Zurcon® Rimseal IM

Injection Molded (IM)

Single-acting

Rubber-energized plastic-faced seal

Material:
Zurcon® Z13 and Elastomer

Zurcon® Rimseal IM

Description

Zurcon® Rimseal IM is an O-Ring energized rod seal designed for high demanding applications, with manufacturing feasible by both injection molding and by lathing from injection molded TPU Zurcon® tubes.

Zurcon® Rimseal IM is an asymmetric rod seal with a slipper ring made of Zurcon® Z13, fitting into both Stepseal® and ISO 7425-2 grooves.

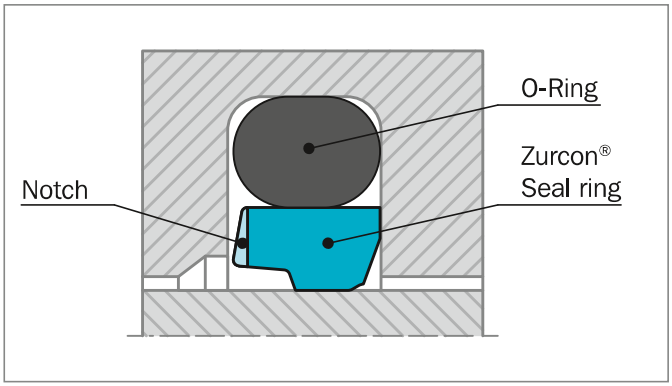


Figure 33: Zurcon® Rimseal IM

Contact length and profile tilting angles are optimized to give the desired contact pressure distribution throughout a wide range of pressures, hardware machining tolerances and different working temperatures within the admissible temperature range.

Especially in tandem with various primary seals, this new design promises to give an effective solution for modern hydraulic applications.

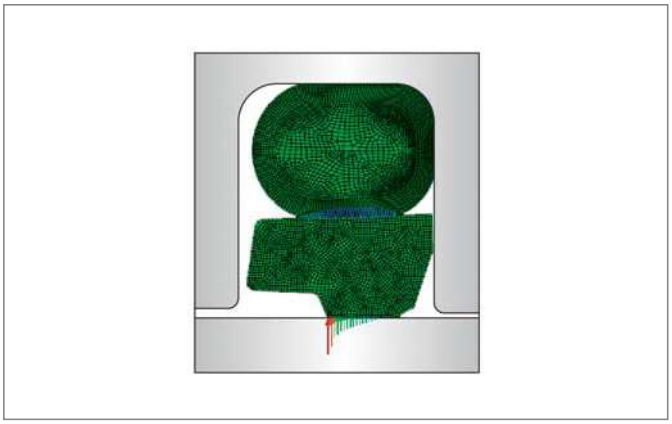


Figure 34: Zurcon® Rimseal IM

This profile is tested and proven to work efficiently within a Lubrication Management (LM) PUR system configuration.

Zurcon® Rimseal IM is able to combine very high abrasion and extrusion resistance together with chemical compatibility.

The wear resistance is improved even more with a LM configuration due to friction reduction within the whole sealing system compared to other traditional TPU solutions.

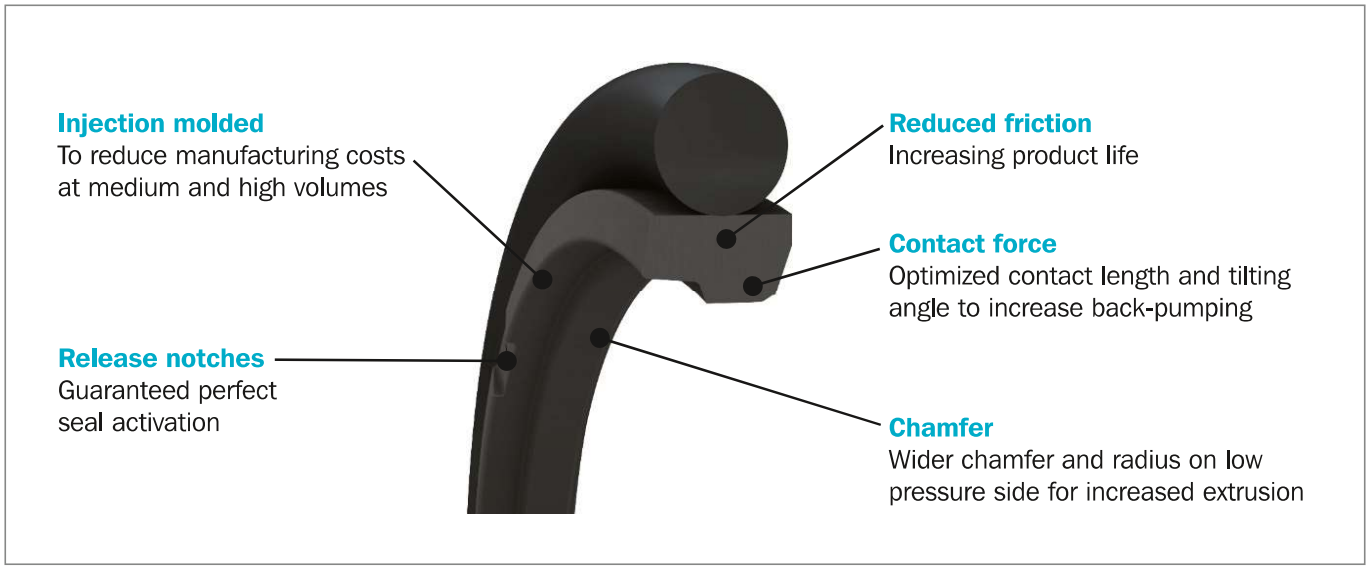


Figure 35: Zurcon® Rimseal IM design features

METHOD OF OPERATION

Like all slipper seals, the initial compression is generated by O-Ring squeeze. The contact force distribution at low pressures is optimized for low friction and tight sealing.
Four radial notches at the back of the seal guarantee O-Ring activation, even in the cases of contact with the back side of the groove or for sudden pressure release when the pressure drops. A design shape at the outer corner was studied to increase extrusion resistance (Figure 34).
In Figure 35 shows Von Mises Stress at 3 different pressure levels: after installation, medium range and 25 MPa.

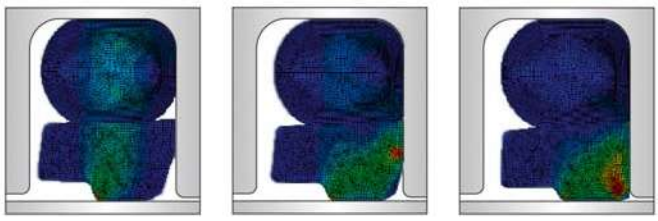


Figure 36: left: 0 MPa; center: 5 MPa; right: 25 MPa

Contact length and tilt angle are also optimized for seal stability at high pressures. The FEA design, shows very good positioning in the groove and relatively small deformation, keeping displacement to a low level with consequent lower material stress, which reduces extrusion risk. Zurcon® Rimseal IM is designed to control fluid film during both outstroke and instroke. The back-pumping function was improved with a special design on the low-pressure side which also provides additional extrusion resistance, unique to Zurcon® Z13 (Figure 36).

ADVANTAGES

- Feasible both by injection moulding and by lathing from injection moulded TPU Zurcon® tubes.
- Increased extrusion resistance and outstanding abrasion resistance of TPU Zurcon® positions Zurcon® Rimseal IM as an effective and reliable choice for tandem seal configurations
- Calibrated rod contact pressure and reduced friction from optimized back-pumping behaviour give Zurcon® Rimseal IM the capability to control oil film, making it a very good choice as a secondary seal in Lubrication Management configurations

APPLICATION EXAMPLES

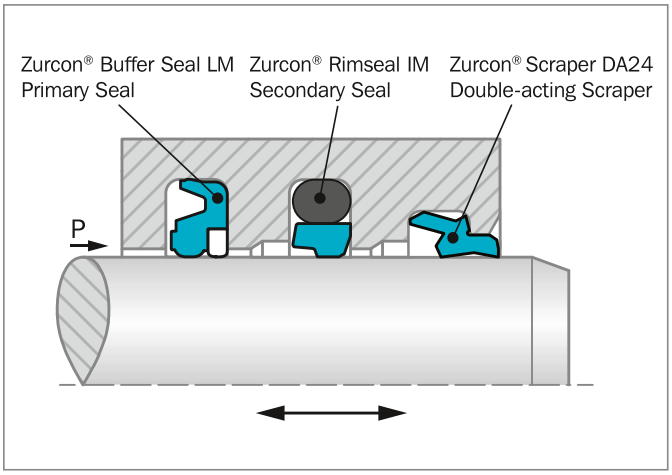


Figure 37: Tandem configuration

- Construction machinery
- Hydraulic cylinders
- Earth moving equipment
- Mobile hydraulics
- Agriculture

- Mobile cranes
- Fork lifts

OPERATING CONDITIONS:

Pressure:	60 MPa in tandem system 25 MPa as individual element
Velocity:	0.5 m/s as primary seal 5 m/s with short strokes (<1 m) in tandem systems
Temperature:	-45 °C to +110 °C depending on O-Ring material
Media:	- Mineral oil - Synthetic and natural esters - HEES, HETG up to +60 °C - Flame retardant fluids HF - Special optimized for flame retardant fluids (HFC) up to +60 °C
Installation:	- Standard mounting in closed grooves. - For Ø <18 mm request a split groove. - No recalibration needed for installation in closed groove.

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g. the maximum operating speed depends on pressure, temperature and gap value. A combination of pressure and speed might cause local heat increases, so care should be taken when evaluating high values for the above parameters simultaneously.

MATERIAL

Zurcon® Z13 is the 60 ShD TPU that combines excellent mechanical and elastic material properties:

- Temperature range from -45 °C to +110 °C (for short periods, up to +120 °C)
- Good combination of elasticity and tensile strength
- Low friction
- Excellent chemical compatibility
- Low compression set at high temperatures

Table 25: Recommended materials

Code	O-Ring Material Shore A	Code	O-Ring Temp. °C*
Z13	NBR 70	N	-30 to +100
	NBR 70 Low temp.	T	-45 to +80
	HNBR 70	H	-30 to +110
	FKM 70	V	-10 to (+200)

* The O-Ring operation temperature is only valid in mineral hydraulic oil.

Table 26: Z13 Chemical compatibility: General guideline (Laboratory compatibility tests 1,008 hours)

FLUIDS TYPE	DIN / ISO Code	Temperatur	Results
Mineral Oils	HLP HVLP HLPD	+110 °C	Excellent
Synthetics fluids	HEES	+80 °C to +100 °C	Excellent
	HEPG (PAG)	+60 °C	Good
	HEPR (PAO)	+100 °C	Excellent
Water based fluids	HFA	+50 °C to +60 °C	Good
	HFC	+60 °C	Excellent
Synthetics water free fluids	HFDU	+100 °C	Excellent

The above results must be considered as general guidelines. We recommend verifying the compound compatibility with the specific fluids and temperature conditions experienced in the application.

Installation Recommendation

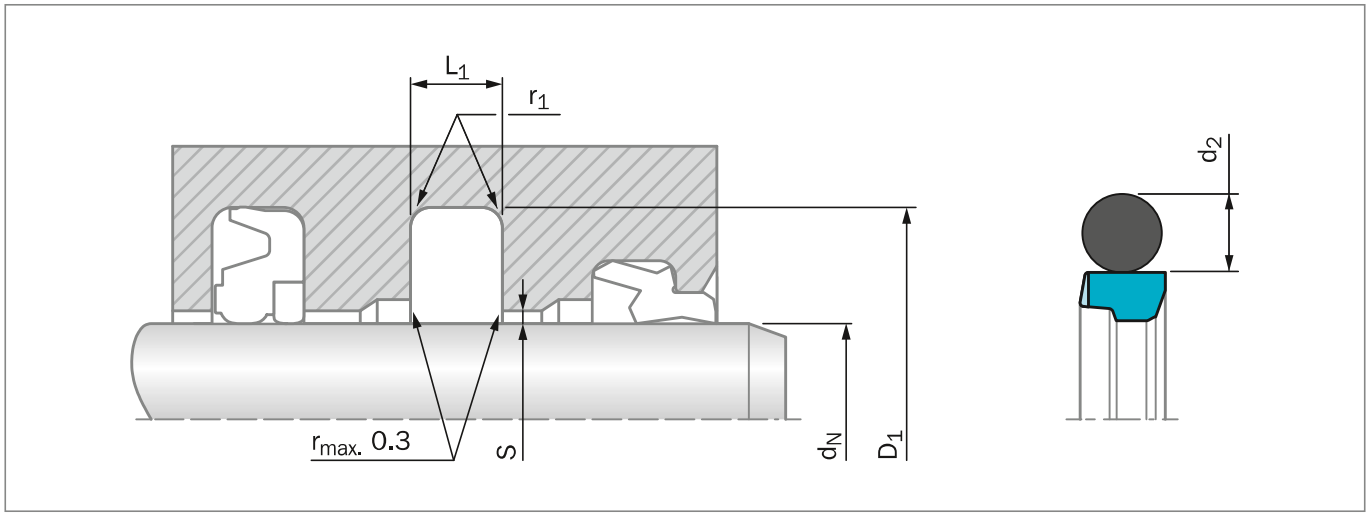


Figure 38: Installation Drawing

Table 27: Installation Dimensions – Standard Recommendations

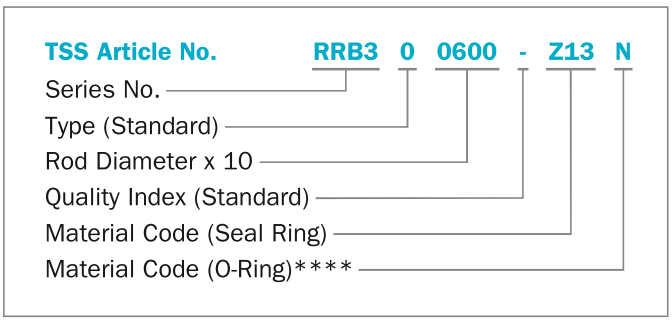
Seal Series No.	Rod Diameter d_N f8/h9			Groove Diameter	Groove Width	Radial Clearance S_{max}** @ +110 °C				O-Ring Cross Section
	Light Application	Standard Application	Heavy Duty Application	D_1 H9	L_1 +0.2	16 MPa	26 MPa	32 MPa	40 MPa	d_2
RRB1	19 - 37.9	8 - 18.9***	-	d_N + 7.3	3.2	0.30	0.20	-	-	2.62
RRB2	38 - 149.9	19 - 37.9	8 - 18.9	d_N + 10.7	4.2	0.40	0.30	0.20	-	3.53
RRB3	200 - 255.9	38 - 199.9	19 - 37.9	d_N + 15.1	6.3	0.40	0.30	0.20	-	5.33
RRB4	256 - 399.9*	200 - 255.9	38 - 199.9	d_N + 20.5	8.1	0.50	0.40	0.30	0.25	7.00
RRB8	-	256 - 399.9*	200 - 255.9	d_N + 24.0	8.1	0.50	0.40	0.30	0.25	7.00
RRB5	-	-	256 - 399.9*	d_N + 27.3	9.5	0.60	0.50	0.40	0.35	8.40

Installation in closed grooves from diameters > 18 mm. Also for installation according to ISO 7425-2.
* Max diameter for lathed seal from IM Z13 tube
** When installed as secondary seal utilize S_{max} of the primary seal.
*** Special type of mold is necessary

ORDERING EXAMPLE

Zurcon® Rimseal IM complete with O-Ring:

Rod diameter	d_N = 60.0 mm
Groove width:	L_1 = 6.3 mm
TSS Part No.:	RRB300600 from Table 27 and Table 28



**** From Table 25

Table 28: Installation Dimensions / TSS Article No.

Rod Diameter	Groove Diameter	Groove Width	TSS Article No.	O-Ring Size
d_N f8/h9	D_1 H9	L_1 +0.2		
50.0	**65.1**	**6.3**	**RRB300500-Z13**	**56.52 x 5.33**
60.0	75.1	6.3	RRB300600-Z13	66.04 x 5.33
65.0	80.1	6.3	RRB300650-Z13	69.22 x 5.33
70.0	**85.1**	**6.3**	**RRB300700-Z13**	**75.57 x 5.33**
75.0	90.1	6.3	RRB300750-Z13	81.92 x 5.33
80.0	**95.1**	**6.3**	**RRB300800-Z13**	**85.09 x 5.33**
85.0	100.1	6.3	RRB300850-Z13	91.44 x 5.33
90.0	**105.1**	**6.3**	**RRB300900-Z13**	**94.62 x 5.33**
95.0	110.1	6.3	RRB300950-Z13	100.97 x 5.33
100.0	**115.1**	**6.3**	**RRB301000-Z13**	**107.32 x 5.33**
105.0	120.1	6.3	RRB301050-Z13	110.49 x 5.33
110.0	**125.1**	**6.3**	**RRB301100-Z13**	**116.84 x 5.33**
115.0	130.1	6.3	RRB301150-Z13	120.02 x 5.33
120.0	135.1	6.3	RRB301200-Z13	126.37 x 5.33
125.0	**140.1**	**6.3**	**RRB301250-Z13**	**129.54 x 5.33**
130.0	145.1	6.3	RRB301300-Z13	135.89 x 5.33
140.0	**155.1**	**6.3**	**RRB301400-Z13**	**145.42 x 5.33**
150.0	165.1	6.3	RRB301500-Z13	158.12 x 5.33

All dimensions in **bold** type are in accordance with ISO 3320

This page is intentionally left blank.

Zurcon® L-Cup

Single-acting

Low Friction Properties

Material:
Zurcon®

Zurcon® L-Cup® *

Introduction

The rod sealing system is the most critical part of a hydraulic cylinder. Therefore it is expected that a rod sealing system performs under leak-free conditions in the static and dynamic state. Moreover it has to fulfil a lifetime of several thousand hours.

To meet these requirements, Trelleborg Sealing Solutions has developed the Zurcon® L-Cup® *, a highly effective and innovative rod sealing component.

DESCRIPTION

Zurcon® L-Cup® is a single-acting polyurethane rod seal with a unique design offering a hydrodynamic backpumping ability over the complete working pressure range. The pressure-independent, hydrodynamic sealing ability of this new sealing element requires no lubrication reservoir in the sealing area and ensures a constant and controlled pressure distribution over a wide pressure range.

The advantages of the Zurcon® L-Cup® design lead to the following improved properties:

ADVANTAGES

- Hydrodynamic back-pumping ability over the complete working pressure range
- Low friction and therefore a reduction of heat generated
- Low breakout force even after a long period of non-operation
- Very low stick-slip
- Low increase in friction at increasing pressure
- High extrusion resistance
- Optimum geometry of the static sealing lip for higher sealing ability
- No entrapped oil and grease between seal and groove (due to notches)
- No pressure build-up between seal and groove OD
- Long service life

The Zurcon® L-Cup® was designed in accordance with customers' demands.

- Groove dimensions according to ISO 5597 Part 2
- Interchangeable with existing U-Cup grooves
- Installation into closed grooves
- Wear and extrusion resistant high-performance polyurethane

APPLICATION EXAMPLES

Zurcon® L-Cup® can be used in all applications in which previously a conventional U-Cup was applied, such as:

- Fork lifts
- Agricultural machines
- Light and medium mobile hydraulics
- Industrial hydraulics
- Machine tools
- Injection molding machines
- Hydraulic presses

Another preferred solution for tandem rod sealing systems is the combination with the Turcon® Stepseal® 2K as primary seal and L-Cup® as secondary seal, in conjunction with a double acting scraper.

OPERATING CONDITIONS

Pressure:	Up to 40 MPa
Velocity:	Up to 0.5 m/s
Temperature:	-35 °C to +110 °C (Zurcon® Z20 standard)
Media:	Hydraulic fluids based on mineral oil

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.

*Patent for: Europe No. EP 0724693
*Patent for: US No. 5,649,711
*Patent for: China No. ZL 94193869.7
*Zurcon® L-Cup® is a trade name.

MATERIALS

Zurcon® Z20 Standard polyurethane 93 Shore A
Temperature: -35 °C to +110 °C
Color: turquoise

Zurcon® Z22 Premium polyurethane 93 Shore A
Temperature: -50 °C to +110 °C
Color: dark petrol

Zurcon® Z25 Premium polyurethane 93 Shore A
Temperature: -35 °C to +130 °C
Color: black

METHOD OF OPERATION

Trelleborg Sealing Solutions experience in the production of hydrodynamic back-pumping seals such as Turcon® Stepseal® 2K, and the use of Finite Element Analysis (FEA) and other laboratory tests have led to the development of Zurcon® L-Cup® . The main objective in the development of this seal was the ability to achieve an optimum pressure distribution over the complete pressure range.

The pressure distribution curve under the sealing lip needs to have a steep gradient on the high-pressure side and a shallow gradient on the rear of the seal.

The operating principles and function of Zurcon® L-Cup® is similar to the well-known Turcon® Stepseal® 2K.

FRICTION

In Figure 39 the friction values of a conventional U-Cup and of Zurcon® L-Cup® are being compared. A high increase in friction of the U-Cup is clearly shown between approximately 5 and 15 MPa. This is due to the U-Cup being totally pressed on the rod surface at increased pressure, causing elimination of the oil reservoir and dry running of the U-Cup.

In comparison, the L-Cup® shows only a low increase in friction which is due to the smaller contact area and better tribological behaviour. The result is a low friction heat generation.

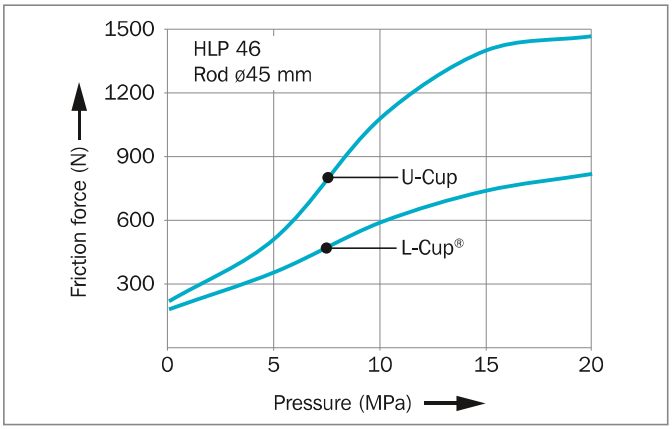


Figure 39: Friction dependent on pressure

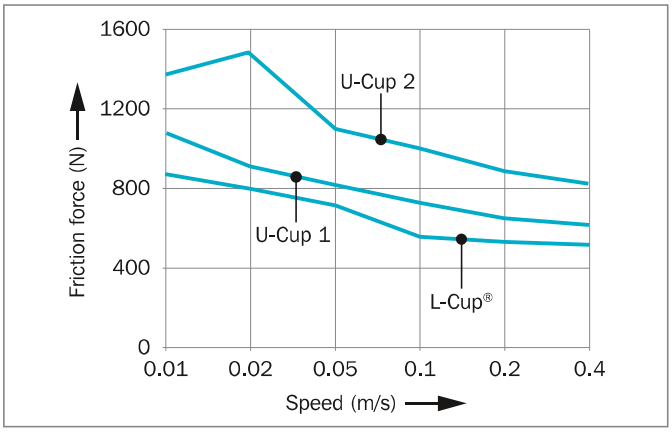


Figure 40: Friction dependent on speed

FRICTION HEAT

The effect described above can be made visible by simply measuring the temperature. Figure 41 shows the increase in temperature on the rod surface caused by friction, measured at a pressure of 40 MPa after 20,000 cycles. This explains the prolonged service life of L-Cup® .

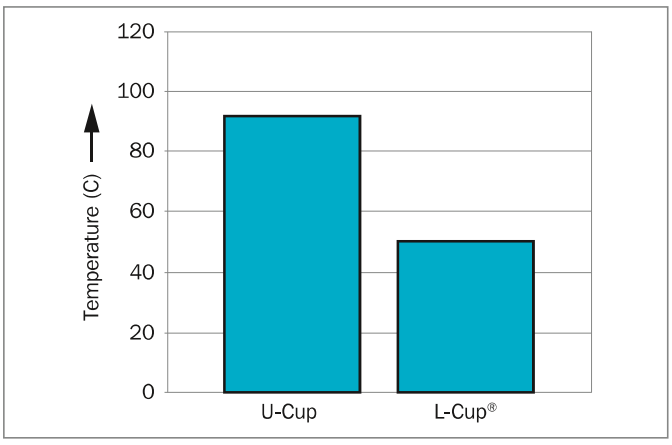


Figure 41: Increase in temperature caused by friction

TEST CONDITIONS (FIGURE 41)

Dimension:	50 x 60 x 11 mm
Pressure:	0/40 MPa
Velocity:	0.1 m/s
Temperature:	ambient

SEALING GAP

The recommended gap dimensions described in Figure 42, depend on pressure and temperature.

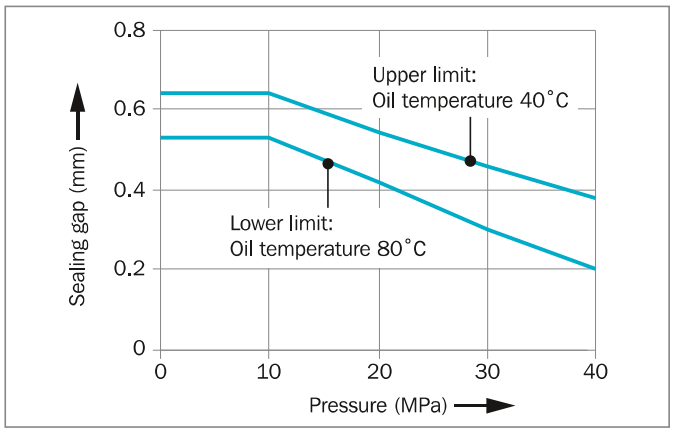


Figure 42: Sealing gap

DESIGN INSTRUCTIONS

Lead in chamfers

In order to avoid damage to the rod seal during installation, lead-in chamfers and rounded edges must be provided on the piston rods (Figure 43). If this is not possible for design reasons, a separate installation tool must be used.

The minimum length of the lead-in chamfer depends on the profile size of the seal and can be seen from the following tables.

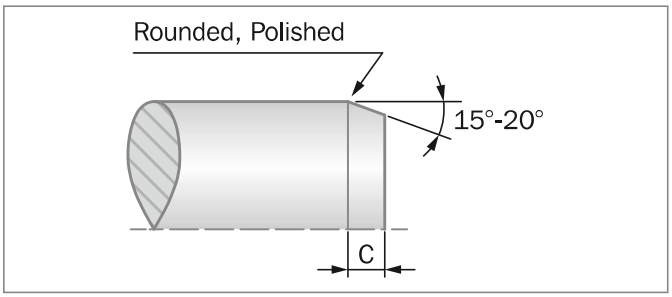


Figure 43: Lead-in chamfer

Table 29: Lead-in chamfers

Lead-in Chamfer Length C min.	Zurcon® L-Cup® Groove Depth*
2.0	3.5
2.0	4.0
2.5	5.0
4.0	7.5
5.0	10.0
6.5	12.5
7.5	15.0

* The groove depth is calculated from: $(D - d_N)/2$.
The dimensions for D and d_N can be found in Table 31.

Table 30: Material Selection

Material Code	Material Description	Temperature Range	Application
Zurcon® Z20	High performance Polyurethane 93 Shore A; standard grade for hydraulic	-35 °C to +110 °C	Excellent abrasion and extrusion resistance, minimal swelling in mineral oil, acceptable hydrolysis resistance.
Zurcon® Z22	High performance Polyurethane 93 Shore A; Premium grade for low temperature	-50 °C to +110 °C	Wide range of working temperatures with very good compression set performance at very low temperature. Excellent balance between swelling in mineral oil and hydrolysis resistance.
Zurcon® Z25	High performance Polyurethane 95 Shore A; Premium grade for high temperature	-35 °C to +130 °C	Wide range of working temperatures with excellent mechanical proprieties at high temperature.

Installation Recommendation

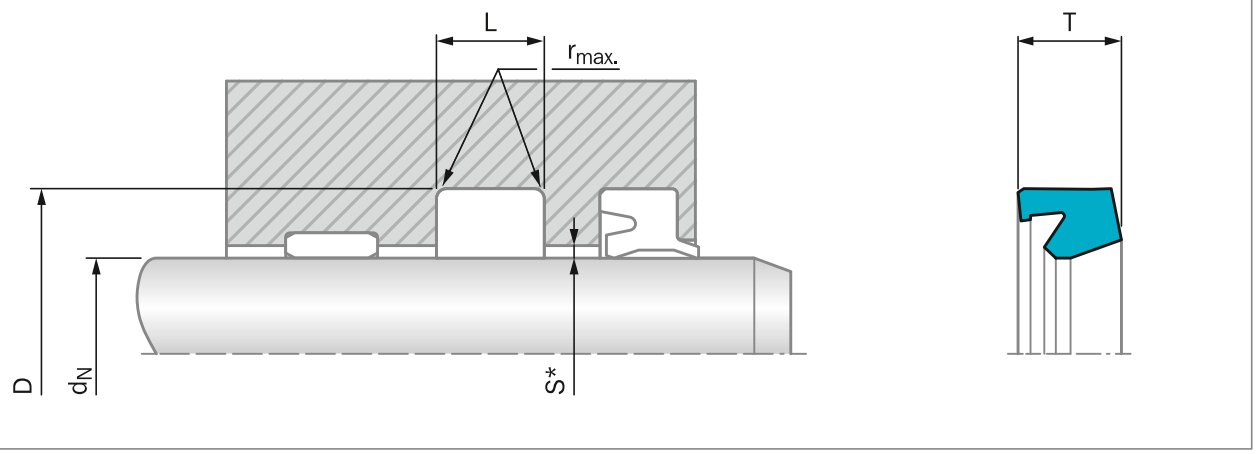


Figure 44: Installation Drawing

* Gap measure "S" see Figure 42

ORDERING EXAMPLE

L-Cup

Rod Diameter:	d_N = 25.0 mm
Groove Diameter:	D = 33.0 mm
Groove Width:	L = 6.3 mm
TSS Part No.:	RL08N0250 - Z20

TSS Article No. RL08 N 0250 - Z20

- TSS Series No.
- Type (Standard)
- Rod Diameter x 10
- Quality Index (Standard)
- Material Code

MATERIAL

Standard Zurcon®:	Z20
Special Polyurethane:	93 Shore A
Color:	turquoise

Table 31: Installation Dimensions / TSS Article No.

Rod Diameter	Groove Diameter	Groove Width	Radius	Ring Width	TSS Part No.
d_N f8	D H10	L +0.25	$r_{max.}$	T	
16	22	6.0	0.3	5.4	RL38N0160
20	26	5.5	0.3	5.0	RL04N0200
***20**	**28**	**6.3**	**0.3**	**5.7**	**RL08N0200**
***22**	**30**	**6.3**	**0.3**	**5.7**	**RL08N0220**
25	**33**	**8.0**	**0.3**	**7.2**	**RL10N0250**
25	**33**	**6.3**	**0.3**	**5.7**	**RL08N0250**
28	**36**	**6.3**	**0.5**	**5.7**	**RL08N0280**
***28**	**38**	**8.0**	**0.3**	**7.2**	**RL14N0280**
30	38	6.3	0.3	5.7	RL08N0300
30	40	8.0	0.3	7.2	RL14N0300
30	38	8.0	0.3	7.2	RL10N0300
30	40	11.0	0.3	9.9	RL17N0300
32	**42**	**8.0**	**0.3**	**7.2**	**RL14N0320**
35	43	6.3	0.3	5.7	RL08N0350
35	45	11.0	0.3	9.9	RL17N0350
36	**44**	**6.3**	**0.5**	**5.7**	**RL08N0360**
36	**46**	**8.0**	**0.3**	**7.2**	**RL14N0360**
36	46	10.0	0.3	9.0	RL16N0360
38	48	11.0	0.3	9.9	RL17N0380
40	48	7.0	0.3	6.3	RL09N0400
40	**50**	**8.0**	**0.3**	**7.2**	**RL14N0400**
40	50	10.0	0.3	9.0	RL16N0400
42	52	8.0	0.3	7.2	RL14N0420
42	52	10.0	0.3	9.0	RL16N0420
45	53	8.0	0.3	7.2	RL10N0450
45	**55**	**8.0**	**0.3**	**7.2**	**RL14N0450**
48	60	11.0	0.3	9.9	RL36N0480
50	58	9.0	0.3	8.1	RL11N0500
50	**60**	**8.0**	**0.3**	**7.2**	**RL14N0500**
50	60	10.0	0.3	9.0	RL16N0500
50	**65**	**12.5**	**0.4**	**11.3**	**RL26N0500**
55	63	9.0	0.3	8.1	RL11N0550
55	65	10.0	0.3	9.0	RL16N0550
56	**71**	**12.5**	**0.4**	**11.3**	**RL26N0560**
60	68	9.0	0.3	8.1	RL11N0600
60	70	8.0	0.3	7.2	RL14N0600
60	70	10.0	0.3	9.0	RL16N0600
63	**78**	**12.5**	**0.4**	**11.3**	**RL26N0630**
65	75	10.0	0.3	9.0	RL16N0650
70	80	10.0	0.3	9.0	RL16N0700

Rod Diameter	Groove Diameter	Groove Width	Radius	Ring Width	TSS Part No.
d_N f8	D H10	L +0.25	$r_{max.}$	T	
70	**85**	**12.5**	**0.4**	**11.3**	**RL26N0700**
75	90	12.5	0.3	11.3	RL26N0750
80	**95**	**12.5**	**0.4**	**11.3**	**RL26N0800**
85	100	13.1	0.4	11.8	RL27N0850
90	**105**	**12.5**	**0.4**	**11.3**	**RL26N0900**
100	**120**	**16.0**	**0.6**	**14.4**	**RL30N1000**
110	**130**	**16.0**	**0.6**	**14.4**	**RL30N1100**
115	135	16.0	0.6	14.4	RL30N1150
119	134	9.4	0.4	8.1	RL22N1190
120	135	12.5	0.4	11.3	RL26N1200
120	140	16.0	0.6	14.4	RL30N1200
125	140	12.0	0.4	10.8	RL25N1250
125	**145**	**16.0**	**0.6**	**14.4**	**RL30N1250**
130	150	16.0	0.6	14.4	RL30N1300
135	155	16.0	0.6	14.4	RL30N1350
140	**160**	**16.0**	**0.6**	**14.4**	**RL30N1400**
150	170	16.0	0.6	14.4	RL30N1500
155	175	16.0	0.6	14.4	RL30N1550
160	180	16.0	0.6	14.4	RL30N1600
195	220	20.0	0.6	18.0	RL32N1950

Dimensions and TSS Part Numbers in bold according to ISO 5597. * Split groove