
429	5.500	5.452		5.000	5.048		5.496	5.004	
430	5.625	5.577		5.125	5.173		5.621	5.129	
431	5.750	5.702		5.250	5.298		5.746	5.254	
432	5.875	5.827	.004	5.375	5.423	.004	5.871	5.379	.538
433	6.000	5.952		5.500	5.548		5.996	5.504	
434	6.125	6.077		5.625	5.673		6.121	5.629	
435	6.250	6.202		5.750	5.798		6.246	5.754	
436	6.375	6.327		5.875	5.923		6.371	5.879	
437	6.500	6.452		6.000	6.048		6.496	6.004	
438	6.750	6.702		6.250	6.298		6.746	6.254	
439	7.000	6.952		6.500	6.548		6.996	6.504	

Groove Dash Size per Industry Standards	A	A-1		B	B-1		C	D	G
	Bore Dia. (Male Gland)	Groove Dia. (Female Gland)		Tube OD (Female Gland)	Groove Dia. (Male Gland)		Plug Dia. (Male Gland)	Throat Dia. (Female Gland)	Groove Width (Wide Preferred)
	+.002 -.000	-.000	+	+.000 -.002	+.000	-	+.000 .001	+.001 -.000	+.005 -.000
440	7.250	7.202		6.750	6.798		7.246	6.754	
441	7.500	7.452		7.000	7.048		7.496	7.004	
442	7.750	7.702		7.250	7.298		7.746	7.254	
443	8.000	7.952		7.500	7.548		7.996	7.504	
444	8.250	8.202		7.750	7.798		8.246	7.754	
445	8.500	8.452		8.000	8.048		8.496	8.004	
446	9.000	8.952		8.500	8.548		8.996	8.504	
447	9.500	9.452		9.000	9.048		9.496	9.004	
448	10.000	9.952		9.500	9.548		9.996	9.504	
449	10.500	10.452		10.000	10.048		10.496	10.000	
450	11.000	10.952		10.500	10.548		10.996	10.504	
451	11.500	11.452		11.000	11.048		11.496	11.004	
452	12.000	11.952		11.500	11.548		11.996	11.504	
453	12.500	12.452		12.000	12.048		12.496	12.004	
454	13.000	12.952		12.500	12.548		12.996	12.504	
455	13.500	13.452		13.000	13.048		13.496	13.004	
456	14.000	13.952		13.500	13.548		13.996	13.504	
457	14.500	14.452	.004	14.000	14.048	.004	14.496	14.004	.538
458	15.000	14.952		14.500	14.548		14.996	14.504	
459	15.500	15.452		15.000	15.048		15.496	15.004	
460	16.000	15.952		15.500	15.548		15.996	15.504	
461	16.500	16.452		16.000	16.048		16.496	16.004	
462	17.000	16.952		16.500	16.548		16.996	16.504	
463	17.500	17.452		17.000	17.048		17.496	17.004	
464	18.000	17.952		17.500	17.548		17.996	17.504	
465	18.500	18.452		18.000	18.048		18.496	18.004	
466	19.000	18.952		18.500	18.548		18.996	18.504	
467	19.500	19.452		19.000	19.048		19.496	19.004	
468	20.000	19.952		19.500	19.548		19.996	19.504	
469	20.500	20.452		20.000	20.048		20.496	20.004	
470	21.500	21.452		21.000	21.048		21.496	21.004	
471	22.500	22.452		22.000	22.048		22.496	22.004	
472	23.500	23.452		23.000	23.048		23.496	23.004	
473	24.500	24.452		24.000	24.048		24.496	24.004	
474	25.500	25.452		25.000	25.048		25.496	25.004	
475	26.500	26.452		26.000	26.048		26.496	26.004	

PART NUMBER SYSTEM



ORDERING EXAMPLES

PJ0100439-GSEJ2:

- XploR™ S-Seal to suit ISO-3601-2 -439 bore
- Intermediate groove width
- Elgiloy® springs
- Isolast® J9523 elastomer

PJ02A0446-GS2X6:

- XploR™ S-Seal to suit ISO-3601-2 -446A incremental bore
- Wide groove width
- 316 stainless steel spring
- XploR™ V9T82 elastomer

XploR™ FS-Seal

DESCRIPTION

The XploR™ FS-Seal utilizes a contoured backside in large cross-section configurations to compensate for hardware deflection and temperature variations in large diameter applications. They are typically used for static sealing in wellhead, tubing and casing hanger applications with industry groove standards. Standard groove sizes and part numbers are shown in the chart below.

The standard XploR™ FS-Seal product is available with the following materials:

- XploR™ H9T20 Shore 90A HNBR
- 300 series stainless steel springs

Because the sizes are standard, tooling already exists and seals can be produced quickly. Any special sizes and materials can be designed by contacting your local Customer Solution Center.

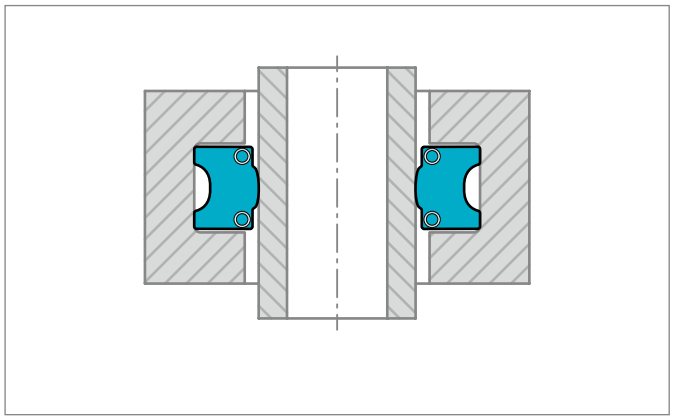


Figure 14: XploR™ FS-Seal

Table 9: Standard Casing FS-Seal Sizes – Inch

TSS Part No.	Casing size	Bore diameter	Groove width
RXYG0004114HRYA	5.500	6.750	0.835
RXYG0004124HRYA	6.625	7.875	0.835
RXYG0004134HRYA	7.000	8.250	0.835
RXYG0004144HRYA	9.000	10.250	0.835
RXYG0004154HRYA	9.625	10.875	0.835
RXYG0004164HRYA	10.750	12.000	1.000
RXYG0004174HRYA	13.375	14.750	1.000
RXYG0004184HRYA	13.625	15.000	1.000
RXYG0004194HRYA	18.625	20.000	1.000

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

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