

# Zurcon® L-Cup®



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Single-acting

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Low Friction Properties

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**Material:**

Zurcon®

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## ■ 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

|                     |                                          |
|---------------------|------------------------------------------|
| <b>Pressure:</b>    | Up to 40 MPa                             |
| <b>Velocity:</b>    | Up to 0.5 m/s                            |
| <b>Temperature:</b> | -35 °C to +110 °C (Zurcon® Z20 standard) |
| <b>Media:</b>       | 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 application: WO 95/11395 A1



## 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 95 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.

## FRICITION

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.

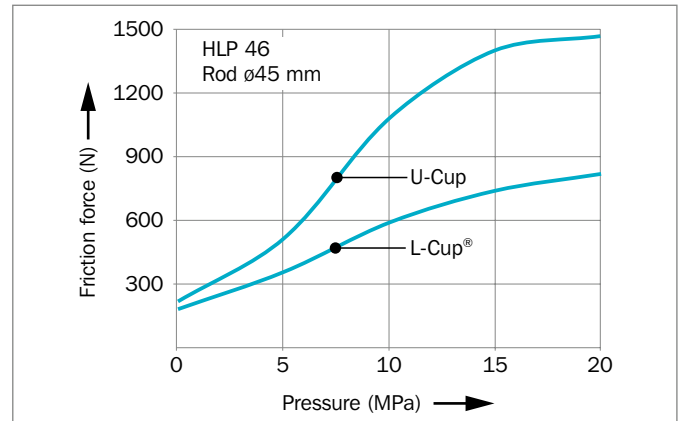


Figure 39: Friction dependent on pressure

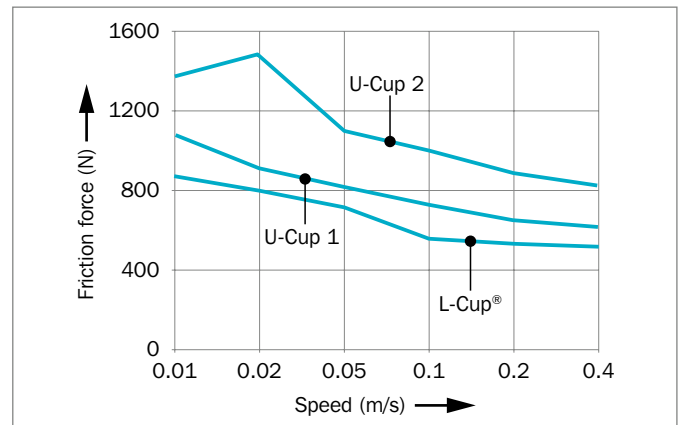


Figure 40: Friction dependent on speed

## FRICITION 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®.

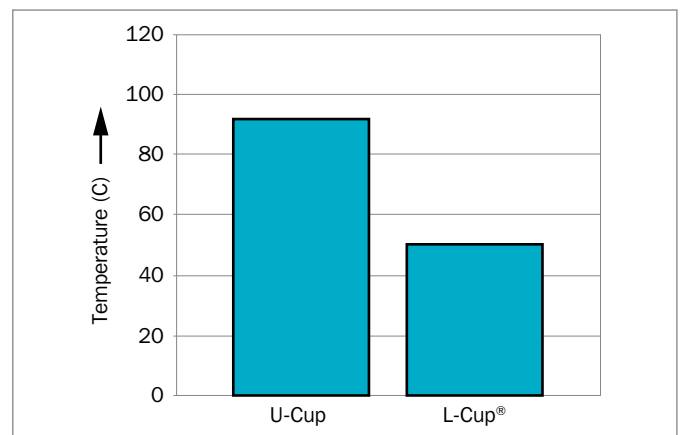


Figure 41: Increase in temperature caused by friction



## TEST CONDITIONS (FIGURE 41)

|                     |                 |
|---------------------|-----------------|
| <b>Dimension:</b>   | 50 x 60 x 11 mm |
| <b>Pressure:</b>    | 0/40 MPa        |
| <b>Velocity:</b>    | 0.1 m/s         |
| <b>Temperature:</b> | ambient         |

## SEALING GAP

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

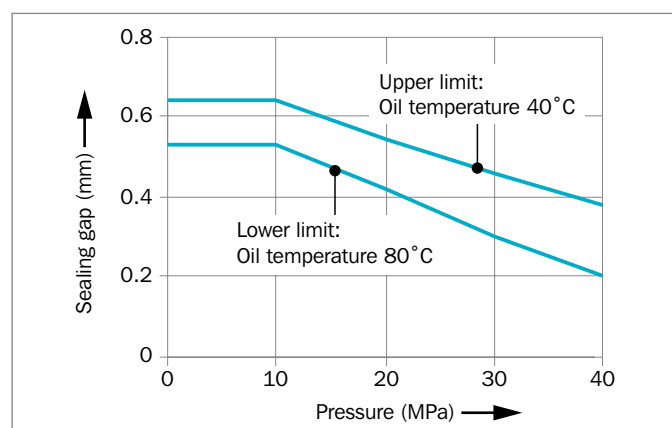


Figure 42: Sealing gap

## 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.

Table 29: Material Selection

| Material Code      | Material Description                                                         | Temperature Range | Application                                                                                                                                                                         |
|--------------------|------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Zurcon® Z20</b> | 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.                                                                     |
| <b>Zurcon® Z22</b> | 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. |
| <b>Zurcon® Z25</b> | 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.                                                                                       |

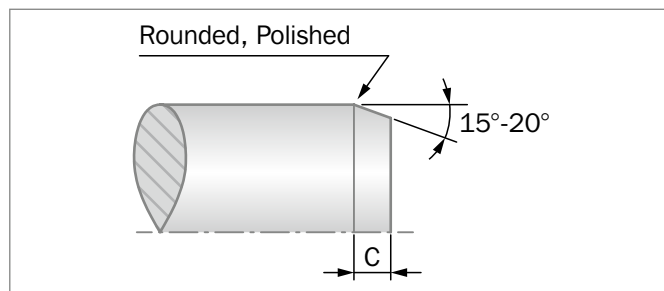


Figure 43: Lead-in chamfer

Table 28: 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 30.



## ■ Installation Recommendation

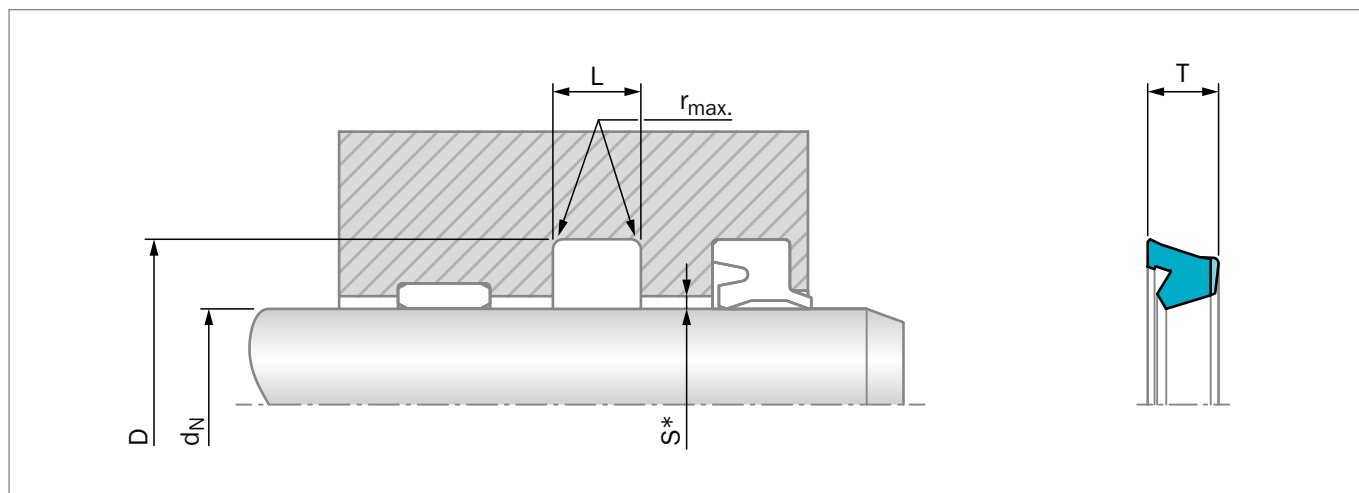


Figure 44: Installation Drawing

\* Gap measure "S" see Figure 42

### ORDERING EXAMPLE

L-Cup®

|                         |                         |
|-------------------------|-------------------------|
| <b>Rod Diameter:</b>    | $d_N = 25.0 \text{ mm}$ |
| <b>Groove Diameter:</b> | $D = 33.0 \text{ mm}$   |
| <b>Groove Width:</b>    | $L = 6.3 \text{ mm}$    |
| <b>TSS Part No.:</b>    | RL08N0250               |

#### TSS Article No.

|                          |             |          |             |          |            |
|--------------------------|-------------|----------|-------------|----------|------------|
|                          | <b>RL08</b> | <b>N</b> | <b>0250</b> | <b>-</b> | <b>Z20</b> |
| TSS Series No.           |             |          |             |          |            |
| Type (Standard)          |             |          |             |          |            |
| Rod Diameter x 10        |             |          |             |          |            |
| Quality Index (Standard) |             |          |             |          |            |
| Material Code            |             |          |             |          |            |

### MATERIAL

|                              |            |
|------------------------------|------------|
| <b>Standard Zurcon®:</b>     | Z20        |
| <b>Special Polyurethane:</b> | 93 Shore A |
| <b>Color:</b>                | Turquoise  |



Table 30: Installation Dimensions / TSS Part No.

| Rod Diameter | Groove Diameter | Groove Width | Radius     | Ring Width  | TSS Part No.     |
|--------------|-----------------|--------------|------------|-------------|------------------|
| $d_N$<br>f8  | D<br>H10        | L<br>+0.25   | $r_{max.}$ | T           |                  |
| 16           | 22              | 6.0          | 0.3        | 5.4         | RL38N0160        |
| 20           | 26              | 5.5          | 0.3        | 5.0         | RL04N0200        |
| <b>*20</b>   | <b>28</b>       | <b>6.3</b>   | <b>0.3</b> | <b>5.7</b>  | <b>RL08N0200</b> |
| <b>*22</b>   | <b>30</b>       | <b>6.3</b>   | <b>0.3</b> | <b>5.7</b>  | <b>RL08N0220</b> |
| <b>25</b>    | <b>33</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL10N0250</b> |
| <b>25</b>    | <b>33</b>       | <b>6.3</b>   | <b>0.3</b> | <b>5.7</b>  | <b>RL08N0250</b> |
| <b>28</b>    | <b>36</b>       | <b>6.3</b>   | <b>0.5</b> | <b>5.7</b>  | <b>RL08N0280</b> |
| <b>*28</b>   | <b>38</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0280</b> |
| 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        |
| <b>32</b>    | <b>42</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0320</b> |
| 35           | 43              | 6.3          | 0.3        | 5.7         | RL08N0350        |
| 35           | 45              | 11.0         | 0.3        | 9.9         | RL17N0350        |
| <b>36</b>    | <b>44</b>       | <b>6.3</b>   | <b>0.5</b> | <b>5.7</b>  | <b>RL08N0360</b> |
| <b>36</b>    | <b>46</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0360</b> |
| 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        |
| <b>40</b>    | <b>50</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0400</b> |
| 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        |
| <b>45</b>    | <b>55</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0450</b> |
| 48           | 60              | 11.0         | 0.3        | 9.9         | RL36N0480        |
| 50           | 58              | 9.0          | 0.3        | 8.1         | RL11N0500        |
| <b>50</b>    | <b>60</b>       | <b>8.0</b>   | <b>0.3</b> | <b>7.2</b>  | <b>RL14N0500</b> |
| 50           | 60              | 10.0         | 0.3        | 9.0         | RL16N0500        |
| <b>50</b>    | <b>65</b>       | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0500</b> |
| 55           | 63              | 9.0          | 0.3        | 8.1         | RL11N0550        |
| 55           | 65              | 10.0         | 0.3        | 9.0         | RL16N0550        |
| <b>56</b>    | <b>71</b>       | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0560</b> |
| 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        |
| <b>63</b>    | <b>78</b>       | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0630</b> |
| 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.     |
|--------------|-----------------|--------------|------------|-------------|------------------|
| $d_N$<br>f8  | D<br>H10        | L<br>+0.25   | $r_{max.}$ | T           |                  |
| <b>70</b>    | <b>85</b>       | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0700</b> |
| 75           | 90              | 12.5         | 0.3        | 11.3        | RL26N0750        |
| <b>80</b>    | <b>95</b>       | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0800</b> |
| 85           | 100             | 13.1         | 0.4        | 11.8        | RL27N0850        |
| <b>90</b>    | <b>105</b>      | <b>12.5</b>  | <b>0.4</b> | <b>11.3</b> | <b>RL26N0900</b> |
| <b>100</b>   | <b>120</b>      | <b>16.0</b>  | <b>0.6</b> | <b>14.4</b> | <b>RL30N1000</b> |
| <b>110</b>   | <b>130</b>      | <b>16.0</b>  | <b>0.6</b> | <b>14.4</b> | <b>RL30N1100</b> |
| 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        |
| <b>125</b>   | <b>145</b>      | <b>16.0</b>  | <b>0.6</b> | <b>14.4</b> | <b>RL30N1250</b> |
| 130          | 150             | 16.0         | 0.6        | 14.4        | RL30N1300        |
| 135          | 155             | 16.0         | 0.6        | 14.4        | RL30N1350        |
| <b>140</b>   | <b>160</b>      | <b>16.0</b>  | <b>0.6</b> | <b>14.4</b> | <b>RL30N1400</b> |
| 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