S-Seal Profile for HTHP Sealing

Technical Bulletin

No. 5277B1/USA

Parker's S-Seal is engineered for today's high temperature, high pressure (HTHP) energy, oil & gas sealing demands

High Temperature, High Pressure Seal

Parker's S-Seal is engineered to meet the rigorous sealing challenges encountered in high pressure and high temperature (**HTHP**) Energy, Oil & Gas (**EOG**) applications. Increasingly deeper drilling means application pressures, once considered high at 5,000 psi, now approach up to 20,000 psi. Traditional elastomer and backup ring-type seals, which sufficiently seal at lesser pressures and temperatures, will extrude at elevated temperatures and pressures. The S-Seal, with its dual-acting design and over-molded anti-extrusion springs, resists extrusion and positively seals pressure from either direction.

Parker S-Seal Features:

Additional features of Parker's S-Seal are:

- Designed to fit existing O-ring type grooves
- Withstands high pressures of 20,000 psi and above
- Elastomer options withstand high temperature and chemical compatibility requirements of down-hole environments
- Integrated over-molded-spring backup system means the backup will not fall out of the seal when blind stab-in conditions exist

Standard Groove Sealing

Parker's S-Seal design retrofits industry standards for existing AS568A grooves and is also available for inch-fractional grooves. Additionally, our experienced team of application, design, and material engineers can design and provide validation testing, as required, to produce custom S-Seals for proprietary or unique sealing applications.

Extrusion Resistant Design and Materials

The S-Seal is a compact, single piece design featuring a molded elastomer with two metal spring anti-extrusion rings molded into the outer edges of the elastomer.

Various Parker elastomers and spring combinations are available.

Material Combination Offering

HTHP Elastomers:

N4007-90 HNBR (highly saturated nitrile, HSN)
V1238-95 FKM (fluorocarbon), explosive decompression and extrusion resistant
N4027-90 low temperature HNBR
N1210-90 NBR, standard peroxide cured nitrile
N4263-90 carboxylated nitrile

Springs:

302 Stainless Steel
Inconel® 600 (NACE spec MR-01-75)

Contact Parker application engineers for custom springs and other material/spring options.

Applications

S-Seals are available with standard or relieved OD's and are ideal for:

- Down hole tools
- Connectors -- subsea and surface
- Wellhead equipment -- subsea and surface
- Safety valves
- HTHP environments where the motion is basically static or there is very little movement

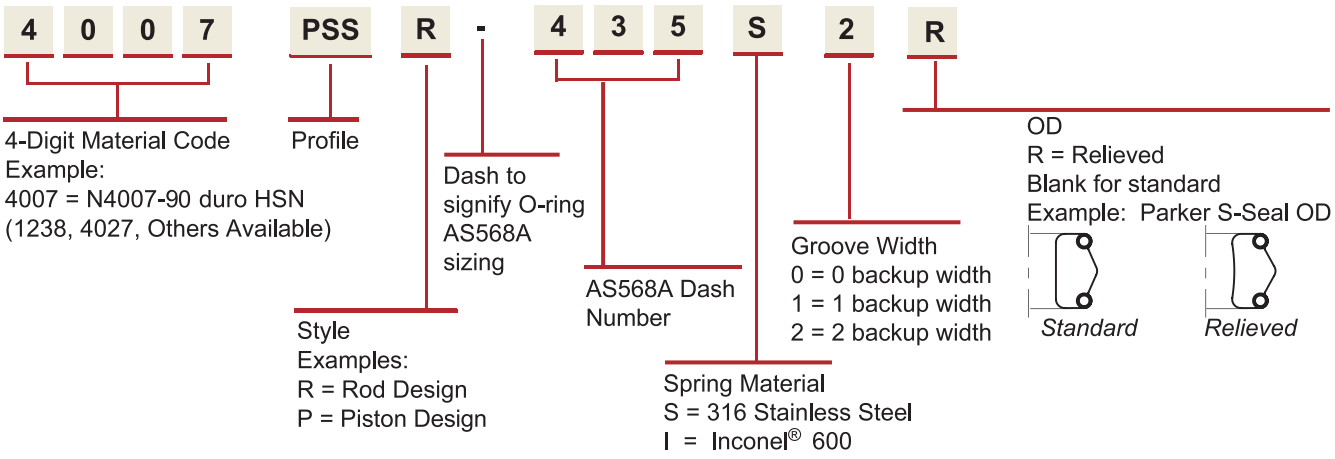
Contact Parker

As the leading developer of engineered solutions, Parker offers a large selection of materials and products to meet the sealing demands of the Energy, Oil, and Gas industry. Call our experienced Application Engineers at (801) 972-3000 for technical support for all of your sealing needs.

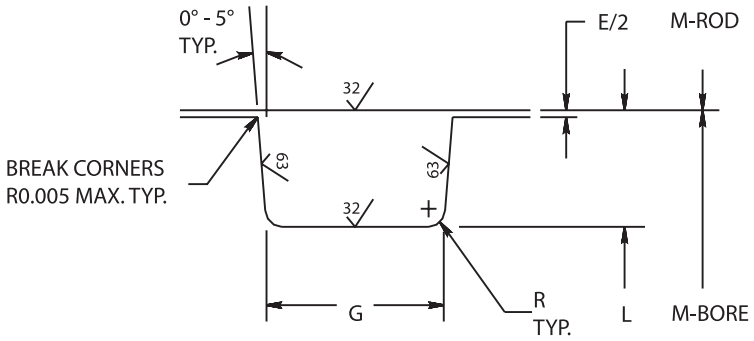
Parker Hannifin Corporation
Engineered Polymer Systems Division
Salt Lake City, Utah, USA ph: (801) 972-3000

Parker anything possible

Parker S-Seal (PSS) Profile -- O-Ring Groove Size Part Numbering



INCONEL® is a registered trademark of Inco Alloys International, Inc.

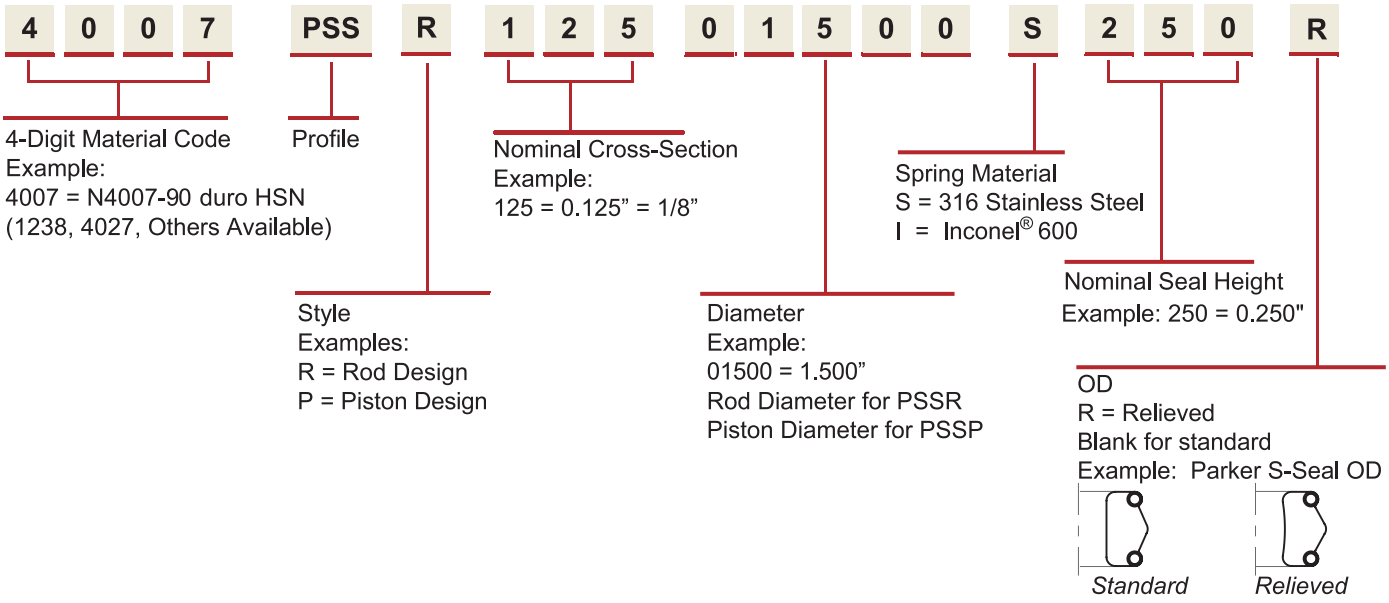


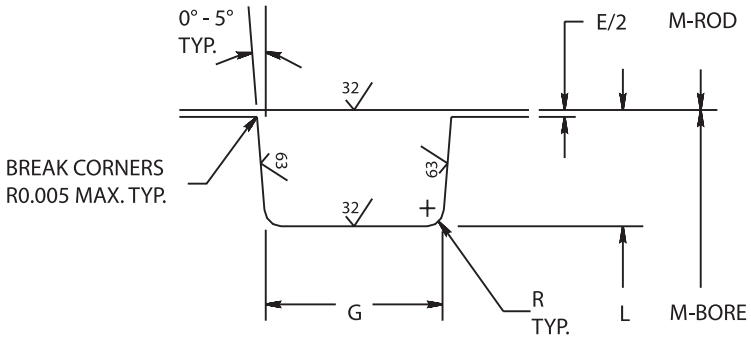
O-Ring Groove Dimensions

O-RING	CROSS-SECTION		(L)	(M)	(E)	(G) GROOVE WIDTH			(R)
2- SIZE	NOMINAL	ACTUAL	GROOVE	Reference Parker O-ring Handbook, Catalog ORD5700	DIAMETRICAL	NO	ONE	TWO	GROOVE
AS568A			DEPTH		CLEARANCE	BACK-UP	BACK-UP	BACK-UP	RADIUS
-100	3/32	0.103	0.081 - 0.083		0.002 - 0.005	NA	NA	0.238 - 0.243	0.005 - 0.015
-200	1/8	0.139	0.111 - 0.113		0.003 - 0.006	NA	0.208 - 0.213	0.275 - 0.280	0.010 - 0.025
-300	3/16	0.210	0.170 - 0.173		0.003 - 0.006	0.281 - 0.286	0.311 - 0.316	0.410 - 0.415	0.020 - 0.035
-400	1/4	0.275	0.226 - 0.229		0.004 - 0.007	0.375 - 0.380	0.408 - 0.413	0.538 - 0.543	0.020 - 0.035

(M) Use diameters from Parker O-ring Handbook ORD5700 for industrial static o-ring grooves.

Parker S-Seal (PSS) Profile -- Inch Fractional Size Part Numbering





Inch Fractional Dimensions

CROSS-SECTION		HEIGHT		(L) GROOVE DEPTH	(M)	(E) DIAMETRICAL CLEARANCE	(G) GROOVE WIDTH	(R) GROOVE RADIUS
1/8	0.125	1/4	0.250	0.125 - 0.127	Reference Dimension as shown in Parker PolyPak Seal Design Handbook, Catalog EPS 3800/US	0.003 - 0.006	0.275 - 0.290	0.010 - 0.025
3/16	0.187	3/8	0.375	0.187 - 0.190		0.003 - 0.006	0.413 - 0.428	0.020 - 0.035
1/4	0.250	1/2	0.500	0.250 - 0.253		0.004 - 0.007	0.550 - 0.565	0.020 - 0.035
5/16	0.312	5/8	0.625	0.312 - 0.315		0.004 - 0.007	0.688 - 0.703	0.020 - 0.035
3/8	0.375	3/4	0.750	0.375 - 0.379		0.004 - 0.007	0.825 - 0.840	0.031 - 0.047
7/16	0.437	7/8	0.875	0.437 - 0.442		0.004 - 0.007	0.963 - 0.978	0.031 - 0.047
1/2	0.500	1	1.000	0.500 - 0.506		0.005 - 0.008	1.100 - 1.115	0.031 - 0.047
9/16	0.562	1-1/8	1.125	0.562 - 0.568		0.005 - 0.008	1.238 - 1.253	0.047 - 0.062
5/8	0.625	1-1/4	1.250	0.625 - 0.632		0.005 - 0.008	1.375 - 1.390	0.047 - 0.062
11/16	0.687	1-3/8	1.375	0.687 - 0.695		0.005 - 0.008	1.513 - 1.528	0.047 - 0.062
3/4	0.750	1-1/2	1.500	0.750 - 0.759		0.006 - 0.009	1.650 - 1.665	0.047 - 0.062
13/16	0.812	1-5/8	1.625	0.812 - 0.821		0.006 - 0.009	1.788 - 1.803	0.047 - 0.062
7/8	0.875	1-3/4	1.750	0.875 - 0.885		0.006 - 0.009	1.925 - 1.940	0.078 - 0.094
15/16	0.937	1-7/8	1.875	0.937 - 0.948		0.007 - 0.010	2.063 - 2.078	0.078 - 0.094
1	1.000	2	2.000	1.000 - 1.012		0.007 - 0.010	2.200 - 2.215	0.109 - 0.125
Standard diameters are available in inch fractional increments from 1" to 75"								

Material Expertise

Parker's S-Seal compounds have excellent fluid compatibility and are formulated to withstand the minimum and maximum operating temperatures and pressures of today's HTHP applications. S-Seals are available in the following materials:

V1238-95
Explosive Decompression and Extrusion-Resistant Fluorocarbon Elastomer

Parker compound V1238-95 is a 95 Shore A durometer fluorocarbon material developed to help protect critical applications from the detrimental effects of explosive decompression and extrusion. Compound V1238-95 has a unique combination of superior physical and chemical properties, as well as excellent compression set resistance. V1238-95 exhibits more than twice the extrusion resistance of standard 90 durometer materials, with the added benefit of showing no visual physical damage after exposure to 100% CO_2 concentrations. Using proprietary Parker compounding technology, V1238-95 offers a fluorocarbon seal material that is both explosive decompression and extrusion resistant for aggressive EOG environments.

N4007-90
High Tensile, Heat Resistant HNBR Elastomer

Parker's N4007-90 was developed to meet the service demands imposed upon rubber materials in oil well applications. Tremendous tensile strength coupled with high resistance to heat, plus compatibility with hydrogen sulfide, corrosion inhibitors, steam and oil make N4007-90 an excellent solution for oil well sealing problems. N4007-90 is ideal for use in blowout preventers, subsea connectors, and similar tough sealing applications found in the oil field industry. N4007-90 features include:

- High tensile strength
- Low compression set
- High modulus
- Resistance to aggressive oils
- High temperature rating

N4027-90
Low temperature HNBR

N4027-90 combines all the attributes of HNBR with extended service in cold temperatures experienced in subsea drilling and North Sea regions. At cold temperatures, most elastomers become stiff and solid, causing the "memory" of the compound to become temporarily non-existent. Without "memory" elastomers fail to push back against the sealing surface and allow fluid to bypass the seal. Parker's N4027-90 retains its "memory" at temperatures as low as -40 °F – making it continuously effective at extreme cold temperatures. This low temperature HNBR has all the same compatibility with hydrogen sulfide, corrosion inhibitors, steam and oil as N4007-90.

Additional Materials

N1210-90 (NBR) standard peroxide cured nitrile
N4263-90 carboxylated nitrile
See Technical Bulletin 5267B1/USA for more information.

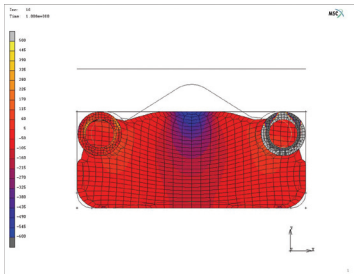
Typical Physical Properties

	N4007-90	N4027-90	V1238-95
Hardness, Shore A	90	90	94
Tensile Strength	4500	3000	2610
Elongation, %	200	105	70
100% Modulus, psi	2000	1990	1710*
Compression Set (%) 70 hrs. @ 212 °F	22	25	23.5
Min/Max Temp °F	-20/+320	-40/+275	-15/+400

*50% Modulus

Finite Element Analysis & S-Seal Design Optimization

Parker's S-Seal design configuration has been optimized using Finite Element Analysis (FEA) software. Parker engineers analyze critical design information, such as stress concentration, fluid flow and pressure properties of new and existing seal geometry. This streamlines tooling and production processes, and helps ensure the selection of the right material and geometry for your application. Using FEA technology, Parker engineers can determine:



FEA of Parker S-Seal profile

- Deformation (deformed shape)
- Volume/void ratios, gland fill %
- Stress distribution
- Load - Deflection
- Stability analysis
- Friction force
- Thermal effects
- Material evaluation

WARNING:

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THESE PRODUCTS CAN CAUSE EQUIPMENT FAILURE OR DAMAGE, PERSONAL INJURY OR DEATH.

For safe and trouble-free use of these products, it is important that you read and follow the Parker Seal Group Product Safety Guide. This Safety Guide can be referenced and downloaded free of charge at www.parkerseals.com. It is also printed in major Seal Group product catalogs, and can be ordered by telephone without charge as Parker Publication No. PSG 5004 by calling 1-800-C-PARKER.