

# Turcon® Stepseal® 2K



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Single-acting

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Rubber-energized plastic-faced seal

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**Material:**

Turcon®, Zurcon® and Elastomer

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## Turcon® Stepseal® 2K\*



### Description

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

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

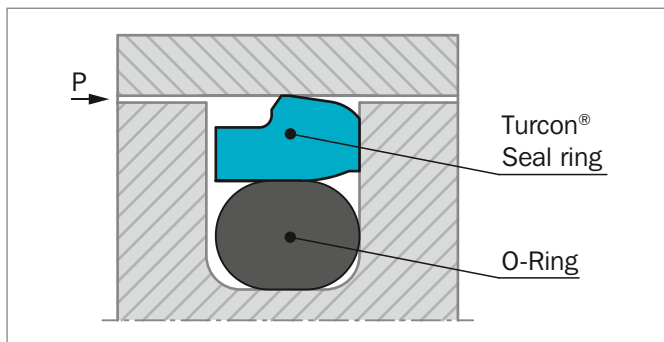


Figure 133: Turcon® Stepseal® 2K

### ADVANTAGES

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

\* Patented geometry

### APPLICATION EXAMPLES

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

- Mobile hydraulics
- Construction Equipment
- Injection molding machines
- Machine tools
- Presses
- Cranes
- Servo hydraulics
- Automotive industry

### OPERATING CONDITIONS

<b>Pressure:</b>	Up to 60 MPa
<b>Speed:</b>	Up to 15 m/s, with reciprocating movements, frequency up to 5 Hz
<b>Temperature:</b>	-45 °C to +200 °C**
<b>Media:</b>	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally friendly hydraulic fluids (bio-oils), phosphate ester, water and others, depending on the seal and O-Ring material compatibility see Table 120
<b>Clearance:</b>	The maximum permissible radial clearance $S_{max}$ is shown in Table 121, as a function of the operating pressure and functional diameter.

### IMPORTANT NOTE

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

\*\* In the case of unpressurized piston applications in temperatures below 0 °C please contact your local Trelleborg Sealing Solutions marketing company for more information!



## SERIES

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

Table 119 shows the relationship between the series number according to the seal diameter range and the different application class sizes. These application classes are:

- Standard application: General applications without no exceptional operating conditions.
- Light application: Applications with demands for reduced friction or for smaller grooves.
- Heavy-duty application: For exceptional operating loads such as high pressures, pressure peaks, etc.

**Table 119: Available Range**

Series No.	Bore Diameter D <sub>N</sub> H9
PSK00	6.0 - 140.0
PSK10	10.0 - 140.0
PSK20	12.0 - 320.0
PSK30	18.0 - 480.0
PSK40	50.0 - 700.0
PSK80	133.0 - 999.9
PSK50	250.0 - 999.9
PSK5X	1,000.0 - 1,200.0
PSK60	670.0 - 999.9
PSK6X	1,000.0 - 2,700.0

For the recommended Standard Application range see Table 121.

## ISO GROOVE

Stepseal® 2K is installed in Trelleborg Sealing Solutions standard Stepseal® grooves or according to ISO 7425-1 seal housing.

## INSTALLATION INSTRUCTIONS

Stepseal® 2K is installed according to information on page 289 to 291.

Closed groove installation according to dimensions in Table 95 page 291.



## RECOMMENDED MATERIALS

The following material combinations have proven effective for hydraulic applications:

### **Turcon® Stepseal® 2K in Turcon® M12**

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

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

Set code:        M12N or M12V

### **Turcon® Stepseal® 2K in Turcon® T46**

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

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

Set code:        T46N or T46V

For specific applications, all Turcon® materials are available.

Other material combinations are listed in Table 120.



**Table 120: Turcon® and Zurcon® Materials for Stepseal® 2K**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °C	Mating Surface Material	MPa max. Dynamic
<b>Turcon® M12</b> First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and Additives filled Color: Dark gray	M12	NBR 70	N	-30 to +100	Steel	50
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Cast iron	
		FKM 70	V	-10 to +200	Stainless steel Titanium	
<b>Turcon® T05</b> For lubricating fluids Also for gas service Very low friction Very good sliding and sealing properties Color: Turquoise	T05	NBR 70	N	-30 to +100	Steel	20
		NBR 70 Low temp.	T	-45 to +80	Steel hardened	
		FKM 70	V	-10 to +200		
<b>Turcon® T08</b> For lubricating fluids and linear motion Very high compressive strength and extrusion resistance Hard counter surfaces is recommended Bronze filled Color: Light to dark brown, which may have variations in shading	T08	NBR 70	N	-30 to +100	Steel hardened	60
		NBR 70 Low temp.	T	-45 to +80	Cast iron	
		FKM 70	V	-10 to +200		
<b>Turcon® T10</b> For hydraulic and pneumatic For lubricating and non-lubricating fluids High extrusion resistance Good chemical resistance Not for electrically conducting fluids BAM tested Carbon, graphite filled Color: Black	T10	NBR 70	N	-30 to +100	Steel	40
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Stainless steel	
		FKM 70	V	-10 to +200		
		EPDM 70	E**	-45 to +145		
<b>Turcon® T29</b> For lubricating and non-lubricating fluids Good extrusion resistance Surface texture is not suitable for gas sealing Not for electrically conducting fluids Carbon fiber filled Color: Gray	T29	NBR 70	N	-30 to +100	Steel	30
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Cast iron Stainless steel	
		FKM 70	V	-10 to +200		
		EPDM 70	E**	-45 to +145		

Table continues on next page



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °C	Mating Surface Material	MPa max. Dynamic
<b>Turcon® T40</b> For lubricating and non-lubricating fluids High frequency and short strokes Water hydraulics Surface texture is not suitable for gas sealing Carbon fiber filled Color: Gray	T40	NBR 70	N	-30 to +100	Steel	25
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Cast iron	
		FKM 70	V	-10 to +200	Stainless steel	
		EPDM 70	E**	-45 to +145	Aluminum	
<b>Turcon® T46</b> For lubricated hydraulics in linear motion High compressive strength High extrusion resistance Very good sliding and wear properties BAM tested Bronze filled Color: Light to dark brown, which may have variations in shading	T46	NBR 70	N	-30 to +100	Steel hardened	50
		NBR 70 Low temp.	T	-45 to +80	Cast iron	
		FKM 70	V	-10 to +200		
<b>Zurcon® Z53***</b> For mineral oil based fluids Very high abrasion and extrusion resistance For counter surface with rougher surface finish Limited chemical resistance Max. working temperature 110 °C Cast polyurethane Color: Yellow to light-brown	Z53	NBR 70	N	-30 to +100	Steel	60
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Ceramic coating	
<b>Zurcon® Z80</b> For lubricating and non-lubricating fluids Water based fluids, air and gases Dry air pneumatics High abrasion and extrusion resistance For service in abrasive conditions and media with particles Good chemical resistance Limited temperature capability (-60 to +80 °C) UHMWPE (Ultra High Molecular Weight Polyethylene) Color: White to off-white	Z80	NBR 70	N	-30 to (+100)	Steel	35
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Stainless steel	
		EPDM 70	E**	-45 to (+145)	Aluminum Ceramic coating	

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

\*\* Material not suitable for mineral oils.

\*\*\* Max. diameter 2,300 mm

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are recommended.



## Installation Recommendation

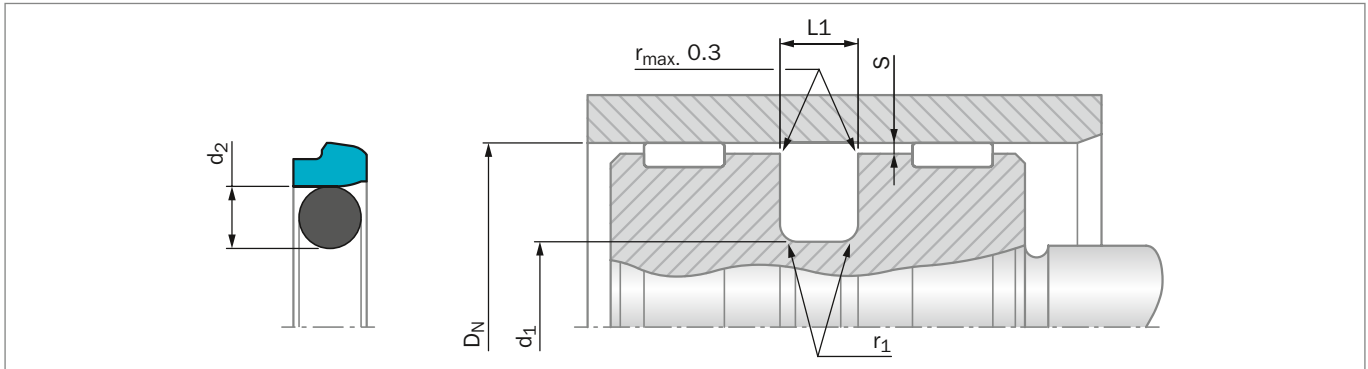


Figure 134: Installation Drawing

**Table 121: Installation Dimensions - Standard Recommendations**

Series No.	Bore Diameter $D_N$ H9			Groove Diameter $d_1$ h9	Groove Width $L_1$ +0.2	Radius $r_1$ max	Radial Clearance $S_{max}^*$			O-Ring Cross Section $d_2$
	Standard Application	Light Application	Heavy-Duty Application				10 MPa	20 MPa	40 MPa	
PSK0	8 - 16.9	17 - 26.9	-	$D_N - 4.9$	2.2	0.4	0.30	0.20	0.15	1.78
PSK1	17 - 26.9	27 - 59.9	-	$D_N - 7.3$	3.2	0.6	0.40	0.25	0.15	2.62
PSK2	27 - 59.9	60 - 199.9	17 - 24.9	$D_N - 10.7$	4.2	1.0	0.50	0.30	0.20	3.53
PSK3	60 - 199.9	200 - 255.9	25 - 59.9	$D_N - 15.1$	6.3	1.3	0.70	0.40	0.25	5.33
PSK4	200 - 255.9	256 - 669.9	60 - 199.9	$D_N - 20.5$	8.1	1.8	0.80	0.60	0.35	7.00
PSK8	256 - 669.9	670 - 999.9	200 - 255.9	$D_N - 24.0$	8.1	1.8	0.90	0.70	0.40	7.00
PSK5	670 - 999.9	-	256 - 669.9	$D_N - 27.3$	9.5	2.5	1.00	0.80	0.60	8.40
PSK5X	-	1,000 - 1,200	-	$D_N - 27.3$	9.5	2.5	1.00	0.80	0.60	8.40
PSK6**	-	-	670 - 999.9	$D_N - 38.0$	13.8	3.0	1.20	0.90	0.60	12.00
PSK6X**	1,000 - 2,700	-	-	$D_N - 38.0$	13.8	3.0	1.20	0.90	0.60	12.00

\* At pressures > 40 MPa use diameter tolerance H8/f8 (bore/piston) in the area behind seal or consult your local Trelleborg Sealing Solutions marketing company for alternative material or profiles.

Slydring® / Wear Rings are not applicable at very small radial clearances please consult the Slydring® catalog.

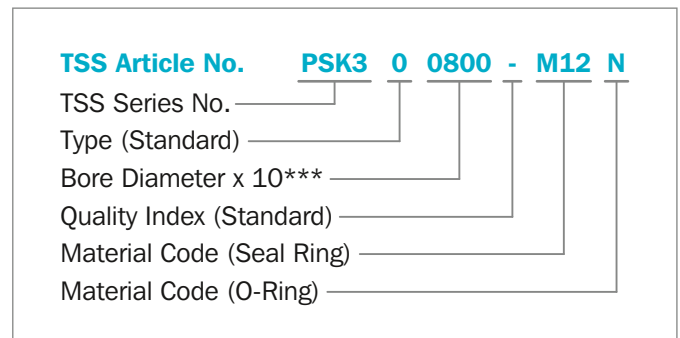
\*\* O-Rings with 12 mm cross section are delivered as special profile ring

### ORDERING EXAMPLE

Turcon® Stepseal® 2K complete with O-Ring, standard application:

<b>Series:</b>	PSK3 from Table 121
<b>Bore Diameter:</b>	$D_N = 80.0$ mm
<b>TSS Part No.:</b>	PSK300800 from Table 122

Select the material from Table 120. The corresponding code numbers are appended to the TSS Part No. Together these form the TSS Article Number. The TSS Article Number for all intermediate sizes can be determined by following the example:



\*\*\* For diameters  $D_N \geq 1,000.0$  mm multiply only by factor 1.  
 Example: PSK6 for diameter  $D_N = 1,200.0$  mm  
 TSS Article No.: PSK6X1200 - M12N





Table 122: Installation Dimensions / TSS Part No.

Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions	Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
$D_N$ h9	$d_1$ h9	$L_1$ +0.2			$D_N$ h9	$d_1$ h9	$L_1$ +0.2		
9.0	4.1	2.2	PSK000090	3.68 x 1.78	90.0	69.5	8.1	PSK400900	68.00 x 7.00
<b>10.0</b>	<b>5.1</b>	<b>2.2</b>	<b>PSK000100</b>	<b>4.47 x 1.78</b>	95.0	79.9	6.3	PSK300950	78.74 x 5.33
<b>12.0</b>	<b>7.1</b>	<b>2.2</b>	<b>PSK000120</b>	<b>6.70 x 1.80</b>	95.0	74.5	8.1	PSK400950	73.00 x 7.00
14.0	9.1	2.2	PSK000140	8.75 x 1.80	<b>100.0</b>	<b>84.9</b>	<b>6.3</b>	<b>PSK301000</b>	<b>81.92 x 5.33</b>
14.5	9.6	2.2	PSK000145	9.25 x 1.78	<b>100.0</b>	<b>79.5</b>	<b>8.1</b>	<b>PSK401000</b>	<b>78.00 x 7.00</b>
15.0	10.1	2.2	PSK000150	9.50 x 1.80	105.0	89.9	6.3	PSK301050	88.27 x 5.33
15.0	7.7	3.2	PSK100150	7.03 x 2.62	105.0	84.5	8.1	PSK401050	83.00 x 7.00
<b>16.0</b>	<b>11.1</b>	<b>2.2</b>	<b>PSK000160</b>	<b>10.60 x 1.80</b>	106.0	90.9	6.3	PSK301060	88.27 x 5.33
18.0	10.7	3.2	PSK100180	9.19 x 2.62	110.0	94.9	6.3	PSK301100	91.44 x 5.33
<b>20.0</b>	<b>15.1</b>	<b>2.2</b>	<b>PSK000200</b>	<b>14.00 x 1.78</b>	110.0	89.5	8.1	PSK401100	88.00 x 7.00
<b>20.0</b>	<b>12.7</b>	<b>3.2</b>	<b>PSK100200</b>	<b>12.37 x 2.62</b>	115.0	99.9	6.3	PSK301150	97.79 x 5.33
22.0	14.7	3.2	PSK100220	13.94 x 2.62	115.0	94.5	8.1	PSK401150	93.00 x 7.00
<b>25.0</b>	<b>17.7</b>	<b>3.2</b>	<b>PSK100250</b>	<b>17.12 x 2.62</b>	120.0	104.9	6.3	PSK301200	104.14 x 5.33
<b>25.0</b>	<b>14.3</b>	<b>4.2</b>	<b>PSK200250</b>	<b>13.87 x 3.53</b>	120.0	99.5	8.1	PSK401200	98.00 x 7.00
28.0	17.3	4.2	PSK200280	15.47 x 3.53	<b>125.0</b>	<b>109.9</b>	<b>6.3</b>	<b>PSK301250</b>	<b>107.32 x 5.33</b>
30.0	22.7	3.2	PSK100300	21.89 x 2.62	<b>125.0</b>	<b>104.5</b>	<b>8.1</b>	<b>PSK401250</b>	<b>103.00 x 7.00</b>
30.0	19.3	4.2	PSK200300	18.66 x 3.53	130.0	114.9	6.3	PSK301300	113.67 x 5.33
<b>32.0</b>	<b>24.7</b>	<b>3.2</b>	<b>PSK100320</b>	<b>23.47 x 2.62</b>	130.0	109.5	8.1	PSK401300	108.00 x 7.00
<b>32.0</b>	<b>21.3</b>	<b>4.2</b>	<b>PSK200320</b>	<b>20.22 x 3.53</b>	135.0	114.5	8.1	PSK401350	113.67 x 7.00
35.0	24.3	4.2	PSK200350	23.40 x 3.53	140.0	119.5	8.1	PSK401400	116.84 x 7.00
<b>40.0</b>	<b>32.7</b>	<b>3.2</b>	<b>PSK100400</b>	<b>31.42 x 2.62</b>	145.0	124.5	8.1	PSK401450	123.19 x 7.00
<b>40.0</b>	<b>29.3</b>	<b>4.2</b>	<b>PSK200400</b>	<b>28.17 x 3.53</b>	150.0	129.5	8.1	PSK401500	126.37 x 7.00
42.0	31.3	4.2	PSK200420	29.75 x 3.53	155.0	139.9	6.3	PSK301550	135.89 x 5.33
45.0	34.3	4.2	PSK200450	32.92 x 3.53	<b>160.0</b>	<b>144.9</b>	<b>6.3</b>	<b>PSK301600</b>	<b>142.24 x 5.33</b>
48.0	37.3	4.2	PSK200480	36.09 x 3.53	<b>160.0</b>	<b>139.5</b>	<b>8.1</b>	<b>PSK401600</b>	<b>135.89 x 7.00</b>
<b>50.0</b>	<b>39.3</b>	<b>4.2</b>	<b>PSK200500</b>	<b>37.69 x 3.53</b>	165.0	149.9	6.3	PSK301650	148.49 x 5.33
<b>50.0</b>	<b>34.9</b>	<b>6.3</b>	<b>PSK300500</b>	<b>32.69 x 5.33</b>	165.0	144.5	8.1	PSK401650	142.24 x 7.00
52.0	41.3	4.2	PSK200520	40.87 x 3.53	170.0	149.5	8.1	PSK401700	145.42 x 7.00
55.0	44.3	4.2	PSK200550	44.04 x 3.53	175.0	159.9	6.3	PSK301750	158.12 x 5.33
60.0	44.9	6.3	PSK300600	43.82 x 5.33	180.0	164.9	6.3	PSK301800	164.47 x 5.33
<b>63.0</b>	<b>52.3</b>	<b>4.2</b>	<b>PSK200630</b>	<b>50.39 x 3.53</b>	180.0	159.5	8.1	PSK401800	158.12 x 7.00
<b>63.0</b>	<b>47.9</b>	<b>6.3</b>	<b>PSK300630</b>	<b>46.99 x 5.33</b>	190.0	174.9	6.3	PSK301900	170.82 x 5.33
65.0	49.9	6.3	PSK300650	46.99 x 5.33	190.0	169.5	8.1	PSK401900	164.47 x 7.00
70.0	59.3	4.2	PSK200700	56.74 x 3.53	<b>200.0</b>	<b>184.9</b>	<b>6.3</b>	<b>PSK302000</b>	<b>183.52 x 5.33</b>
70.0	54.9	6.3	PSK300700	53.34 x 5.33	<b>200.0</b>	<b>179.5</b>	<b>8.1</b>	<b>PSK402000</b>	<b>177.17 x 7.00</b>
75.0	59.9	6.3	PSK300750	56.52 x 5.33	205.0	184.5	8.1	PSK402050	183.52 x 7.00
<b>80.0</b>	<b>64.9</b>	<b>6.3</b>	<b>PSK300800</b>	<b>62.87 x 5.33</b>	210.0	189.5	8.1	PSK402100	183.52 x 7.00
<b>80.0</b>	<b>59.5</b>	<b>8.1</b>	<b>PSK400800</b>	<b>58.00 x 7.00</b>	220.0	204.9	6.3	PSK302200	202.57 x 5.33
85.0	69.9	6.3	PSK300850	69.22 x 5.33	220.0	199.5	8.1	PSK402200	196.22 x 7.00
85.0	64.5	8.1	PSK400850	63.00 x 7.00	230.0	209.5	8.1	PSK402300	208.90 x 7.00
90.0	74.9	6.3	PSK300900	72.39 x 5.33	240.0	219.5	8.1	PSK402400	215.27 x 7.00



Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
D <sub>N</sub> h9	d <sub>1</sub> h9	L <sub>1</sub> +0.2		
<b>250.0</b>	<b>229.5</b>	<b>8.1</b>	<b>PSK402500</b>	<b>227.97 x 7.00</b>
<b>250.0</b>	<b>226.0</b>	<b>8.1</b>	<b>PSK802500</b>	<b>227.97 x 7.00</b>
260.0	236.0	8.1	PSK802600	227.97 x 7.00
270.0	246.0	8.1	PSK802700	240.67 x 7.00
280.0	256.0	8.1	PSK802800	253.37 x 7.00
300.0	276.0	8.1	PSK803000	266.07 x 7.00
306.0	285.5	8.1	PSK403060	278.77 x 7.00
310.0	286.0	8.1	PSK803100	278.77 x 7.00
<b>320.0</b>	<b>299.5</b>	<b>8.1</b>	<b>PSK403200</b>	<b>291.47 x 7.00</b>
<b>320.0</b>	<b>296.0</b>	<b>8.1</b>	<b>PSK803200</b>	<b>291.47 x 7.00</b>
330.0	306.0	8.1	PSK803300	304.17 x 7.00
340.0	316.0	8.1	PSK803400	316.87 x 7.00
345.0	324.5	8.1	PSK403450	316.87 x 7.00
350.0	326.0	8.1	PSK803500	316.87 x 7.00
360.0	336.0	8.1	PSK803600	329.57 x 7.00
370.0	346.0	8.1	PSK803700	342.27 x 7.00
380.0	356.0	8.1	PSK803800	354.97 x 7.00
<b>400.0</b>	<b>376.0</b>	<b>8.1</b>	<b>PSK804000</b>	<b>367.67 x 7.00</b>
420.0	396.0	8.1	PSK804200	393.07 x 7.00
430.0	406.0	8.1	PSK804300	405.26 x 7.00
440.0	416.0	8.1	PSK804400	405.26 x 7.00
450.0	426.0	8.1	PSK804500	417.96 x 7.00

Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
D <sub>N</sub> h9	d <sub>1</sub> h9	L <sub>1</sub> +0.2		
480.0	456.0	8.1	PSK804800	456.06 x 7.00
<b>500.0</b>	<b>476.0</b>	<b>8.1</b>	<b>PSK805000</b>	<b>468.76 x 7.00</b>
520.0	499.5	8.1	PSK405200	494.16 x 7.00
540.0	516.0	8.1	PSK805400	506.86 x 7.00
600.0	576.0	8.1	PSK806000	557.66 x 7.00
650.0	626.0	8.1	PSK806500	608.08 x 7.00
700.0	672.7	9.5	PSK507000	670.00 x 8.40
800.0	772.7	9.5	PSK508000	770.00 x 8.40
860.0	832.7	9.5	PSK508600	830.00 x 8.40
900.0	872.7	9.5	PSK509000	870.00 x 8.40
920.0	892.7	9.5	PSK509200	890.00 x 8.40
1,000.0	972.7	9.5	PSK5X1000	970.00 x 8.40
1,000.0	962.0	13.8	PSK6X1000	960.00 x 12.00
1,200.0	1,172.7	9.5	PSK5X1200	1,170.00 x 8.40
1,200.0	1,162.0	13.8	PSK6X1200	1,160.00 x 12.00
1,500.0	1,462.0	13.8	PSK6X1500	1,460.00 x 12.00
2,000.0	1,962.0	13.8	PSK6X2000	1,960.00 x 12.00
2,700.0	2,662.0	13.8	PSK6X2700	2,660.00 x 12.00

The bore diameters in **bold** type comply with the recommendations of ISO 3320. Other dimensions and all intermediate sizes up to 2,700 mm diameter including imperial (inch) sizes can be supplied.

All O-Rings with 12 mm cross section are delivered as special profile ring.