

Turcon® Stepseal® V LM



Single-acting

Designed for Lubrication Management
Technology

Rubber-energized plastic-faced seal

Material:

Turcon®, Zurcon® and Elastomer





■ Turcon® Stepseal® V LM



■ Description

Turcon® Stepseal® V LM is a new type of primary seal, conceived and developed to improve system performance and service life of the whole system, including hardware and other seals.

Stepseal® V LM is the first unidirectional seal element to integrate the Lubrication Management principles developed by Trelleborg Sealing Solutions as a standard feature.

Traditionally, unidirectional seals provide sealing by means of sharp, defined sealing edges, which establish high contact pressure with the hardware and suppress fluid film during the forward stroke.

With Lubrication Management, a modified seal edge reduces contact pressure with the hardware and supports the formation of a lubricating fluid film during the forward stroke. This allows fluid to reach secondary seals and scrapers in a controlled way, while back-pumping of fluid ensures lubrication during the return stroke. The efficient, built-in check valve action introduced with Stepseal® V protects secondary seals and scrapers against system pressure and ensures that pressure build-up between the seals is eliminated.

Lower contact pressure and improved lubrication reduce the mechanical and thermal load on seals and on the hardware, resulting in increased service life and system reliability.

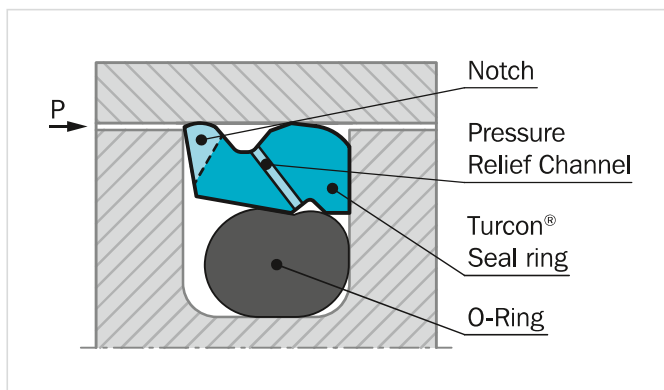


Figure 126: Turcon® Stepseal® V LM

ADVANTAGES:

- Built-in check valve performance identical to that of Stepseal® V
- No pressure build-up on secondary sealing element and Excluder®
- Independent of in- and out-stroke velocity
- High tolerance to hardware non-concentricity and radial play
- Minimum contribution to friction by secondary sealing element and Excluder®
- Minimum wear of secondary sealing element and Excluder®
- Robust, optimized seal face
- Increased leakage control
- Extended seal life
- Increased operational reliability
- Fits standard Stepseal® 2K groove dimensions as well as ISO 7425 seal housings

APPLICATION EXAMPLES

- Wind turbine pitch control
- Production presses
- Injection molding clamping cylinders
- Mobile cranes and lifts
- Vehicle suspensions



CHARACTERISTICS

- Primary seal with hydrostatic pressure release
- Check valve function
- Hydrodynamic back-pumping
- Stabilized position in the groove
- Extended seal life
- Improved system reliability

IMPROVED FRICTION PERFORMANCE

Turcon® Stepseal® V LM offers uniform low friction for the complete sealing system through improved lubrication of all sealing elements and by preventing pressurization of the secondary seal element.

FEATURES

Stepseal® V LM combines efficiency with reliability and longevity for the full sealing system and hardware. Controlled support of lubrication and lowered contact pressure reduce friction and wear, while the refined valve function eliminates pressure build-up in seal systems, making drain lines and buffer volumes between the seals a thing of the past.

OPERATING CONDITIONS

Pressure:	Up to 50 MPa (Turcon® M12) Up to 60 MPa (Turcon® T08 and Zurcon® Z53)
Speed:	Up to 15 m/s with linear movements, frequency up to 15 Hz
Temperature:	-45 °C to +200 °C* depending on seal and O-Ring material
Media:	Mineral oil based hydraulic fluids, flame retardant hydraulic fluids, environmentally friendly fluids (bio-oils), phosphate ester, water and others, depending on the seal and O-Ring material. See Table 114.
Clearance:	The maximum permissible radial clearance S_{max} is shown in Table 115, 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 applications in temperatures below 0 °C please contact your local Customer Solution Center for more information.

SERIES

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

Table 113 shows the relationship between the series number according to the seal diameter range and the different application class sizes:

Standard application:	General applications without 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, large clearances, etc.

**Table 113: Available Range**

Series No.	Rod Diameter d_N f8/h9
PSL20	15.0 - 200.0
PSL30	27.0 - 256.0
PSL40	60.0 - 670.0
PSL80	133.0 - 999.9
PSL50	250.0 - 999.9
PSL5X	1,000.0 - 1,200.0
PSL60	670.0 - 999.9
PSL6X	1,000.0 - 2,700.0

SEALING SYSTEM

Stepseal® V LM is developed for use with a secondary sealing element. Figure 127 shows such a tandem configuration with Stepseal® V LM.

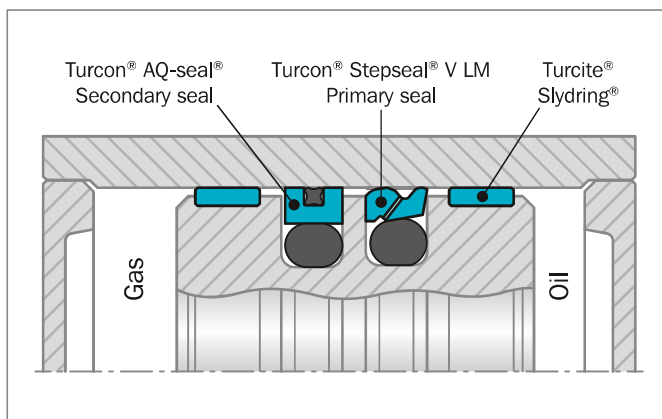


Figure 127: Turcon® Stepseal® V LM and Zurcon® Rimseal in tandem configuration

The integrated check valve function of Stepseal® V LM ensures that pressure cannot be trapped between the primary and secondary seals, and no extra space between them is required to accumulate hydraulic fluid.

Depending on the application and the operating conditions, the combination of different materials offers a further improvement in the sealing efficiency and the service life of the system. For example in hydraulic cylinders subject to high loads and under rough operating conditions, the primary seal should be made of Turcon® and the secondary seal of Zurcon®.

INSTALLATION INSTRUCTIONS

Stepseal® V LM is installed according to information on page 247 to page 249.

Closed groove installation according to dimensions in Table 81 page 249.

RECOMMENDED MATERIALS

The following material combinations have proven effective for hydraulic applications:

Turcon® Stepseal® V LM 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® V LM 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 114.



Table 114: Turcon® and Zurcon® Materials for Stepseal® V LM

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °C	Mating Surface Material	MPa max. Dynamic
Turcon® M12 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	
Turcon® T05 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		
Turcon® T08 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		
Turcon® T10 For hydraulic and pneumatic For linear motion in 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		
Turcon® T29 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	
		FKM 70	V	-10 to +200	Stainless steel	
		EPDM 70	E**	-45 to +145		



Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp. * °C	Mating Surface Material	MPa max. Dynamic
Turcon® T40 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	
Turcon® T46 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		
Zurcon® Z53*** 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	
Zurcon® Z80 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

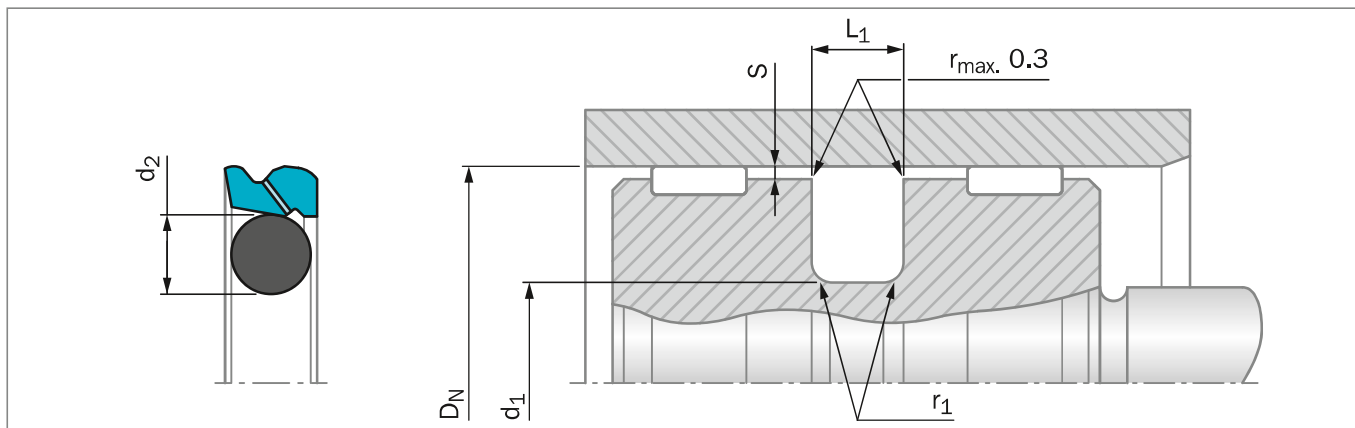


Figure 128: Installation Drawing

Table 115: Installation Dimensions – Standard Recommendations

Series No.	Rod 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	
PSL20	25 - 59.9	60 - 199.9	15 - 24.9	$D_N - 10.7$	4.2	1.0	0.50	0.30	0.20	3.53
PSL30	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
PSL40	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
PSL80	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
PSL50	670 - 999.9	-	256 - 669.9	$D_N - 27.3$	9.5	2.5	1.00	0.80	0.50	8.40
PSL5X	-	1,000 - 1,200	-	$D_N - 27.3$	9.5	2.5	1.00	0.80	0.50	8.40
PSL60**	-	-	670 - 999.9	$D_N - 38.0$	13.8	3.0	1.20	0.90	0.60	12.00
PSL6X**	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/rod) in the area behind seal or consult your local Customer Solution Center for alternative material or profiles.

Slydring® / Wear Rings are not applicable at very small radial clearances S, please consult the Slydring® section in this catalog.

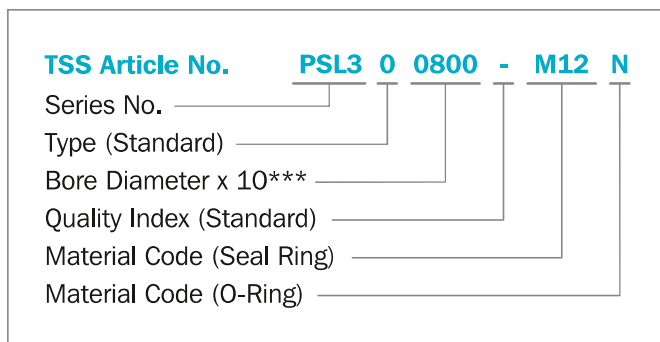
** All O-Rings with 12 mm cross section are delivered as special profile ring.

ORDERING EXAMPLE

Turcon® Stepseal® V LM complete with O-Ring, standard application:

Series:	PSL3 from Table 115
Bore Diameter:	$D_N = 80.0$ mm
TSS Part No.:	PSL300800 from Table 116

Select the material from Table 114. 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: PSL6 for diameter $D_N = 1,200.0$ mm
TSS Article No.: PSL6X1200 - M12N



Table 116: 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		
15.0	4.3	4.2	PSL200150	3.47 x 3.53	115.0	99.9	6.3	PSL301150	97.79 x 5.33
20.0	9.3	4.2	PSL200200	8.47 x 3.53	115.0	94.5	8.1	PSL401150	93 x 7.00
25.0	14.3	4.2	PSL200250	13.87 x 3.53	120.0	104.9	6.3	PSL301200	104.14 x 5.33
28.0	17.3	4.2	PSL200280	15.47 x 3.53	120.0	99.5	8.1	PSL401200	98 x 7.00
30.0	19.3	4.2	PSL200300	18.66 x 3.53	125.0	109.9	6.3	PSL301250	107.32 x 5.33
32.0	21.3	4.2	PSL200320	20.22 x 3.53	125.0	104.5	8.1	PSL401250	103 x 7.00
35.0	24.3	4.2	PSL200350	23.40 x 3.53	130.0	114.9	6.3	PSL301300	113.67 x 5.33
40.0	29.3	4.2	PSL200400	28.17 x 3.53	130.0	109.5	8.1	PSL401300	108 x 7.00
42.0	31.3	4.2	PSL200420	29.75 x 3.53	135.0	114.5	8.1	PSL401350	113.67 x 7.00
45.0	34.3	4.2	PSL200450	32.92 x 3.53	140.0	119.5	8.1	PSL401400	116.84 x 7.00
48.0	37.3	4.2	PSL200480	36.09 x 3.53	145.0	124.5	8.1	PSL401450	123.19 x 7.00
50.0	39.3	4.2	PSL200500	37.69 x 3.53	150.0	129.5	8.1	PSL401500	126.37 x 7.00
50.0	34.9	6.3	PSL300500	32.69 x 5.33	155.0	139.9	6.3	PSL301550	135.89 x 5.33
52.0	41.3	4.2	PSL200520	40.87 x 3.53	160.0	144.9	6.3	PSL301600	142.24 x 5.33
55.0	44.3	4.2	PSL200550	44.04 x 3.53	160.0	139.5	8.1	PSL401600	135.89 x 7.00
55.0	39.9	6.3	PSL300550	37.47 x 5.33	165.0	149.9	6.3	PSL301650	148.49 x 5.33
60.0	44.9	6.3	PSL300600	43.82 x 5.33	165.0	144.5	8.1	PSL401650	142.24 x 7.00
62.0	51.3	4.2	PSL200620	50.39 x 3.53	170.0	149.5	8.1	PSL401700	145.42 x 7.00
63.0	52.3	4.2	PSL200630	50.39 x 3.53	175.0	159.9	6.3	PSL301750	158.12 x 5.33
63.0	47.9	6.3	PSL300630	46.99 x 5.33	180.0	164.9	6.3	PSL301800	164.47 x 5.33
65.0	49.9	6.3	PSL300650	46.99 x 5.33	180.0	159.5	8.1	PSL401800	158.12 x 7.00
70.0	59.3	4.2	PSL200700	56.74 x 3.53	190.0	174.9	6.3	PSL301900	170.82 x 5.33
70.0	54.9	6.3	PSL300700	53.34 x 5.33	190.0	169.5	8.1	PSL401900	164.47 x 7.00
70.0	49.5	8.1	PSL400700	48 x 7.00	195.0	174.5	8.1	PSL401950	170.82 x 7.00
75.0	59.9	6.3	PSL300750	56.52 x 5.33	200.0	184.9	6.3	PSL302000	183.52 x 5.33
80.0	64.9	6.3	PSL300800	62.87 x 5.33	200.0	179.5	8.1	PSL402000	177.17 x 7.00
80.0	59.5	8.1	PSL400800	58 x 7.00	205.0	184.5	8.1	PSL402050	183.52 x 7.00
85.0	69.9	6.3	PSL300850	69.22 x 5.33	210.0	189.5	8.1	PSL402100	183.52 x 7.00
85.0	64.5	8.1	PSL400850	63 x 7.00	220.0	204.9	6.3	PSL302200	202.57 x 5.33
90.0	74.9	6.3	PSL300900	72.39 x 5.33	220.0	199.5	8.1	PSL402200	196.22 x 7.00
90.0	69.5	8.1	PSL400900	68 x 7.00	230.0	209.5	8.1	PSL402300	208.90 x 7.00
95.0	79.9	6.3	PSL300950	78.74 x 5.33	240.0	219.5	8.1	PSL402400	215.27 x 7.00
95.0	74.5	8.1	PSL400950	73 x 7.00	250.0	229.5	8.1	PSL402500	227.97 x 7.00
100.0	84.9	6.3	PSL301000	81.92 x 5.33	250.0	226.0	8.1	PSL802500	227.97 x 7.00
100.0	79.5	8.1	PSL401000	78 x 7.00	260.0	236.0	8.1	PSL802600	227.97 x 7.00
105.0	89.9	6.3	PSL301050	88.27 x 5.33	270.0	246.0	8.1	PSL802700	240.67 x 7.00
105.0	84.5	8.1	PSL401050	83 x 7.00	280.0	256.0	8.1	PSL802800	253.37 x 7.00
106.0	90.9	6.3	PSL301060	88.27 x 5.33	300.0	276.0	8.1	PSL803000	266.07 x 7.00
110.0	94.9	6.3	PSL301100	91.44 x 5.33	306.0	285.5	8.1	PSL403060	278.77 x 7.00
110.0	89.5	8.1	PSL401100	88 x 7.00	310.0	286.0	8.1	PSL803100	278.77 x 7.00



Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
D_N H9	d_1 h9	L_1 +0.2		
320.0	299.5	8.1	PSL403200	291.47 x 7.00
320.0	296.0	8.1	PSL803200	291.47 x 7.00
330.0	306.0	8.1	PSL803300	304.17 x 7.00
340.0	316.0	8.1	PSL803400	316.87 x 7.00
345.0	324.5	8.1	PSL403450	316.87 x 7.00
350.0	326.0	8.1	PSL803500	316.87 x 7.00
360.0	336.0	8.1	PSL803600	329.57 x 7.00
370.0	346.0	8.1	PSL803700	342.27 x 7.00
380.0	356.0	8.1	PSL803800	354.97 x 7.00
400.0	376.0	8.1	PSL804000	367.67 x 7.00
420.0	396.0	8.1	PSL804200	393.07 x 7.00
430.0	406.0	8.1	PSL804300	405.26 x 7.00
440.0	416.0	8.1	PSL804400	405.26 x 7.00
450.0	426.0	8.1	PSL804500	417.96 x 7.00
480.0	456.0	8.1	PSL804800	456.06 x 7.00
500.0	476.0	8.1	PSL805000	468.76 x 7.00
520.0	499.5	8.1	PSL405200	494.16 x 7.00
540.0	516.0	8.1	PSL805400	506.86 x 7.00
600.0	576.0	8.1	PSL806000	557.66 x 7.00
650.0	626.0	8.1	PSL806500	608.08 x 7.00

Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
D_N H9	d_1 h9	L_1 +0.2		
700.0	672.7	9.5	PSL507000	670 x 8.40
780.0	752.7	9.5	PSL507800	750 x 8.40
800.0	772.7	9.5	PSL508000	770 x 8.40
820.0	792.7	9.5	PSL508200	790 x 8.40
860.0	832.7	9.5	PSL508600	830 x 8.40
900.0	872.7	9.5	PSL509000	870 x 8.40
920.0	892.7	9.5	PSL509200	890 x 8.40
1,000.0	972.7	9.5	PSL5X1000	970 x 8.40
1,000.0	962.0	13.8	PSL6X1000	960 x 12.00
1,200.0	1,172.7	9.5	PSL5X1200	1,171 x 8.40
1,200.0	1,162.0	13.8	PSL6X1200	1,160 x 12.00
1,500.0	1,462.0	13.8	PSL6X1500	1,460 x 12.00
2,000.0	1,962.0	13.8	PSL6X2000	1,960 x 12.00
2,650.0	2,612.0	13.8	PSL6X2650	2,610 x 12.00
2,700.0	2,662.0	13.8	PSL6X2700	2,660 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.