Turcon® VL Seal®

Single-acting

Rubber-energized plastic-faced seal

Material:
Turcon®, Zurcon® and Elastomer

Notes

Turcon® VL Seal® *

Description

Turcon® VL Seal® is a unidirectional Rod seal for the same groove dimensions as standard O-Rings - Figure 67.

The design is optimized with regard to performance, friction, leakage and service life through meticulous simulation, in-house testing and qualification in the most demanding Aerospace applications.

VL Seal® effectively provides static sealing by the O-Ring. The O-Ring is protected from damage under pressure cycles by the contoured O-Ring contact zone which supports the O-Ring and keeps it in position also at high working pressure.

VL Seal® is designed with hydrodynamic back-pumping effect which allows the seal to relieve pressure trapped between tandem seals or between seals and double-acting scrapers.

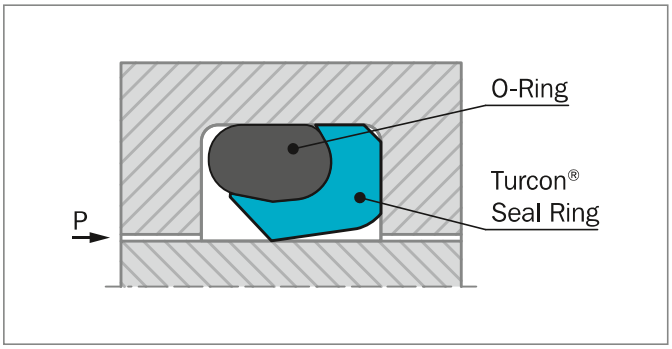

Figure 67: Turcon® VL Seal® mounted in O-Ring groove

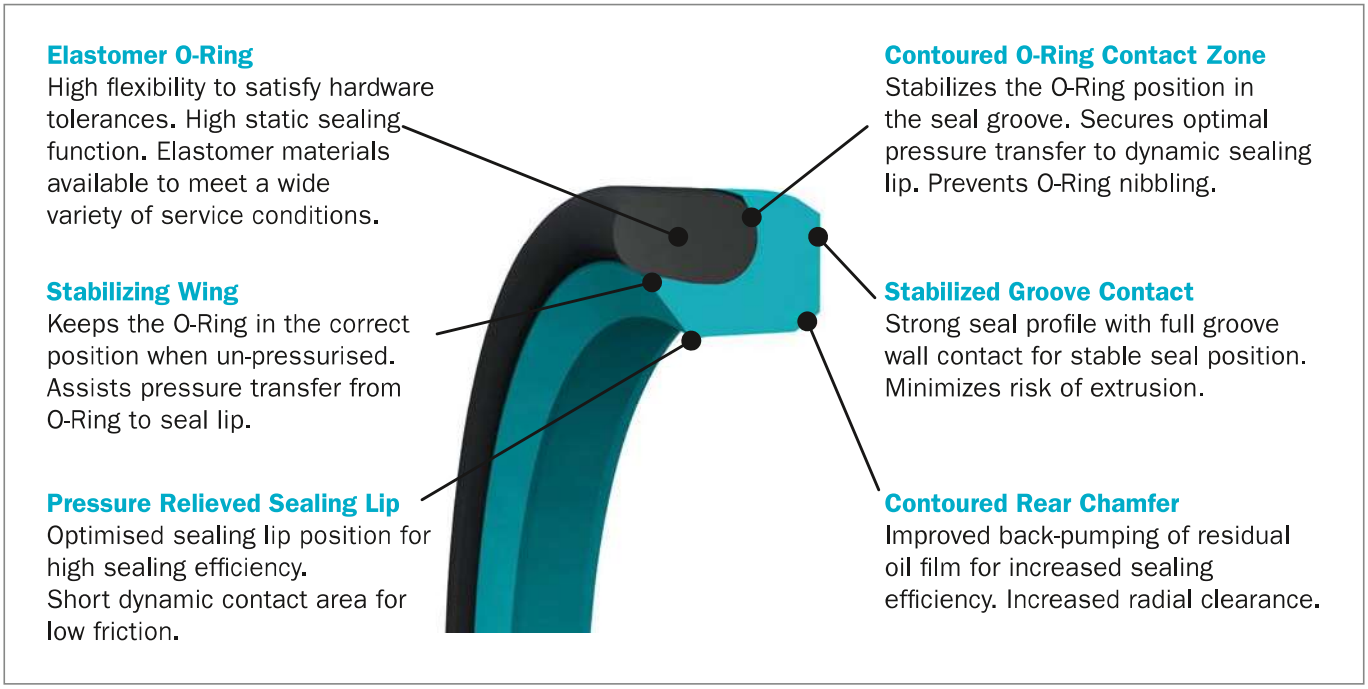

Figure 68: Turcon® VL Seal® design features

* Patent pending. (US Patent No. 6,497,415)

METHOD OF OPERATION

The sealing mechanism of VL Seal® is based on the hydrodynamic properties of the seal. The specially formed seal edge has a steep contact pressure gradient on the high pressure side and a shallow contact pressure gradient on the low pressure side. This ensures that the fluid film adhering to the piston rod is returned to the high pressure chamber on the return stroke of the rod, minimizing the risk of leaks.

This also prevents the build-up of inter-seal pressure normally associated with tandem seal configurations - Figure 69. Inter-seal pressure depends on the system pressure, speed, stroke length and groove design.

ADVANTAGES

- Groove design with shallow radial depth
- Optimized leakage control and service life
- Low friction with small contact area between seal and counter surface
- Featuring the Turcon® Stepseal® 2K back pumping effect
- Utilize standard O-Ring installation groove
- Available in all diameter sizes from 6 to 2,600 mm

APPLICATION EXAMPLES

VL Seal® is recommended for hydraulics and general machine construction as an alternative to Stepseal® 2K and other single-acting seals for example in:

- Aerospace hydraulics
- Machine tools
- Automation
- Handling devises
- Telescopic cylinders
- Automobile industry
- Servo hydraulics
- Valves
- Valve stems
- Down-hole tools
- O-Ring replacement

OPERATING CONDITIONS

Pressure:	Up to 60 MPa
Speed:	Up to 15 m/s with linear movements, frequency up to 5 Hz
Temperature:	-45 °C to +200 °C depending on O-Ring material
Media:	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 47
Clearance:	The maximum permissible radial clearance S_{max} is shown in Table 48, 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 dependent on media.

RADIAL NOTCH

VL Seal® can be delivered with radial notches at the low pressure side. This is an advantage if the seal is used in rotary applications. Notches can prevent the seal from rotating in the groove by avoiding pressurised fluid being trapped between seal and groove corner.

REDUNDANT SEALING SYSTEM

In many applications, secondary seal systems are required. Figure 67 shows such a tandem configuration with VL Seal® .

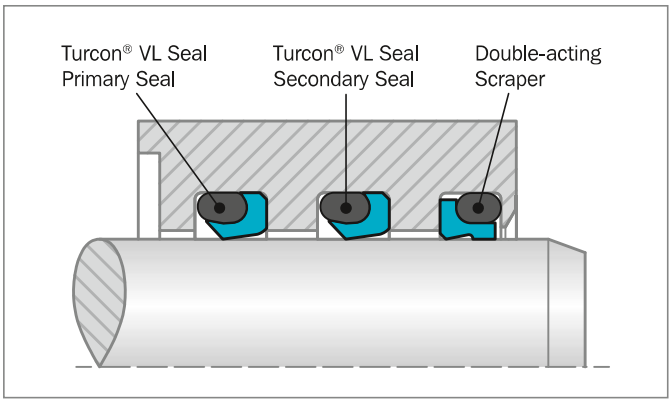

Figure 69: Turcon® VL Seal® in tandem configuration

INSTALLATION INSTRUCTIONS

VL Seal® is dimensionally interchangeable with seals for O-Ring housings, like Turcon® Double Delta® and Turcon® Variseal® M2. Groove dimensions, radial clearances and recommended seal series in relation to diameter are as illustrated in Table 48.

VL Seal® is preferably installed in closed grooves according to Figure 11 page 39. Depending on type and size installation in split grooves is also possible. Recommended minimum diameters for installation in closed grooves see Table 7 page 39.

RECOMMENDED MATERIALS

The following material combinations have proven effective for hydraulic applications:

Turcon® VL Seal ® 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 lubricating properties:

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

Set code: M12N or M12V

Turcon® VL Seal® in Turcon® T46
For medium to heavy applictions 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

Zurcon® Z54 is recommended for VL Seal® as an alternative to polyurethane U-Cups especially outside the size range of these products.

For specific applications, all Turcon® materials are available.

Other material combinations are listed in Table 47.

Table 47: Turcon® and Zurcon® Materials for VL Seal®

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 Steel hardened Steel chrome plated (rod) Steel plated (rod) Cast iron Stainless steel Titanium	50
		NBR 70 Low temp.	T	-45 to +80		
		FKM 70	V	-20 to +200		
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 Steel hardened Steel chrome plated (rod)	20
		NBR 70 Low temp.	T	-45 to +80		
		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 Steel chrome plated (rod) Cast iron	60
		NBR 70 Low temp.	T	-45 to +80		
		FKM 70	V	-10 to +200		
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 Steel hardened Steel chrome plated (rod) Cast iron Stainless steel	30
		NBR 70 Low temp.	T	-45 to +80		
		FKM 70	V	-10 to +200		
		EPDM 70	E**	-45 to +145		
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 Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Aluminum	25
		NBR 70 Low temp.	T	-45 to +80		
		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. Dyna-mic
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 Steel chrome plated (rod) Cast iron	50
		NBR 70 Low temp.	T	-45 to +80		
		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 Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Ceramic coating	60
		NBR 70 Low temp.	T	-45 to +80		
Zurcon® Z54*** For mineral oil based fluids Linear and slowly turning movements High abrasion resistance For counter surface with rougher surface finish Good extrusion resistance Limited chemical resistance Max. working temperature 110 °C Cast polyurethane Color: Turquoise	Z54	NBR 70	N	-30 to +100	Steel Steel hardened Steel chrome plated (rod) Cast iron Stainless steel Ceramic coating	25
		NBR 70 Low temp.	T	-45 to +80		
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 Steel hardened Steel chrome plated (rod) Stainless steel Aluminum Ceramic coating	35
		NBR 70 Low temp.	T	-45 to +80		
		EPDM 70	E**	-45 to (+145)		

* The O-Ring Operation Temperature is only valid in mineral hydraulic oil.

** Material not suitable for mineral oils.

*** Max. diameter 2,200 mm.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

Highlighted materials are recommended.

Installation Recommendation

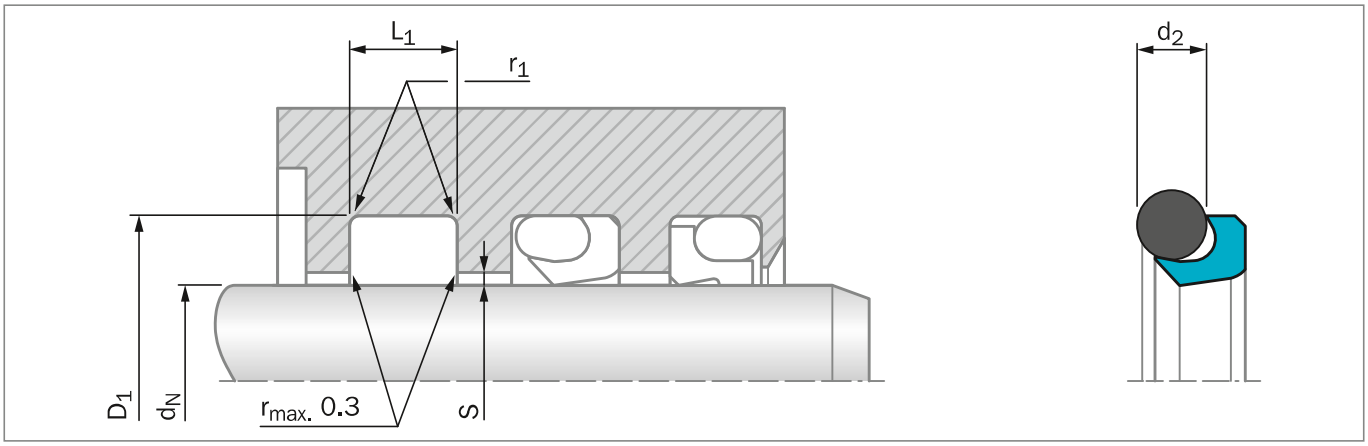

Figure 70: Installation Drawing

Table 48: Installation Dimensions - Standard Recommendations

Series No.	Rod Diameter d_N f8/h9		Groove Diameter	Groove Width	Radius	Radial Clearance S_{max}*			O-Ring Cross Section
	Standard Application	Available Range	D_1 H9	L_1 +0.2	$r_{1\,max}$	10 MPa	20 MPa	30 MPa	d_2
REL10	10 - 19.9	6 - 100.0	d_N + 4.5	3.6	0.4	0.40	0.25	0.15	1.78
REL20	20 - 39.9	10 - 200.0	d_N + 6.2	4.8	0.6	0.40	0.25	0.20	2.62
REL30	40 - 119.9	20 - 400.0	d_N + 9.4	7.1	0.8	0.50	0.30	0.20	3.53
REL40	120 - 399.9	35 - 650.0	d_N + 12.2	9.5	0.8	0.60	0.35	0.25	5.33
REL50	400 - 649.9	125 - 999.9	d_N + 15.9	12.2	0.8	0.70	0.50	0.30	7.00
REL60	650 - 999.9	400 - 999.9	d_N + 19.0	15.0	0.8	1.00	0.70	0.60	8.40
REL6X	1,000 - 2,600		d_N + 19.0	15.0	0.8	1.00	0.70	0.60	8.40

* 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 please consult the Slydring® section in this catalog.
For minimum diameter installation in closed grooves see Table 7 page 39.

ORDERING EXAMPLE

Turcon® VL Seal® complete with O-Ring, standard application:

Series:	REL40 from Table 48
Rod diameter:	d_N = 250.0 mm
TSS Part No.:	REL402500 from Table 49

Select the material from Table 47. 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.

TSS Article No. **REL4 0 2500 - M12 N**

- Series No. — REL4
- Type (Standard)*** — 0
- Rod Diameter x 10** — 2500
- Quality Index (Standard) — -
- Material Code (Seal Ring) — M12
- Material Code (O-Ring) — N

** For diameters $d_N \geq 1{,}000.0$ mm multiply only by factor 1.
Example: REL6X for diameter d_N = 1,200.0 mm
TSS Article No.: REL6**X1200** - M12N

*** Use suffix "N" for seals with radial notches, for diameter d_N < 1,000 mm. (Radial notches for diameter $d_N \geq 1{,}000$ mm a special part number is required).

Table 49: Installation Dimensions / TSS Part No.

Rod Dia. d_N f8/h9	Groove Dia. D_1 H9	Groove Width L_1 +0.2	TSS Part No.	O-Ring Size
6.0	**10.5**	**3.6**	**REL100060**	**7.10 x 1.80**
8.0	**12.5**	**3.6**	**REL100080**	**9.25 x 1.78**
9.0	13.5	3.6	REL100090	10.60 x 1.80
10.0	**14.5**	**3.6**	**REL100100**	**11.20 x 1.80**
12.0	**16.5**	**3.6**	**REL100120**	**13.20 x 1.80**
12.7	17.2	3.6	REL100127	14.00 x 1.78
14.0	**18.5**	**3.6**	**REL100140**	**15.60 x 1.78**
15.0	19.5	3.6	REL100150	17.17 x 1.78
16.0	**20.5**	**3.6**	**REL100160**	**17.17 x 1.78**
18.0	**22.5**	**3.6**	**REL100180**	**19.00 x 1.80**
19.0	25.2	4.8	REL200190	20.29 x 2.62
20.0	**24.5**	**3.6**	**REL100200**	**21.95 x 1.78**
20.0	**26.2**	**4.8**	**REL200200**	**21.89 x 2.62**
22.0	**26.5**	**3.6**	**REL100220**	**23.52 x 1.78**
22.0	**28.2**	**4.8**	**REL200220**	**23.47 x 2.62**
24.0	28.5	3.6	REL100240	25.12 x 1.78
25.0	**29.5**	**3.6**	**REL100250**	**26.70 x 1.78**
25.0	**31.2**	**4.8**	**REL200250**	**26.64 x 2.62**
25.4	29.9	3.6	REL100254	26.70 x 1.78
25.4	31.6	4.8	REL200254	26.64 x 2.62
26.0	30.5	3.6	REL100260	28.30 x 1.78
26.0	32.2	4.8	REL200260	28.24 x 2.62
28.0	**32.5**	**3.6**	**REL100280**	**29.87 x 1.78**
28.0	**34.2**	**4.8**	**REL200280**	**29.82 x 2.62**
30.0	34.5	3.6	REL100300	31.47 x 1.78
30.0	36.2	4.8	REL200300	31.42 x 2.62
32.0	**36.5**	**3.6**	**REL100320**	**33.05 x 1.78**
32.0	**38.2**	**4.8**	**REL200320**	**34.59 x 2.62**
35.0	39.5	3.6	REL100350	37.82 x 1.78
35.0	41.2	4.8	REL200350	36.17 x 2.62
36.0	**40.5**	**3.6**	**REL100360**	**37.82 x 1.78**
36.0	**42.2**	**4.8**	**REL200360**	**37.77 x 2.62**
37.0	41.5	3.6	REL100370	37.82 x 1.78
37.0	43.2	4.8	REL200370	39.34 x 2.62
38.0	44.2	4.8	REL200380	39.34 x 2.62
38.0	47.4	7.1	REL300380	40.87 x 3.53
40.0	**46.2**	**4.8**	**REL200400**	**42.52 x 2.62**
40.0	**49.4**	**7.1**	**REL300400**	**44.04 x 3.53**
42.0	48.2	4.8	REL200420	44.12 x 2.62
42.0	51.4	7.1	REL300420	44.04 x 3.53
43.0	49.2	4.8	REL200430	44.12 x 2.62
45.0	**51.2**	**4.8**	**REL200450**	**47.29 x 2.62**
45.0	**54.4**	**7.1**	**REL300450**	**47.22 x 3.53**
48.0	54.2	4.8	REL200480	50.47 x 2.62
48.0	57.4	7.1	REL300480	50.39 x 3.53
50.0	**56.2**	**4.8**	**REL200500**	**52.07 x 2.62**
50.0	**59.4**	**7.1**	**REL300500**	**53.57 x 3.53**
50.8	57.0	4.8	REL200508	52.07 x 2.62
50.8	60.2	7.1	REL300508	53.57 x 3.53
52.0	58.2	4.8	REL200520	53.64 x 2.62
52.0	61.4	7.1	REL300520	56.74 x 3.53
54.0	63.4	7.1	REL300540	56.74 x 3.53
55.0	61.2	4.8	REL200550	56.82 x 2.62
55.0	64.4	7.1	REL300550	59.92 x 3.53
56.0	**62.2**	**4.8**	**REL200560**	**58.42 x 2.62**
56.0	**65.4**	**7.1**	**REL300560**	**59.92 x 3.53**
56.0	**68.2**	**9.5**	**REL400560**	**59.69 x 5.33**
60.0	66.2	4.8	REL200600	61.60 x 2.62
60.0	69.4	7.1	REL300600	63.09 x 3.53
63.0	**69.2**	**4.8**	**REL200630**	**64.77 x 2.62**
63.0	**72.4**	**7.1**	**REL300630**	**66.27 x 3.53**
65.0	71.2	4.8	REL200650	66.34 x 2.62
65.0	74.4	7.1	REL300650	69.44 x 3.53
70.0	**76.2**	**4.8**	**REL200700**	**71.12 x 2.62**
70.0	**79.4**	**7.1**	**REL300700**	**72.62 x 3.53**
70.0	**82.2**	**9.5**	**REL400700**	**75.57 x 5.33**
72.0	78.2	4.8	REL200720	75.87 x 2.62
75.0	81.2	4.8	REL200750	77.00 x 2.62
75.0	84.4	7.1	REL300750	78.97 x 3.53
76.2	85.6	7.1	REL300762	78.97 x 3.53
80.0	**86.2**	**4.8**	**REL200800**	**82.22 x 2.62**
80.0	**89.4**	**7.1**	**REL300800**	**82.14 x 3.53**
80.0	**92.2**	**9.5**	**REL400800**	**85.09 x 5.33**
85.0	91.2	4.8	REL200850	88.57 x 2.62
85.0	94.4	7.1	REL300850	88.49 x 3.53
85.0	97.2	9.5	REL400850	88.27 x 5.33
90.0	**96.2**	**4.8**	**REL200900**	**94.92 x 2.62**
90.0	**99.4**	**7.1**	**REL300900**	**94.84 x 3.53**
90.0	**102.2**	**9.5**	**REL400900**	**94.62 x 5.33**
95.0	101.2	4.8	REL200950	97.00 x 2.62

Rod Dia. d_N f8/h9	Groove Dia. D_1 H9	Groove Width L_1 +0.2	TSS Part No.	O-Ring Size
95.0	104.4	7.1	REL300950	98.02 x 3.53
100.0	**106.2**	**4.8**	**REL201000**	**101.27 x 2.62**
100.0	**109.4**	**7.1**	**REL301000**	**104.37 x 3.53**
100.0	**112.2**	**9.5**	**REL401000**	**104.14 x 5.33**
101.6	111.0	7.1	REL301016	104.37 x 3.53
105.0	114.4	7.1	REL301050	107.54 x 3.53
105.0	117.2	9.5	REL401050	110.49 x 5.33
110.0	**116.2**	**4.8**	**REL201100**	**113.97 x 2.62**
110.0	**119.4**	**7.1**	**REL301100**	**113.89 x 3.53**
110.0	**122.2**	**9.5**	**REL401100**	**113.67 x 5.33**
115.0	124.4	7.1	REL301150	117.07 x 3.53
120.0	129.4	7.1	REL301200	123.42 x 3.53
120.0	132.2	9.5	REL401200	123.19 x 5.33
125.0	**134.4**	**7.1**	**REL301250**	**129.77 x 3.53**
125.0	**137.2**	**9.5**	**REL401250**	**129.54 x 5.33**
127.0	136.4	7.1	REL301270	129.77 x 3.53
130.0	139.4	7.1	REL301300	132.94 x 3.53
130.0	142.2	9.5	REL401300	132.72 x 5.33
135.0	141.2	4.8	REL201350	139.37 x 2.62
135.0	144.4	7.1	REL301350	139.29 x 3.53
140.0	**146.2**	**4.8**	**REL201400**	**145.72 x 2.62**
140.0	**149.4**	**7.1**	**REL301400**	**142.47 x 3.53**
140.0	**152.2**	**9.5**	**REL401400**	**145.42 x 5.33**
145.0	154.4	7.1	REL301450	148.82 x 3.53
145.0	157.2	9.5	REL401450	148.49 x 5.33
150.0	159.4	7.1	REL301500	158.34 x 3.53
150.0	162.2	9.5	REL401500	158.12 x 5.33
155.0	164.4	7.1	REL301550	158.34 x 3.53
160.0	**169.4**	**7.1**	**REL301600**	**164.69 x 3.53**
160.0	**172.2**	**9.5**	**REL401600**	**164.47 x 5.33**
165.0	174.4	7.1	REL301650	171.04 x 3.53
170.0	179.4	7.1	REL301700	177.39 x 3.53
170.0	182.2	9.5	REL401700	177.17 x 5.33
175.0	184.4	7.1	REL301750	177.39 x 3.53
180.0	**189.4**	**7.1**	**REL301800**	**183.74 x 3.53**
180.0	**192.2**	**9.5**	**REL401800**	**183.52 x 5.33**
185.0	194.4	7.1	REL301850	190.09 x 3.53
185.0	197.2	9.5	REL401850	189.87 x 5.33
190.0	199.4	7.1	REL301900	196.44 x 3.53
190.0	202.2	9.5	REL401900	196.22 x 5.33
195.0	204.4	7.1	REL301950	202.79 x 3.53

Rod Dia. d_N f8/h9	Groove Dia. D_1 H9	Groove Width L_1 +0.2	TSS Part No.	O-Ring Size
200.0	**209.4**	**7.1**	**REL302000**	**202.79 x 3.53**
200.0	**212.2**	**9.5**	**REL402000**	**202.57 x 5.33**
205.0	217.2	9.5	REL402050	208.92 x 5.33
210.0	222.2	9.5	REL402100	215.27 x 5.33
215.0	227.2	9.5	REL402150	221.62 x 5.33
220.0	**232.2**	**9.5**	**REL402200**	**227.97 x 5.33**
225.0	237.2	9.5	REL402250	227.97 x 5.33
230.0	239.4	7.1	REL302300	234.54 x 3.53
230.0	242.2	9.5	REL402300	234.32 x 5.33
235.0	247.2	9.5	REL402350	240.67 x 5.33
240.0	252.2	9.5	REL402400	247.02 x 5.33
245.0	257.2	9.5	REL402450	253.37 x 5.33
250.0	**262.2**	**9.5**	**REL402500**	**253.37 x 5.33**
270.0	282.2	9.5	REL402700	278.77 x 5.33
275.0	287.2	9.5	REL402750	278.77 x 5.33
280.0	**292.2**	**9.5**	**REL402800**	**291.47 x 5.33**
285.0	297.2	9.5	REL402850	291.47 x 5.33
290.0	302.2	9.5	REL402900	304.17 x 5.33
295.0	307.2	9.5	REL402950	304.17 x 5.33
300.0	312.2	9.5	REL403000	304.17 x 5.33
310.0	322.2	9.5	REL403100	313.00 x 5.33
320.0	**332.2**	**9.5**	**REL403200**	**329.57 x 5.33**
330.0	342.2	9.5	REL403300	333.00 x 5.33
340.0	352.2	9.5	REL403400	354.97 x 5.33
350.0	362.2	9.5	REL403500	354.97 x 5.33
360.0	**372.2**	**9.5**	**REL403600**	**365.00 x 5.30**
370.0	382.2	9.5	REL403700	380.37 x 5.33
380.0	392.2	9.5	REL403800	383.00 x 5.33
390.0	402.2	9.5	REL403900	405.26 x 5.33
400.0	412.2	9.5	REL404000	405.26 x 5.33
400.0	415.9	12.2	REL504000	405.26 x 7.00
410.0	422.2	9.5	REL404100	413.00 x 5.33
420.0	432.2	9.5	REL404200	430.66 x 5.33
420.0	435.9	12.2	REL504200	430.66 x 7.00
430.0	442.2	9.5	REL404300	433.00 x 5.33
440.0	452.2	9.5	REL404400	456.06 x 5.33
450.0	462.2	9.5	REL404500	456.06 x 5.33
450.0	465.9	12.2	REL504500	456.06 x 7.00
460.0	472.2	9.5	REL404600	481.38 x 5.33
470.0	482.2	9.5	REL404700	481.38 x 5.33
480.0	492.2	9.5	REL404800	483.00 x 5.33

Rod Dia. d_N f8/h9	Groove Dia. D_1 H9	Groove Width L_1 +0.2	TSS Part No.	O-Ring Size
480.0	495.9	12.2	REL504800	494.16 x 7.00
490.0	502.2	9.5	REL404900	506.78 x 5.33
500.0	512.2	9.5	REL405000	506.78 x 5.33
500.0	515.9	12.2	REL505000	506.86 x 7.00
510.0	522.2	9.5	REL405100	532.18 x 5.33
520.0	532.2	9.5	REL405200	532.18 x 5.33
520.0	535.9	12.2	REL505200	532.26 x 7.00
530.0	542.2	9.5	REL405300	533.00 x 5.33
540.0	552.2	9.5	REL405400	557.58 x 5.33
550.0	562.2	9.5	REL405500	557.58 x 5.33
550.0	565.9	12.2	REL505500	557.66 x 7.00
560.0	572.2	9.5	REL405600	582.68 x 5.33
570.0	582.2	9.5	REL405700	582.68 x 5.33
580.0	592.2	9.5	REL405800	582.68 x 5.33
580.0	595.9	12.2	REL505800	608.08 x 7.00
590.0	602.2	9.5	REL405900	608.08 x 5.33
600.0	612.2	9.5	REL406000	608.08 x 5.33
600.0	615.9	12.2	REL506000	608.08 x 7.00
610.0	622.2	9.5	REL406100	633.48 x 5.33
620.0	632.2	9.5	REL406200	633.48 x 5.33
620.0	635.9	12.2	REL506200	633.48 x 7.00
630.0	642.2	9.5	REL406300	633.48 x 5.33
640.0	652.2	9.5	REL406400	658.88 x 5.33
650.0	665.9	12.2	REL506500	658.88 x 7.00
650.0	669.0	15.0	REL606500	654.00 x 8.40
660.0	675.9	12.2	REL506600	664.00 x 7.00
660.0	679.0	15.0	REL606600	664.00 x 8.40
680.0	695.9	12.2	REL506800	684.00 x 7.00
680.0	699.0	15.0	REL606800	684.00 x 8.40
700.0	715.9	12.2	REL507000	704.00 x 7.00
700.0	719.0	15.0	REL607000	704.00 x 8.40
710.0	725.9	12.2	REL507100	714.00 x 7.00
710.0	729.0	15.0	REL607100	714.00 x 8.40
730.0	745.9	12.2	REL507300	734.00 x 7.00
730.0	749.0	15.0	REL607300	734.00 x 8.40
760.0	775.9	12.2	REL507600	764.00 x 7.00
760.0	779.0	15.0	REL607600	764.00 x 8.40
780.0	795.9	12.2	REL507800	784.00 x 7.00
780.0	799.0	15.0	REL607800	784.00 x 8.40
790.0	805.9	12.2	REL507900	794.00 x 7.00
790.0	809.0	15.0	REL607900	794.00 x 8.40

Rod Dia. d_N f8/h9	Groove Dia. D_1 H9	Groove Width L_1 +0.2	TSS Part No.	O-Ring Size
800.0	815.9	12.2	REL508000	804.00 x 7.00
800.0	819.0	15.0	REL608000	804.00 x 8.40
810.0	825.9	12.2	REL508100	814.00 x 7.00
810.0	829.0	15.0	REL608100	814.00 x 8.40
820.0	835.9	12.2	REL508200	824.00 x 7.00
820.0	839.0	15.0	REL608200	824.00 x 8.40
830.0	845.9	12.2	REL508300	834.00 x 7.00
830.0	849.0	15.0	REL608300	834.00 x 8.40
850.0	865.9	12.2	REL508500	854.00 x 7.00
850.0	869.0	15.0	REL608500	854.00 x 8.40
870.0	885.9	12.2	REL508700	874.00 x 7.00
870.0	889.0	15.0	REL608700	874.00 x 8.40
880.0	895.9	12.2	REL508800	884.00 x 7.00
880.0	899.0	15.0	REL608800	884.00 x 8.40
890.0	905.9	12.2	REL508900	894.00 x 7.00
890.0	909.0	15.0	REL608900	894.00 x 8.40
930.0	945.9	12.2	REL509300	934.00 x 7.00
930.0	949.0	15.0	REL609300	934.00 x 8.40
1,000.0	1,019.0	15.0	REL6X1000	1,004.00 x 8.40
1,050.0	1,069.0	15.0	REL6X1050	1,054.00 x 8.40
1,100.0	1,119.0	15.0	REL6X1100	1,104.00 x 8.40
1,200.0	1,219.0	15.0	REL6X1200	1,204.00 x 8.40
1,500.0	1,519.0	15.0	REL6X1500	1,504.00 x 8.40
1,600.0	1,619.0	15.0	REL6X1600	1,604.00 x 8.40
2,000.0	2,019.0	15.0	REL6X2000	2,004.00 x 8.40
2,600.0	2,619.0	15.0	REL6X2600	2,604.00 x 8.40

The rod diameters in **bold** type are in accordance with the recommendations of ISO 3320.

Other dimensions and all intermediate sizes up to 2,600 mm diameter, including imperial (inch) sizes converted to mm, can be supplied.