

technologies for hydraulics

guiding elements | ptfе sealing | rotary sealing | backup rings





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double acting wiper

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spiral



## **guide elements**

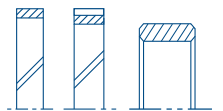
tape

piston guide ring

rod guide ring

plunger guide element

bushes





## General

Guide elements perform the task of locating the piston and piston rod in the cylinder, absorbing any side loads that arise and preventing metallic contact between the sliding parts.

Non-metallic guide elements are becoming increasingly popular as substitutes for the conventional metallic guides, offering a range of advantages that traditional solutions are unable to match. The result is increased functional reliability, longer service lifetimes and cost optimisation.

Owing to the different and specific requirements placed on each type of guide element, there is a broad spectrum of different materials and designs of component available for adaptation to your individual requirements.

## Compounds

### PTFE-Compounds

For light to medium-duty applications; low-friction, no stick-slip effect, good chemical resistance, reliable embedding of contaminant particles, available either cut to length or in stock lengths.

### Glass-reinforced polyacetal

For medium-duty applications; good sliding properties, high wear resistance, good media compatibility, easy to install by snap-fitting into the groove, low-cost alternative, supplied as ready-to-install ring.

### Fabric-based laminates

For heavy-duty applications involving high operating and side loads. The material construction offers long service lifetimes through the selection of optimum composite combinations, plus low friction and good emergency running properties. Available in stock lengths or as ready-to-install ring.

## Choice

The variety of deployment scenarios and thus operational conditions call for a respective dimensioning of the guiding element.

Depending on the shearing forces and other parameters such as temperature, clearance and the selected combination of materials, an approximate calculation of the required number and width of the guiding elements can be made using the following formula:

$$B_{\min} \geq \frac{F_r \times S_f}{F_d \times D_{KS}}$$

Since shearing forces are not always calculated precisely, we recommend using a safety factor of at least 2 (see calculation).

$B_{\min}$  = Guide ring width min. [mm]

$F_r$  = max. radial load [N]

$S_f$  = Safety factor

$D_{KS}$  = Diameter of piston or rod

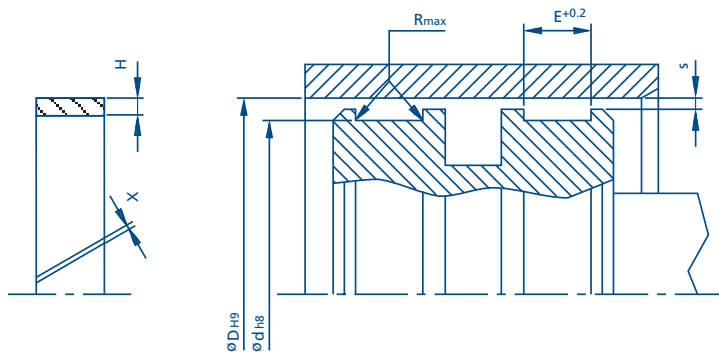
$F_d$  = Permissible dynamic load [N/mm<sup>2</sup>]

# Installation

## Piston-, rod guide elements



### Piston guides



**Bore**  $\varnothing D H9$

Groove root  $\varnothing d h8$

Groove width  $E +0.2$

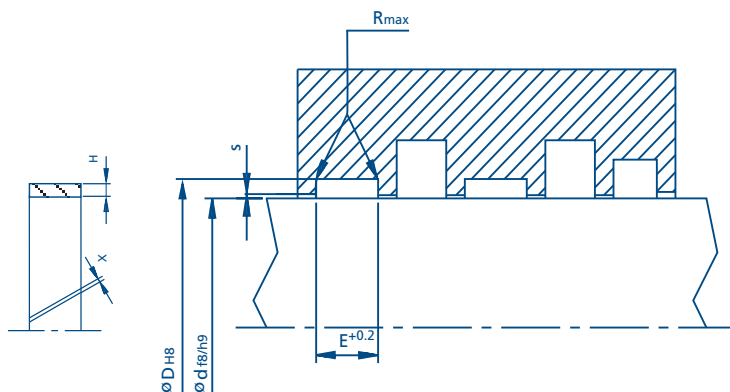
$R_{max}$  0.2 for  $\varnothing \leq 250mm$   
0.4 for  $\varnothing > 250mm$

**Recommended gap dimensions (S), (X)** (PTFE - materials)

$\varnothing D$	H	E	S	X
15 - 20	2.00	9.70	0.20- 0.5	2 - 3
15 - 140	2.50	5.60	0.25 -0.5	2 - 6
50 - 200	2.50	9.70	0.25 -0.7	3 - 10
120 - 400	2.50	15.00	0.25 -0.90	4 - 40
250 - 1000	2.50	25.00	0.25 - 1.00	10 - 40

In the case of PTFE guide elements, the gap dimension **s** should be max. 0.3 to 0.4 mm.

### Rod guides



**Rod**  $\varnothing d f8/h9$

Groove root  $\varnothing D H8$

Groove width  $E +0.2$

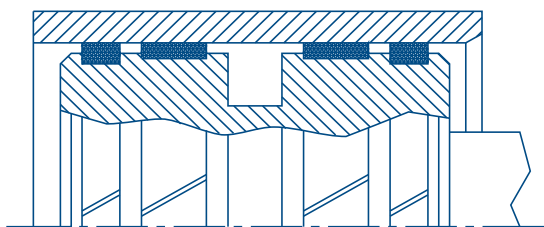
$R_{max}$  0.2 for  $\varnothing \leq 250mm$   
0.4 for  $\varnothing > 250mm$

**Recommended gap dimensions (S), (X)** (PTFE - materials)

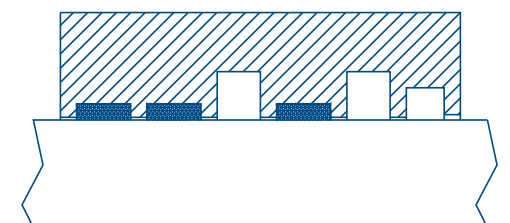
$\varnothing D$	H	E	S	X
15 - 20	2.00	9.70	0.20- 0.5	1 - 3
15 - 140	2.50	5.60	0.25 -0.5	2 - 6
30 - 250	2.50	9.70	0.25 -0.7	3 - 10
80 - 400	2.50	15.00	0.25 -0.90	4 - 20
200 - 1000	2.50	25.00	0.25 - 1.00	8 - 40

In the case of PTFE guide elements, the gap dimension **s** should be max. 0.3 to 0.4 mm.

### Piston guides



### Rod guides



### Fitting recommendations

In order to enhance the functional reliability and service lifetime of the sealing and guiding system, we recommend in the case of applications likely to involve elevated contamination of the medium in the system, e.g. in mobile hydraulics, that a combination of guide elements of fabric-based laminates (HGW) and PTFE compounds be used.

This has the advantage that any foreign particles entrained in the system circuit become embedded in the upstream PTFE material on the oil/fluid side, so protecting the actual guidance and sealing system against damage. This additional ring serves as an internal wiper, so countering the effects of contaminated media.

The mating contact surfaces should have an Ra value between 0.4  $\mu m$  and 0.6  $\mu m$  (microns).



## Selection

### Piston-, rod guide elements

### Plunger guides

Type	Material	Technical Data			Application	Mating Surface	Size range [mm]
		Compressive strength / static [N/mm <sup>2</sup> ]	Temperature [°C]	Speed [m/s]			
<b>TP - ...</b>	<b>PTFE-Compounds</b> PTFE-Bronze PTFE-Carbon PTFE-Carbon/Graphit PTFE-Carbonfibre PTFE-Kohle/Graphit	5 - 25	-60 to +200	15	<i>mobil hydraulics</i> <i>standard cylinder</i> <i>machine tools</i> <i>generell hydraulics</i> <i>pneumatics</i> <i>bronze</i>	<i>steel</i> <i>chrom-plated steel</i> <i>cast iron</i> <i>stainless steel</i> <i>aluminium</i>	<i>stock length</i>  <i>and</i> <i>cut to length</i> <i>up to</i> <i>Ø 5000</i>
<b>FPO - ...</b> <b>WR - ...</b> <b>WR/I - ...</b>	<i>Polyacetal</i> <i>glass reinforced</i>	> 25°C < 40	-40 bis +110	0,8	<i>mobil hydraulics</i> <i>standard cylinder</i> <i>machine tools</i> <i>agricultural machinery</i>	<i>steel</i> <i>chrom-plated steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 200</i>
<b>KT - 100</b>	<i>Phenolic resin</i> <i>cotton fabric</i>	290 static +120 ISO 604	-40 bis 1	1	<i>mobil hydraulics</i> <i>heavy duty hydr.</i> <i>press construction</i>	<i>steel</i> <i>chrom-plated steel</i> <i>cast iron</i> <i>stainless steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 500</i>
<b>KT - 107</b>	<i>Phenolic resin</i> <i>cotton fabric</i> <i>with graphite</i>	300 static ISO 604	-40 bis +120	1 1	<i>mobil hydraulics</i> <i>heavy duty hydr.</i> <i>press construction</i>	<i>steel</i> <i>chrom-plated steel</i> <i>cast iron</i> <i>stainless steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 500</i>
<b>KT - 200</b>	<i>Phenolic resin</i> <i>synthetic woven</i> <i>including PTFE</i>	330 static	-40 bis + 130	1	<i>mobil hydraulics</i> <i>heavy duty hydr.</i> <i>mining industry</i> <i>ship industry</i> <i>press construction</i>	<i>steel</i> <i>chrom-plated steel</i> <i>stainless steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 500</i>
<b>KT - 200B</b>	<i>Polyester woven</i> <i>Epoxy resin</i>	310 n. ISO 604	-40 bis +120	1	<i>mobil hydraulics</i> <i>standard cylinder</i>	<i>steel</i> <i>chrom-plated steel</i> <i>stainless steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 350</i>
<b>KT - 700</b>	<i>Aramid woven</i> <i>high temp. phenolic</i> <i>and graphite</i>	350 static n. ISO 604	-40 bis +200	0,8	<i>steel industry</i> <i>mobil hydraulics</i> <i>heavy duty hydr.</i>	<i>steel</i> <i>chrom plated steel</i> <i>stainless steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 300</i>
<b>KT - 500T</b> <b>KT - 500TS</b>	<i>guide tape / stock length</i> <i>Polyester woven</i> <i>Polyester resin</i> <i>with Graphit ore PTFE</i> <i>in spool o. spiral</i>	340 static n. ISO 604	-30 bis +120	0,8	<i>mobil hydraulics</i> <i>standard cylinder</i> <i>press construction</i>	<i>steel</i> <i>chrom plated steel</i> <i>stainless steel</i>	<i>stock length</i> <i>and</i> <i>cutted</i> <i>up to Ø 3000</i>
<b>KT - 700T</b>	<i>guide tape / stock length</i> <i>Aramid woven</i> <i>and graphite</i>	350 static n. ISO 604	-40 bis +200	0,8	<i>steel industry</i> <i>mobil hydraulics</i> <i>press construction</i> <i>heavy duty hydr.</i>	<i>steel</i> <i>crom plated steel</i> <i>stainless steel</i>	<i>stock length</i> <i>and</i> <i>cutted</i> <i>bis Ø 3000</i>
<b>FPL - ....</b>	<i>Polyacetal</i> <i>glass reinforced</i>	40	-40 bis +110	0,8	<i>standard cylinder</i> <i>plunger cylinder</i>	<i>steel</i> <i>crom plated steel</i>	<i>Rings</i> <i>up to</i> <i>Ø 120</i>





## Piston-, rod guide elements of PTFE

Guide bands of PTFE compound serve to locate pistons and rods, prevent metallic contact between the moving components and absorb any side loads that occur. Guide bands of this type are used in hydraulic and pneumatic cylinders.

Guide elements of PTFE compounds are characterized by their exceptional frictional behavior, stick-slip-free running and high thermal and chemical resistance.

PTFE guide elements can be supplied as ready-to-fit cut lengths for piston and rod guidance applications, but are also available in stock lengths. The profile is rectangular and beveled or rounded at the edges in order to avoid impermissible edge compression in the groove corners and to facilitate fitting in the groove.

The guide bands are generally provided with a diagonal cut; a straight 90° cut or a stepped Z cut is also possible.

The gap required for functional efficiency has already been provided in the case of the cut-to-size bands. This gap is required to avoid undesirable pressure build-up and to balance the elongation of the bands at high temperatures.

### Benefits

- Outstanding frictional behavior
- No stick-slip effect, even at low velocities
- High wear resistance
- Good damping of mechanical vibrations
- Embedding of foreign particles possible, good wiping effect
- Simple groove design
- Available in stock lengths or in cut sizes ready for installation

### Application ranges

Velocity:	reciprocating up to 15 m/s
Temperature:	-60°C to +200°C
Stat. compressive strength:	max. 25 N/mm <sup>2</sup>

### Compounds

**PTFE-Bronze (BR)** – standard material – for applications ranging from light to medium duty; material exhibits outstanding sliding properties and very good thermal and chemical resistance.

**PTFE-Carbon (C)** – This standard material is specifically suited to soft/yielding mating surfaces and applications involving water hydraulics.

**PTFE-Carbon/Graphite (CG)** – This modified material exhibits high wear resistance when used in water hydraulics and dry-running applications.

### Calculation

$$B_{\min} \geq \frac{F_r \times S_f}{F_d \times D_{k/s}}$$

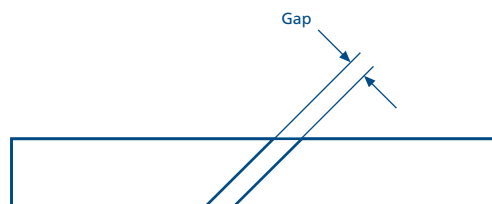
$B_{\min}$  = Guide ring width min. [mm]

$F_r$  = max. radial load [N]

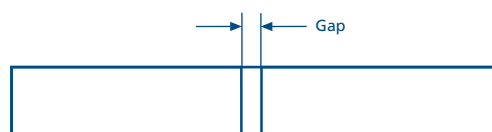
$S_f$  = Safety factor

$D_{k/s}$  = Diameter of piston or rod

$F_d$  = Permissible dynamic load [N/mm<sup>2</sup>]



Standard design: Diagonal cut



Special design: Straight 90° cut



**Piston-, rod guide elements of fabric-based laminates**

Guide rings of fabric-based laminates (fabric composites) are used for pistons and rods serving to prevent mechanical contact between the moving components and absorbing any side loads that occur.

As guide rings they are used predominantly in heavy-duty hydraulic cylinders.

Depending on the materials selected for the fabric-based laminates, certain combinations can offer excellent friction behavior, outstanding wear properties, stick-slip-free operation and extremely high load-bearing capacities as well as exceptional elasticity and good media resistance.

Rings of fabric-based laminates are manufactured from tubing and feature a preload especially aligned to the piston and/or rod. They are supplied ready to fit to the piston or rod.

The profile is rectangular with beveled or rounded edges in order to prevent impermissible edge compression at the groove corners and to facilitate installation in the groove.

The guide rings are supplied ready to fit with a diagonal cut of 45°. A stepped Z-cut and also a straight 90° cut can also be provided if required. The gap necessary to ensure reliable function has already been taken into account in the manufacture of the rings. This gap is necessary in order to avoid undesirable pressure build-up and to compensate for band/ring elongation.

Individual dimensional ranges can also be manufactured in slotted designs, as closed, continuous designs or as bushings.

**Benefits**

- Very high compressive strength
- High side load absorption capacity
- Minimal friction and wear
- Good sliding and emergency running properties
- High service lifetimes, extremely abrasion-resistant
- Good chemical resistance
- Foreign particle embedding capability
- Easy fitting by snapping into the groove

**Applications**

- Velocity: reciprocating up to 1 m/s
- Temperature: -50° to +120°C
- Stat. compressive strength: from 290 to 345 N/mm<sup>2</sup>

**Compressive strength depends on material combination**

**Material**

**KT-100** is a phenolic resin laminated fabric made up of impregnated cotton fabric webs,  
**Static compressive strength vertical to the layered structure: 270 N/mm<sup>2</sup>**

**KT-107**, is a phenolic resin laminated fabric made up of impregnated cotton fabric webs, additional lubricate graphite.  
**Static compressive strength vertical to the layered structure: 300 N/mm<sup>2</sup>**

**KT-200**, is a phenolic resin-bonded artificial fibre laminated fabric with embedded PTFE. This material exhibits very high load-bearing capacity, outstanding sliding properties and is characterized by its extremely high resilience. The material undergoes no swelling, and water absorption is very low.  
**Static compressive strength vertical to the layered structure: 330 N/mm<sup>2</sup>**

**KT200B**, is a epoxy resin-bonded artificial fibre laminated fabric. This material exhibits very high flexibility, outstanding sliding properties and is characterized by its high resilience. The material undergoes no swelling, and water absorption is negligible.  
**Static compressive strength vertical to the layered structure: 310 N/mm<sup>2</sup>**

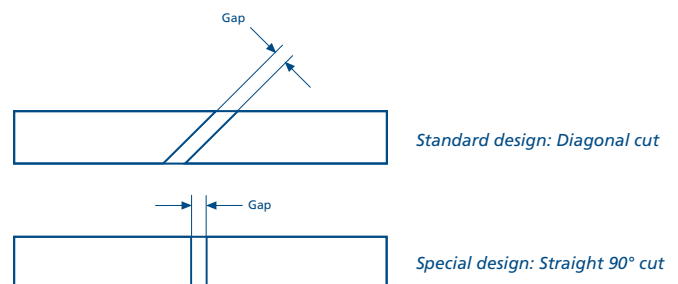
**KT700**, it's a combination of aramid woven and high temp. modif. phenolic resin, with additional lubrication graphite. This This material exhibits very high load-bearing capacity and a high temperature range. This material is also available in stock length.  
**Static compressive strength vertical to the layered structure: 350 N/mm<sup>2</sup>**

**KT-500, KT500T/TS** is a combination of polyester and polyester resin, additional lubrication graphite or PTFE. This fabric-based laminate exhibits high load-bearing capacity, high wear resistance and is characterized by very good elastic properties. The material is available both as a ready-to-fit ring from spiral version and in stock lengths.  
**Static compressive strength vertical to the layered structure: 340 N/mm<sup>2</sup>**

**Manufacturing ranges**

Inside diameter:	from 15 to 550 mm
Wall thickness:	from 1.5 to 25 mm
Widths:	from 3 mm
Tolerances:	0.03 mm to 0.08 mm

*The materials KT100, KT107 and KT200 can be used to manufacture fittings and bushings to individual specifications.*





## **Piston-, rod guide elements of polyacetal (POM)**

Guide rings of polyacetal (POM) are glass-reinforced and serve to locate the piston and rod. They prevent metallic contact between the moving components and absorb any side loads that occur.

The guide rings are used in hydraulic and pneumatic cylinders.

Guide rings of polyacetal (POM) are characterized by good frictional behavior, stick-slip-free running, high load-bearing capacity and optimum wear resistance.

POM guide elements are manufactured by the injection molding process and are supplied for piston and rod guiding applications as ready-to-install components. The profile is rectangular and beveled or rounded at the edges in order to avoid impermissible edge compression in the groove corners and to facilitate fitting in the groove.

The guide rings are pre-formed and provided with a diagonal cut. A straight 90° cut is also possible for special applications. The gap necessary for efficient operation has already been accommodated in the rings. This gap is necessary to avoid undesirable pressure build-up and to compensate for elongation of the rings.

### **Benefits**

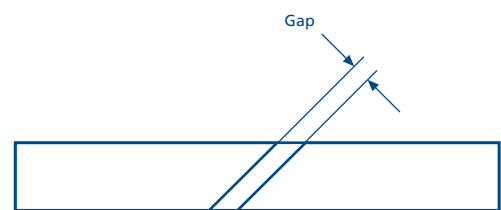
- Good friction and wear behavior
- No stick-slip effect
- High wear resistance
- Very low water absorption
- Good chemical resistance
- Embedding of foreign particles possible within limits
- Simple installation by snapping into the groove

### **Application ranges**

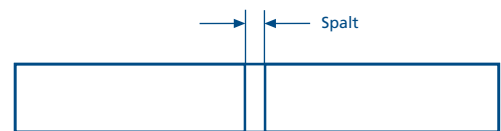
- Velocity: reciprocating up to 1 m/s
- Temperature: -40°C to +120°C
- Stat. compressive strength: up to 40 N/mm<sup>2</sup>

### **Material**

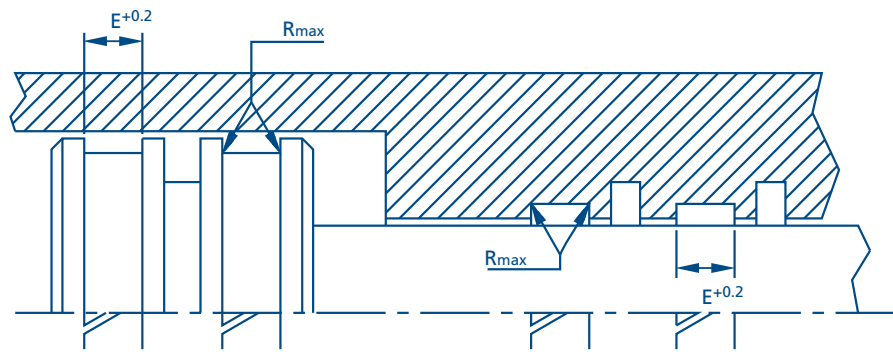
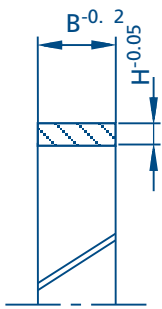
The guide rings are manufactured from glass-reinforced polyacetal and are suitable for a wide range of medium-duty applications in hydraulics and pneumatics.



*Standard design: Diagonal cut*



*Special design: Straight 90° cut*



**PTFE - stock lengths / spool version**

Typ	H -0,05	B -0,2	E +0,2
TP - ...	1.55	2.40	2.50
TP - ...	1.55	3.90	4.00
TP - ...	2.00	5.40	5.60
TP - ...	2.00	7.80	8.00
TP - ...	2.00	9.80	10.00
TP - ...	2.00	11.80	12.00
TP - ...	2.00	14.80	15.00
TP - ...	2.50	5.40	5.60
TP - ...	2.50	9.50	9.70
TP - ...	2.50	12.50	12.70
TP - ...	2.50	14.80	15.00
TP - ...	2.50	19.80	20.00
TP - ...	2.50	24.50	25.00
TP - ...	2.50	29.50	30.00
TP - ...	2.50	39.50	40.00
TP - ...	3.00	9.50	9.70
TP - ...	3.00	12.50	12.70
TP - ...	3.00	14.80	15.00
TP - ...	3.00	19.50	20.00
TP - ...	3.00	24.50	25.00
TP - ...	3.00	29.50	30.00
TP - ...	4.00	9.50	9.70
TP - ...	4.00	14.80	15.00
TP - ...	4.00	24.50	25.00

**Material**

- BR PTFE - bronze
- C PTFE - carbon
- V PTFE - virginal
- KF PTFE - carbon fibre

PTFE-stock length type, is also available with surface structure

**PTFE - Stock lengths / ordering example:**

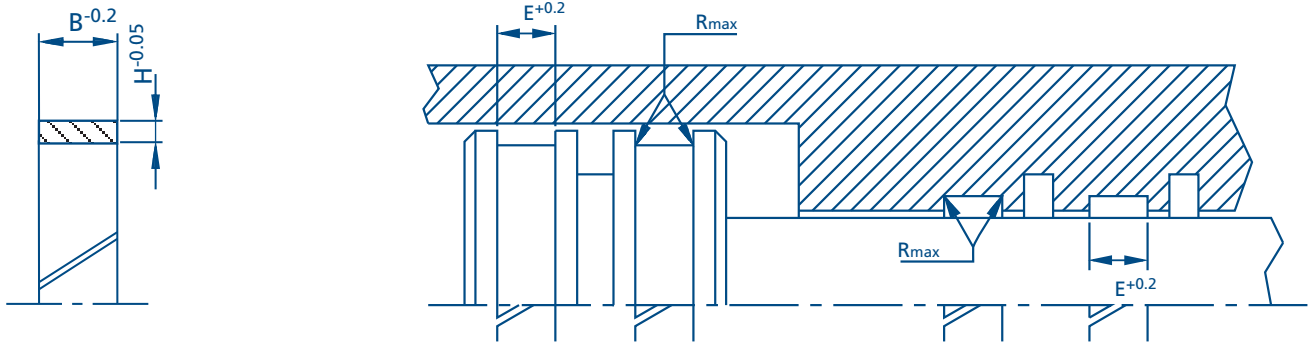
TP - 2.50 x 9.7 - BR  
 Stock lengths 2.5 x 9.7 PTFE-Bronze

TP - 2.50 x 15 - K  
 Stock lengths 2.5 x 15.00 PTFE-Carbon

Special dimensions and intermediate size are also available.

**Cut-to-size guide band can be made to specification to meet all your individual dimensional requirements.**

The length of the roll is depending of the cross section of the tape.



**Phenolic - stock lengths / spool version**

Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	roll circa meter
KT200T -	2.50	5.40	5.60	5
KT200T -	2.50	9.50	9.70	5
KT200T -	2.50	14.80	15.00	5
KT200T -	2.50	19.80	20.00	5
KT200T -	2.50	24.50	25.00	5
KT200T -	2.50	29.50	30.00	5
KT200T -	3.00	9.50	9.70	5
KT200T -	3.00	14.80	15.00	5
KT200T -	3.00	19.80	20.00	5
KT200T -	3.00	24.50	25.00	5
KT200T -	3.00	29.50	30.00	5
KT200T -	4.00	9.50	9.70	5
KT200T -	4.00	14.80	15.00	5
KT200T -	4.00	19.80	20.00	5
KT200T -	4.00	24.50	25.00	5

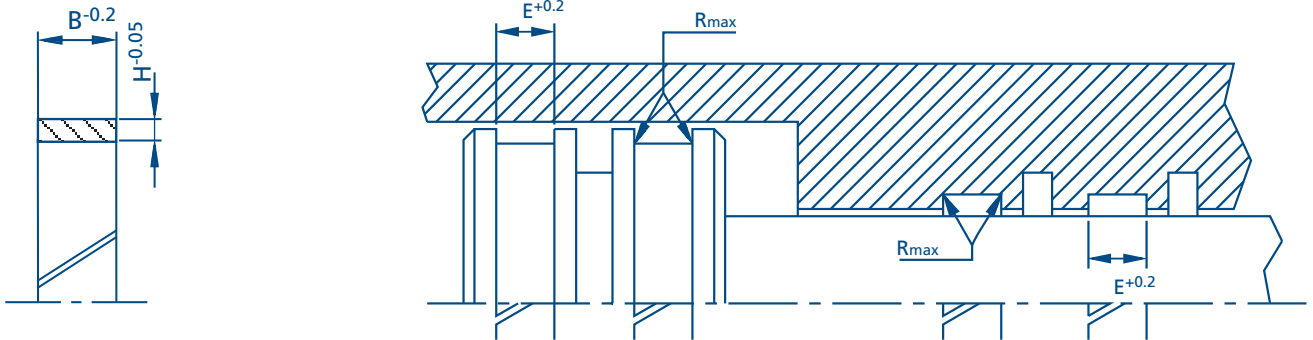
Special dimensions and intermediate size are also available.

**Cut-to-size guide band can be made to specification to meet all your individual dimensional requirements.**

**Phenolic resin stock lengths / ordering example:**

KT200T - 2.50 x 9.7

Stock lengths 2.5 x 9.7 Phenolic resin



## Polyester - stock lengths / spool version

Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	roll ca. meter
KT500 -	2.50	5.40	5.60	10
KT500 -	2.50	9.50	9.70	10
KT500 -	2.50	14.80	15.00	10
KT500 -	2.50	19.80	20.00	10
KT500 -	2.50	24.50	25.00	10
KT500 -	3.00	9.50	9.70	10
KT500 -	3.00	14.80	15.00	10
KT500 -	3.00	19.80	20.00	10
KT500 -	3.00	24.50	25.00	10
KT500 -	3.00	29.50	30.00	10
KT500 -	4.00	9.50	9.70	10
KT500 -	4.00	14.80	15.00	10
KT500 -	4.00	19.80	20.00	10
KT500 -	4.00	24.50	25.00	10

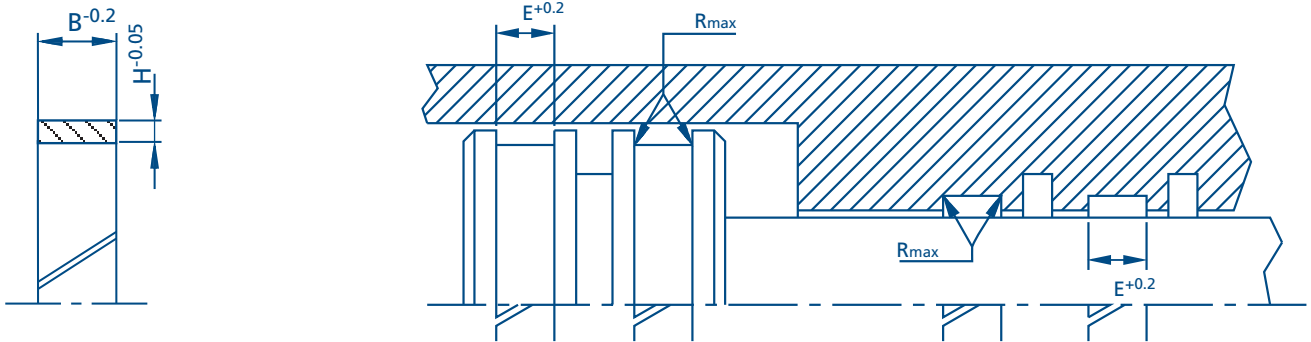
**Cut-to-size guide band can be made to specification to meet all your individual dimensional requirements.**

Special dimensions and intermediate size are also available.

### Polyester resin stock lengths / ordering example:

KT 5 0 0 - 2 . 5 0 x 9 . 7

Stock lengths 2.5 x 9.7 Polyester resin



## Polyester - stock lengths / spool version

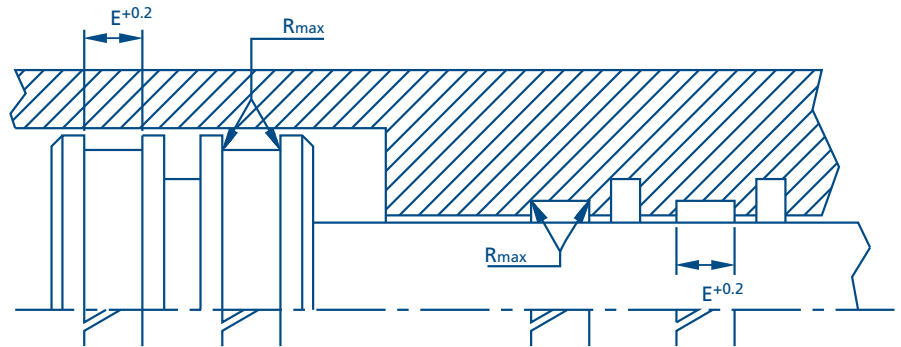
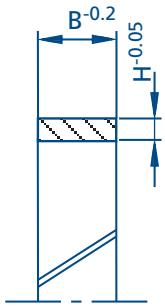
Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	roll ca. meter
KT700T -	2,50	5,40	5,60	10
KT700T -	2,50	9,50	9,70	10
KT700T -	2,50	14,80	15,00	10
KT700T -	2,50	19,80	20,00	10
KT700T -	2,50	24,50	25,00	10
KT700T -	2,50	29,50	30,00	10
KT700T -	3,00	9,50	9,70	10
KT700T -	3,00	14,80	15,00	10
KT700T -	3,00	19,80	20,00	10
KT700T -	3,00	24,50	25,00	10
KT700T -	3,00	29,50	30,00	10
KT700T -	4,00	9,50	9,70	10
KT700T -	4,00	14,80	15,00	10
KT700T -	4,00	19,80	20,00	10
KT700T -	4,00	24,50	25,00	10

Special dimensions and intermediate size are also available.

### Polyester resin stock lengths / ordering example:

KT 700 - 2.50 x 9.7

Stock lengths 2.5 x 9.7 aramid woven



**Polyester - stock lengths / spiral version**

Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	diameter spiral
KT500TS		2	5,6	60
KT500TS		2	5,6	80
KT500TS		2	5,6	100
KT500TS		2	9,7	60
KT500TS		2	9,7	80
KT500TS		2	9,7	100
KT500TS		2	9,7	150
KT500TS		2	15	60
KT500TS		2	15	80
KT500TS		2	15	100
KT500TS		2	15	150
KT500TS		2	20	80
KT500TS		2	20	100
KT500TS		2	20	150
KT500TS		2	20	200
KT500TS		2	25	80
KT500TS		2	25	100
KT500TS		2	25	150
KT500TS		2	25	200

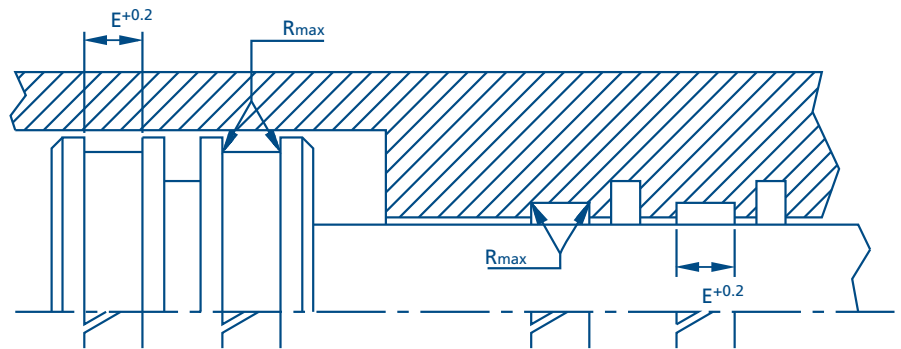
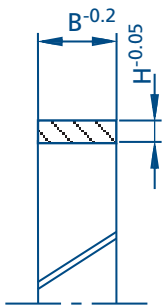
Special dimensions and intermediate size are also available.

**Polyester resin stock leghts / ordering example:**

KT 500 TS - 2 . 5 0 x 9 . 7 - 80

Stock lengths 2.5 x 9.7 / housing 9,7 / diameter spiral 80 mm

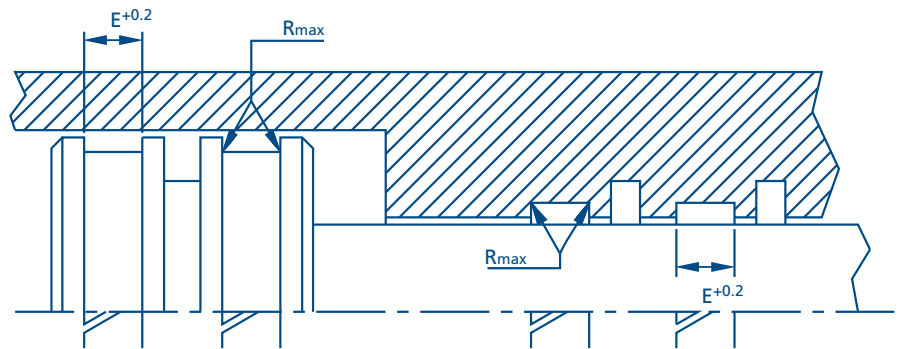
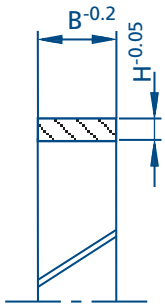




## Polyester - stock lengths / spiral version

Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	diameter spiral
KT500TS		2,5	5,6	60
KT500TS		2,5	5,6	80
KT500TS		2,5	5,6	100
KT500TS		2,5	9,7	60
KT500TS		2,5	9,7	80
KT500TS		2,5	9,7	100
KT500TS		2,5	9,7	150
KT500TS		2,5	15	60
KT500TS		2,5	15	80
KT500TS		2,5	15	100
KT500TS		2,5	15	150
KT500TS		2,5	20	80
KT500TS		2,5	20	100
KT500TS		2,5	20	150
KT500TS		2,5	20	200
KT500TS		2,5	25	80
KT500TS		2,5	25	100
KT500TS		2,5	25	150
KT500TS		2,5	25	200

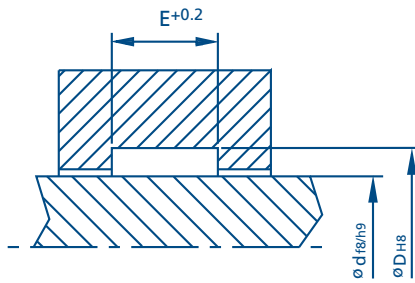
Special dimensions and intermediate size are also available.



## Polyester - stock lengths / spiral version

Typ	H <sup>-0,05</sup>	B <sup>-0,2</sup>	E <sup>+0,2</sup>	diameter spiral
KT500TS		3	5,6	60
KT500TS		3	5,6	80
KT500TS		3	5,6	100
KT500TS		3	9,7	60
KT500TS		3	9,7	80
KT500TS		3	9,7	100
KT500TS		3	9,7	150
KT500TS		3	15	60
KT500TS		3	15	80
KT500TS		3	15	100
KT500TS		3	15	150
KT500TS		3	20	80
KT500TS		3	20	100
KT500TS		3	20	150
KT500TS		3	20	200
KT500TS		3	25	80
KT500TS		3	25	100
KT500TS		3	25	150
KT500TS		3	25	200

Special dimensions and intermediate size are also available.



TP <sub>BR</sub>	PTFE - Bronze
TP <sub>C</sub>	PTFE - Carbon
FPO	Polyacetal (POM)
KT100	Phenolic resin/cotton fabric
KT107	Phenolic resin/ cotton fabric/ add. grahite
KT200	Syntetic fibre fabric/with embedded PTFE
KT200B	Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

$\varnothing d_{f8/h9}$	$\varnothing D_{H8}$	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
16	20	9,7	x	x	x			x
18	22	9,7	x	x	x			x
20	24	9,7	x	x	x			x
20	25	5,6	x	x	x			x
20	25	9,7	x	x	x			x
22	26	9,7	x	x	x			x
22	27	5,6	x	x	x			x
22	27	9,7	x	x	x			x
25	29	9,7	x	x	x			x
25	30	5,6	x	x	x			x
25	30	9,7	x	x	x			x
27	32	5,6	x	x	x			x
27	32	9,7	x	x	x			x
28	32	9,7	x	x	x			x
28	33	5,6	x	x	x			x
30	34	9,7	x	x	x			x
30	35	5,6	x	x	x			x
30	35	9,7	x	x	x			x
32	37	5,6	x	x	x			x
32	37	9,7	x	x	x			x

Special dimensions and intermediate size are also available.

**Guide ring / Ordering example:**

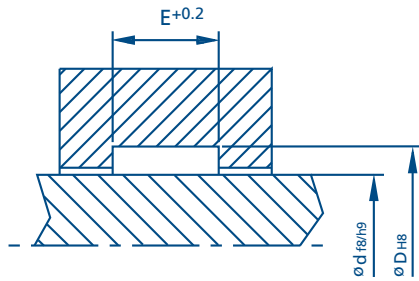
TP - 20 x 25 x 5.6 - BR

Tape cut to length l for rod diameter  $\varnothing 20$  / PTFE-Bronze

FPO - 50 x 55 x 9.7

Guide ring POM / for rod diameter  $\varnothing 50$

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



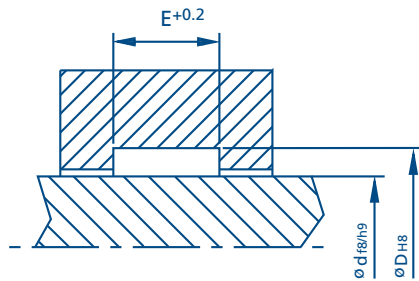
- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

ø d f8/h9	ø D H8	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
35	39	9,7	x	x	x		x	x
35	40	5,6	x	x	x		x	x
35	40	9,7	x	x	x		x	x
36	40	9,7	x	x	x		x	x
36	41	5,6	x	x	x		x	x
36	41	9,7	x	x	x		x	x
38	42	9,7	x	x	x		x	x
40	44	9,7	x	x	x		x	x
40	45	5,6	x	x	x	x	x	x
40	45	9,7	x	x	x	x	x	x
42	46	9,7	x	x	x			x
45	50	5,6	x	x	x	x	x	x
45	50	9,7	x	x	x	x	x	x
45	51	9,7	x	x	x	x		
50	55	5,6	x	x	x	x	x	x
50	55	9,7	x	x		x	x	x
50	56	9,7	x	x	x	x		
52	58	9,7	x	x	x	x	x	x
52	58	12,8	x		x	x		x
55	61	9,7	x	x	x	x		
56	61	5,6	x	x	x	x	x	x
56	61	9,7	x	x	x	x	x	x
56	62	12,8	x		x	x		
58	63	5,6	x	x	x	x	x	x
58	63	9,7	x	x	x	x	x	x

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



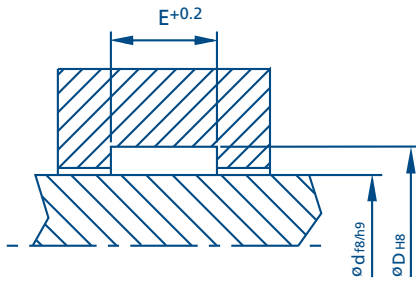
- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

ø d f8/h9	ø D H8	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
60	65	5,6	x	x	x	x		x
60	65	9,7	x	x	x	x	x	x
60	66	12,8	x		x	x		
61	67	12,8	x		x	x		
62	68	12,8	x		x	x		
63	68	5,6	x	x	x	x	x	x
63	68	9,7	x	x	x	x	x	x
63	69	12,8	x		x	x		x
65	70	9,7	x			x	x	x
65	71	12,8	x		x	x		
66	72	12,8	x		x	x		
70	75	5,6	x	x	x	x		x
70	75	9,7	x	x	x	x	x	x
70	76	12,8	x		x	x		
75	80	5,6	x	x	x	x	x	x
75	80	9,7	x	x	x	x	x	x
75	81	12,8	x	x	x	x		
80	85	5,6	x	x	x	x		x
80	85	9,7	x	x	x	x	x	x
80	85	15,0	x	x		x	x	x
90	86	12,8	x		x	x		
90	95	5,6	x	x	x	x	x	x
90	95	9,7	x	x	x	x	x	x
90	95	15,0	x	x		x	x	x
90	96	12,8	x		x	x		

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



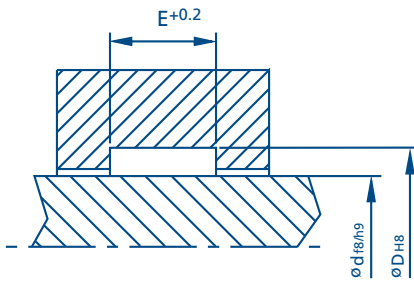
- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

ø d f8/h9	ø D H8	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
95	100	5,6	x	x	x	x		
95	100	9,7	x	x	x	x	x	x
95	101	12,8	x	x	x	x		
100	105	5,6	x	x	x	x		
100	105	9,7	x	x	x	x	x	x
100	105	15,0	x	x		x	x	x
100	106	12,8	x	x	x	x		
105	110	9,7	x	x		x	x	x
105	110	15,0	x	x		x		x
110	115	12,8	x	x	x	x		
110	115	15,0	x	x		x	x	x
115	120	9,7	x	x		x		x
115	120	15,0	x	x		x	x	x
115	121	12,8	x	x	x	x		
120	125	5,6	x	x	x	x		
120	125	9,7	x	x	x	x	x	x
120	125	15,0	x	x		x	x	x
120	126	12,8	x		x	x		
125	130	9,7	x	x		x	x	x
125	130	15,0	x	x		x		x
125	131	12,8	x		x	x		
130	135	9,7	x			x		x
130	135	15,0	x				x	x
130	136	12,8	x		x	x		
135	140	15,0	x	x		x	x	x

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



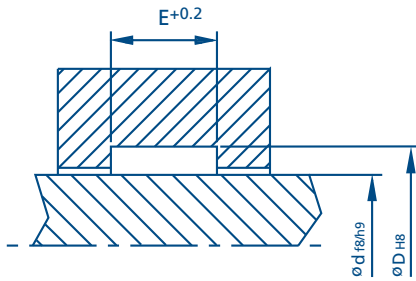
- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

ø d f8/h9	ø D H8	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
135	141	12,8	x		x	x		
140	145	9,7	x			x		
140	145	15,0	x			x		x
140	146	12,8	x		x			
150	155	9,7	x			x		
150	155	15,0	x	x				x
150	156	12,8	x		x			
160	165	9,7	x	x		x		x
160	165	15,0	x	x				x
170	175	15,0	x	x				x
180	185	9,7	x			x		x
180	185	15,0	x					x
190	195	15,0	x					x
200	205	9,7	x			x		
200	205	15,0	x	x				x
200	205	25,0	x					x
210	215	15,0	x	x				x
220	225	15,0	x	x				x
220	225	25,0	x					x
230	235	15,0	x	x				x
230	235	25,0	x					x
240	245	25,0	x					x
250	255	15,0	x	x				x
250	255	25,0	x					x
260	265	15,0	x	x				x

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



TP <sub>BR</sub>	PTFE - Bronze
TP <sub>C</sub>	PTFE - Carbon
FPO	Polyacetal (POM)
KT100	Phenolic resin/cotton fabric
KT107	Phenolic resin/ cotton fabric/ add. grahite
KT200	Syntetic fibre fabric/with embedded PTFE
KT200B	Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions Type**

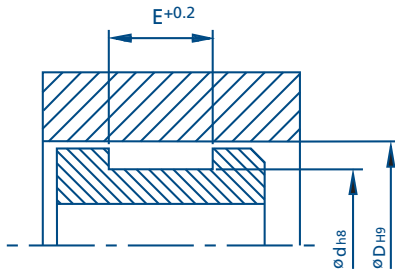
$\varnothing d_{f8/h9}$	$\varnothing D_{H8}$	E+0,2	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
280	285	15,0	x	x				x
280	285	25,0	x					x
290	295	15,0	x	x				x
300	305	15,0	x	x				x
300	305	25,0	x					x
320	325	15,0	x	x				x
320	325	25,0	x					x
350	355	15,0	x	x				x
350	355	25,0	x					x
360	365	15,0	x	x				x
360	365	25,0	x					x
380	385	25,0	x					x
400	405	25,0	x					x
420	425	25,0	x					x
450	455	25,0	x					x
450	455	40,0	x					x
480	485	25,0	x					
480	485	40,0	x					x
500	505	25,0	x					
500	505	40,0	x					x

Special dimensions and intermediate size are also available.

Up to diameter 500 mm are used material KT200 cutted from stock lenghts KT200T!

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**





- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
18	13	5,6	x	x				x
18	14	9,7	x	x				x
20	16	9,7	x	x	x			x
22	17	5,6	x	x				x
22	18	9,7	x	x	x			x
25	20	5,6	x	x	x			x
25	20	9,7	x	x	x			x
25	21	9,7	x	x	x			x
28	23	5,6	x	x				x
28	24	9,7	x	x	x			x
30	25	5,6	x	x	x			x
30	25	9,7	x	x	x			x
30	26	9,7	x	x	x			x
32	27	5,6	x	x	x			x
32	27	9,7	x	x	x			x
32	28	9,7	x	x	x			x
35	30	5,6	x	x	x			x
35	30	9,7	x	x	x			x
35	31	9,7	x	x	x			x
36	32	9,7	x	x	x			x

Special dimensions and intermediate size are also available.

**Guide ring / ordering example:**

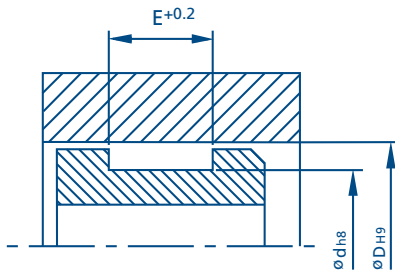
TP - 30 x 25 x 5.6 - BR

Tape cut to length/ for piston diameter ø 30 / PTFE-Bronze

KT200 - 50 x 45 x 9.7

Guide ring phenolic resin / for piston diameter ø 50

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

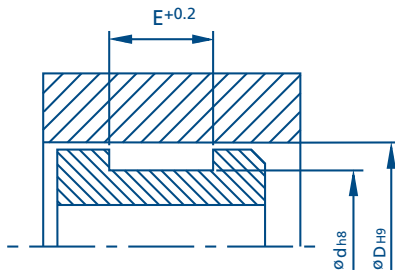
**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
38	34	9,7	x	x	x			x
40	35	5,6	x	x	x			x
40	35	9,7	x	x	x		x	x
40	36	9,7	x	x	x			x
42	37	5,6	x	x				x
42	37	9,7	x	x				x
42	38	9,7	x	x	x			x
45	40	5,6	x	x	x	x		x
45	40	9,7	x	x	x	x	x	x
48	43	5,6	x	x				x
48	43	9,7	x	x		x	x	x
50	45	5,6	x	x	x	x	x	x
50	45	9,7	x	x	x	x	x	x
52	46	12,8	x		x		x	
52	47	5,6	x	x		x		x
55	49	12,8	x		x			
55	50	5,6	x	x	x	x		x
55	50	9,7	x	x		x		x
56	50	9,7	x	x	x	x		
58	52	9,7	x	x	x	x	x	x
58	52	12,8	x		x	x		x
60	54	12,8	x		x		x	
60	55	5,6	x	x		x		x
60	55	9,7	x	x		x	x	x
62	56	12,8	x		x	x		

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

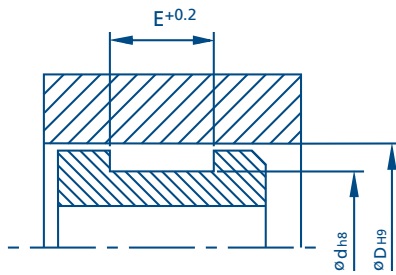
**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
63	57	12,8	x		x			
63	58	5,6	x	x	x	x		x
63	58	9,7	x	x	x	x	x	x
65	60	5,6	x	x	x	x		x
65	59	12,8	x		x			
65	60	9,7	x	x	x	x	x	x
68	63	5,6	x	x		x		x
68	63	9,7	x	x		x	x	x
68	62	12,8	x		x	x		
68	63	5,6	x	x	x	x		x
68	63	9,7	x	x	x	x	x	x
70	64	12,8	x		x			
70	65	9,7	x			x		
75	69	12,8	x		x			
75	70	5,6	x	x	x	x		x
75	70	9,7	x	x	x	x	x	x
80	74	12,8	x		x			
80	75	5,6	x	x	x	x	x	x
80	75	9,7	x	x	x	x	x	x
85	80	5,6	x	x	x	x		x
85	80	9,7	x	x	x	x	x	x
85	80	15,0	x	x		x		x
90	85	5,6	x	x		x	x	x
90	85	9,7	x	x		x		x
95	90	5,6	x	x	x	x	x	x

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



- TP<sub>BR</sub> PTFE - Bronze
- TP<sub>C</sub> PTFE - Carbon
- FPO Polyacetal (POM)
- KT100 Phenolic resin/cotton fabric
- KT107 Phenolic resin/ cotton fabric/ add. grahite
- KT200 Syntetic fibre fabric/with embedded PTFE
- KT200B Polyester fibre / epoxy resin (dimension individuell)

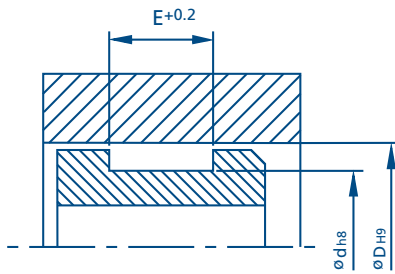
**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
95	90	9,7	x	x	x	x	x	x
95	90	15,0	x	x				x
100	95	5,6	x	x	x	x		
100	95	9,7	x	x	x	x	x	x
105	100	5,6	x	x	x	x		
105	100	9,7	x	x	x	x	x	x
105	100	15,0	x	x		x		x
110	104	12,8	x		x			
110	105	9,7	x	x		x		
110	105	15,0	x	x		x		x
115	109	12,8	x		x			
115	110	12,8	x	x	x	x		
115	110	15,0	x	x		x		x
120	114	12,8	x		x			
120	115	9,7	x	x		x		x
120	115	15,0	x	x		x		x
125	119	12,8	x		x			
125	120	5,6	x	x	x	x		
125	120	9,7	x	x	x	x	x	x
125	120	15,0	x	x		x		x
130	124	12,8	x		x			
130	125	9,7	x	x		x	x	x
130	125	15,0	x	x		x		x
130	125	9,7	x	x		x		x
130	125	15,0	x	x				x

Special dimensions and intermediate size are also available.

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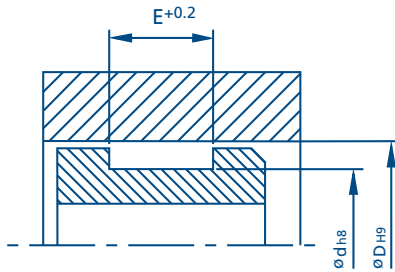
**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
140	134	12,8	x		x			
140	135	15,0	x	x		x		x
150	145	15,0	x	x				x
160	155	9,7	x	x		x		
160	155	15,0	x	x				x
170	165	15,0	x	x				x
180	175	9,7	x			x		x
180	175	15,0	x					x
190	185	15,0	x					x
200	195	9,7	x			x		x
200	195	15,0	x	x				x
200	195	25,0	x					x
210	205	15,0	x	x				x
220	215	15,0	x	x				x
220	215	25,0	x					x
230	225	15,0	x	x				x
230	225	25,0	x					x
240	235	15,0	x					x
240	235	25,0	x					x
250	245	15,0	x	x				x
250	245	25,0	x					x
280	275	15,0	x	x				x
280	275	25,0	x					x
300	295	15,0	x	x				x
300	295	25,0	x					x

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**



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- KT200B Polyester fibre / epoxy resin (dimension individuell)

**Standard dimensions**

**Type**

ø D <sub>H9</sub>	ø d <sub>h8</sub>	E <sup>+0,2</sup>	TP <sub>BR</sub>	TP <sub>K</sub>	FPO	KT100	KT107	KT200
320	315	15,0	x	x				x
320	315	25,0	x					x
350	345	15,0	x	x				x
350	345	25,0	x					x
360	355	15,0	x					x
360	355	25,0	x					x
380	375	25,0	x					x
400	395	25,0	x					x
400	395	40,0	x					x
420	415	25,0	x					x
450	445	25,0	x					x
450	445	40,0	x					x
480	475	25,0	x					x
480	475	40,0	x					x
500	495	25,0	x					x
500	495	40,0	x					x

Up to diameter 500 mm are used material KT200 cutted from stock lenghts KT200T!

Special dimensions and intermediate size are also available.

**Guide rings of laminated fabric can be made to specification to meet all your individual dimensional requirements. PTFE-guide rings are adjusted to all requisite diameters, there a made from tape.**





**Plunger guide elements of polyacetal (POM)**

FPL guide rings of polyacetal (POM) are glass-reinforced. The ring guides the piston rod in the plunger cylinder, thus preventing mechanical contact between the moving components and absorbing any side loads that occur.

Guide rings of polyacetal (POM) exhibit good friction behaviour, stick-slip-free operation, high load-bearing capacities and optimum wear resistance.

POM guide elements are manufactured by the injection moulding process and are supplied ready to install. The profile is rectangular and bevelled or rounded at the edges in order to avoid impermissible edge compression in the groove corners and to facilitate fitting in the groove.

The dynamic side is provided with axial oil notches in order to facilitate flow-back of the medium. The guide rings are generally pre-formed and provided with a diagonal cut.

**Benefits**

- Good friction and wear behaviour
- No stick-slip effect
- High wear resistance
- High load-bearing capacity
- Medium bypass ensured by multi-channel design
- Simple installation by snapping into the groove

**Application ranges**

Velocity:	reciprocating up to 0.8 m/s
Temperature:	-40°C to +120°C
Stat. compressive strength:	up to 40 N/mm <sup>2</sup>
Material KT200:	up to 350 N/mm <sup>2</sup>

**Material**

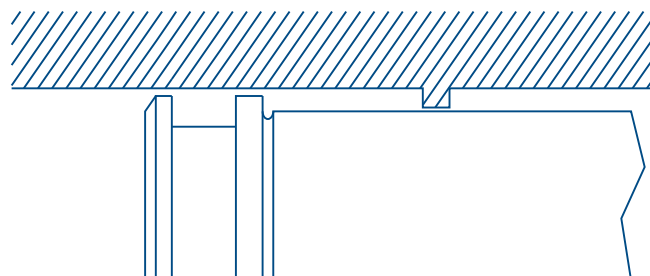
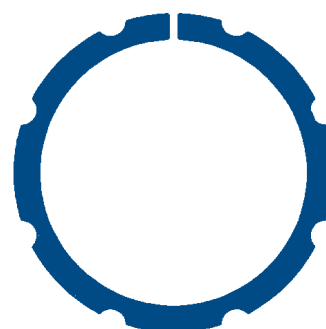
Guide rings of glass-reinforced polyacetal are suitable for medium-duty applications. The ring can also be provided in a special design under the designation **KT200 / KT100** for heavy-duty applications as a laminated fabric construction with synthetic fibres bonded with phenolic resin and PTFE.

The materials selected cover a wide range of applications in hydraulics.

Individual dimensions can also be provided to your specifications.

Der Plungerführungsring kann auch in den höher belastbaren modifizierten Hartgewebewerkstoffen KT100 und KT200 gefertigt werden.

Individuelle Abmessungen, nach Ihren Vorgaben können ebenfalls realisiert werden.

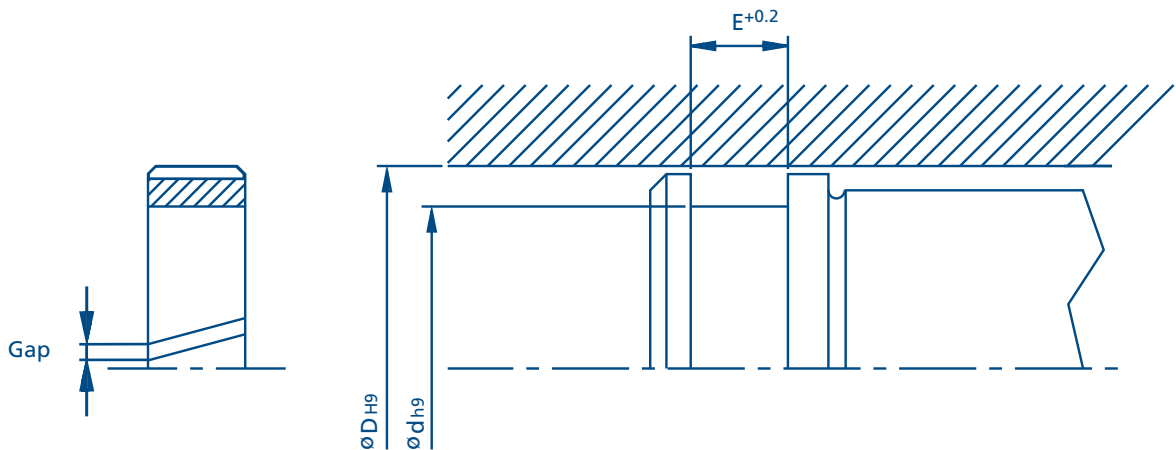






Order designation	∅D H9	∅d h9	E+0.2	Gap	Order designation	∅D H9	∅d h9	E+0.2	Gap
FPL - 30 - 20 - 12	30	20	12.00	2.00	FPL - 65 - 56 - 12	65	56	12.00	3.00
FPL - 35 - 25 - 12	35	25	12.00	2.00	FPL - 70 - 59 - 12	70	59	12.00	2.00
FPL - 40 - 30 - 12	40	30	12.00	2.00	FPL - 70 - 60 - 15	70	60	15.00	3.00
FPL - 40 - 32 - 9.6	40	32	9.60	2.00	FPL - 70 - 64 - 12.7	70	64	12.70	2.00
FPL - 40 - 34 - 12	40	34	12.00	2.00	FPL - 72 - 61 - 12	72	61	12.00	2.00
FPL - 45 - 35 - 12	45	35	12.00	2.00	FPL - 75 - 65 - 15	75	65	15.00	3.00
FPL - 45 - 36 - 12	45	36	12.00	2.00	FPL - 75 - 66 - 12	75	66	12.00	2.00
FPL - 50 - 41 - 12	50	41	12.00	2.00	FPL - 75 - 69 - 12.7	65	69	12.70	2.00
FPL - 50 - 44 - 9.6	50	44	9.60	2.00	FPL - 80 - 70 - 24	80	70	24.00	2.00
FPL - 55 - 45 - 12	55	45	12.00	2.00	FPL - 80 - 74 - 12.7	80	74	12.70	2.00
FPL - 55 - 45 - 15	55	45	15.00	3.00	FPL - 85 - 76 - 15	85	76	15.00	3.00
FPL - 55 - 46 - 12	55	46	12.00	2.00	FPL - 90 - 84 - 12.7	90	84	12.70	2.00
FPL - 55 - 46 - 15	55	46	15.00	3.00	FPL - 95 - 89 - 12.7	95	89	12.70	2.00
FPL - 60 - 50 - 15	60	50	15.00	3.00	FPL - 97 - 86 - 15	97	86	15.00	3.00
FPL - 60 - 51 - 12	60	51	12.00	2.00	FPL - 110 - 104 - 12.7	110	104	12.70	2.00
FPL - 60 - 54 - 12.7	60	54	12.70	2.00	FPL - 125 - 119 - 12.7	125	119	12.70	2.00
FPL - 65 - 55 - 15	65	55	15.00	3.00					

Intermediate sizes and special dimensions on application.



**Guide ring / Ordering example:**

F P L - 55 x 45 x 15

Plunger guide ring for barrel diameter 55 mm

F P L - 55 x 45 x 15 - K T 2 0 0

Plunger guide ring for barrel diameter 55 mm/Special material: Laminated synthetic fibre fabric/phenolic resin/PTFE



## ***PTFE - seals***

piston seals *single acting*

piston seals *double acting*

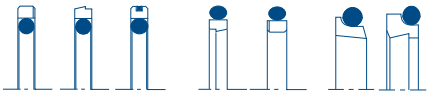
rod seals *single acting*

rod seals *double acting*

wiper

wiper *double acting*





## General

A classic solution for the low-friction sealing of pistons and piston rods in a system involves the use of a PTFE seal with a preload rubber laminate. This form of compact design has proven highly successful in a wide range of different applications over many years.

The sealing elements have a decisive influence on the design, function and service lifetime of hydraulic cylinders. The various material combinations possible within the PTFE segment offer high functional reliability and durability adapted to each requirements profile. Owing to the special material properties inherent in PTFE, high abrasion resistance, shape and dimensional stability and also outstanding sliding properties are ensured. The material also offers very good thermal and chemical resistance values.

## Standard-PTFE-Comounds

### PTFE-Compounds

The many different PTFE compounds offer a widely dispersed application spectrum in hydraulics and pneumatics. Generally, these materials exhibit very good sliding properties, high shape and dimensional stability values and are characterised by good chemical and thermal resistances. Compounds not specifically mentioned, and also modified compounds, can likewise be provided with individualised adaptation to each requirements profile.

### PTFE-Bronze

This is one of the preferred material combinations for medium to heavy-duty hydraulic applications. The material exhibits high compressive strength, and good sliding and wearing properties. It is extremely extrusion-resistant and offers optimum thermal conductivity.

### PTFE-Carbon

Recommended for medium-duty applications and preferred in conjunction with water and water-oil emulsions. The material exhibits high abrasion resistance and good chemical resistance. Dry-running is possible; suitable for soft/yielding mating surfaces.

### PTFE-Carbon fibre

Recommended for medium-duty applications in both hydraulics and industry in general, in water and water oil emulsion. PTFE-carbon fiber seals exhibit high abrasion resistance, good chemical resistance and are very extrusion-resistant. It is possible to use it in dry application.

### PTFE-Fibreglass

Recommended for medium-duty applications in both hydraulics and industry in general. PTFE-fibreglass seals exhibit high abrasion resistance, good chemical resistance and are very extrusion-resistant.

### PTFE-virginal

Recommended for light-duty mechanical-contact applications, and the preferred alternative in the food, chemical and pharmaceutical industry. Very good thermal and chemical resistance values.

**Further interesting materials available, depending of applications.**

## Selection

The variety of deployment scenarios and thus operational conditions call for a respective dimensioning of the sealing element. The selection of materials and considering all required parameters for influencing the sealing behaviour of a seal and its limit values result in the requirement of a functional overall solution.

Standard design of the multi-part sealing element, for piston and bar for back and forth deployments, is PTFE bronze along with an O-ring of NBR 70 Shore for the pressure element.



## Piston seals of PTFE

The classic **type KD** double-acting piston seal has a proven track record as a low-friction component for application in hydraulic cylinders and has been successfully employed over many years.

Its compact design with an O-ring of NBR as the preload element provides for an optimum sealing system in most hydraulic applications. The broad spectrum of material combinations available for the sealing element and selection of the appropriate material for the preload element ensure almost unlimited suitability in a wide range of different applications.

The piston seal has a rectangular profile with the edges on the dynamic side slightly bevelled. Stress-relief notches are provided on both faces of the seal to enable fast response to load changes while at the same time preventing backpressure build-up.

A special stepped profile, **type KE**, is available for hydraulic cylinders pressurised on one side only. The otherwise identical properties of the PTFE combinations likewise ensure high functional reliability throughout the entire service range of this seal.

### Benefits

- Outstanding friction behaviour
- No stick-slip effect, even at low velocities
- High wear resistance, long service life
- Very good thermal and chemical resistance
- Individual size ranges possible
- Simple groove design
- Two-part design suitable for fitting to single-piece pistons

### Application ranges

Velocity:	reciprocating up to 15 m/s
Temperature:	-60°C to +200°C depending on material combination and O-ring material
Pressure:	up to 80 MPa (800 bar)
Groove root:	$R_a \leq 1.8 \mu\text{m} / R_t \leq 10 \mu\text{m}$
Groove flanks:	$R_a \leq 3.0 \mu\text{m} / R_t \leq 16 \mu\text{m}$
Contact area:	$R_a \leq 0.4 \mu\text{m} / R_t \leq 4.2 \mu\text{m}$

### Installation

The **type KD** piston seal can be installed without problem in continuous grooves.

To facilitate mounting, it may be advisable to warm the seal in oil at a temperature of approx. 80°C prior to fitting. After fitting the preload and sealing elements, the PTFE piston seal must be sized. This can be done by using the insertion bevel on the cylinder barrel, which should have an angle of between 15° and 20° and a length of 2 mm to 8 mm depending on the as-designed sealing height. Likewise, a separate sizing sleeve can be used. It must always be ensured that sharp edges are removed by rounding or bevelling. Thread tips should be covered. Before fitting, ensure that all machining residues such as swarf, chips, dirt and other foreign particles have been removed.

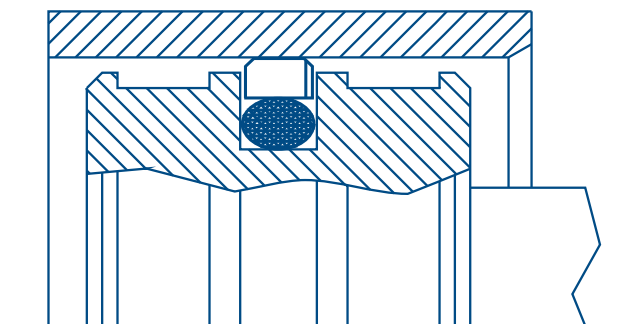
The surface quality of the mating faces being sealed is of decisive importance for the functional reliability and service life of the seal.

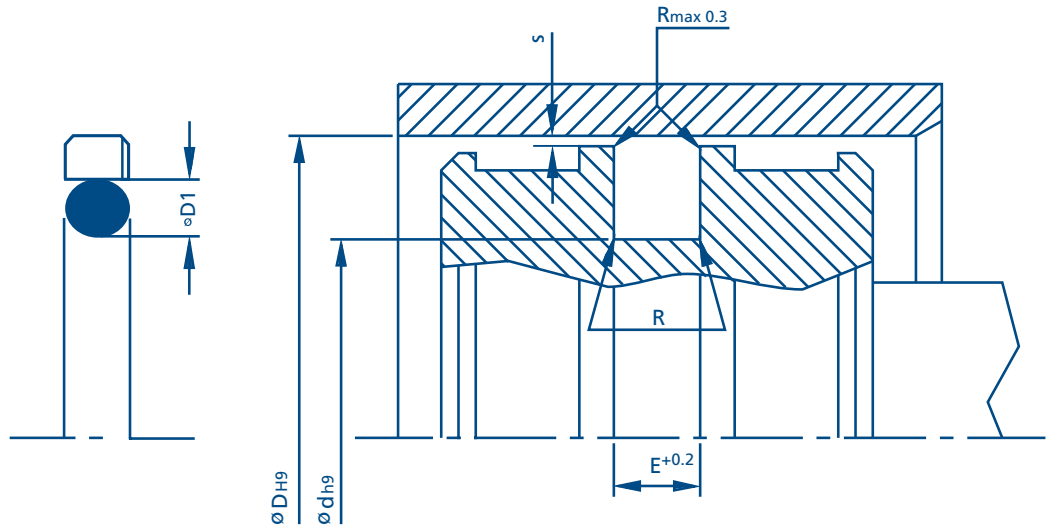
It is important to ensure that there are no ridges, scratches or recesses, nor any concentric or spiral machining marks on the surface.

The parameters usually applied for surface description such as  $R_a$ ,  $R_z$ ,  $R_t$  and  $R_{\text{max}}$  are defined in DIN 4762 and DIN 4768.

In order to properly assess surface quality for sealing applications, the material ratio (bearing curve  $tp$ ) should also be taken into account.

This profile shape parameter is influenced by the machining process applied. The material ratio ( $Mr$ ) should lie between 50 and 70% as determined at a slice depth of approx.  $0.25 \times R_z$  based on a reference percentage of approx. 5%.





**Selection**

**Diameter D<sub>H9</sub>**

Standard design	Light-duty design	Heavy-duty design	Groove root $\varnothing d_{H9}$	Groove width $E^{+0.2}$	O-Ring Cord thickness $\varnothing D1$
8 - 14.9	15 - 39.9		$\varnothing D - 4.9$	2.2	1.78
15 - 39.9	40 - 79.9		$\varnothing D - 7.5$	3.2	2.62
40 - 79.9	80 - 132.9	15 - 39.9	$\varnothing D - 11.0$	4.2	3.53
80 - 132.9	133 - 329.9	40 - 79.9	$\varnothing D - 15.5$	6.3	5.33
133 - 329.9	330 - 669.9	80 - 132.9	$\varnothing D - 21.0$	8.1	7.00
330 - 669.9	670 - 999.9	133 - 329.9	$\varnothing D - 24.5$	8.1	7.00
670 - 999.9		330 - 669.9	$\varnothing D - 28.0$	9.5	8.50

**Gap dimension "s" / radius "R"**

Groove width $E^{+0.2}$	Gap "s" 0 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
2.2	0.3 - 0.2	0.2 - 0.1	0.3 - 0.5
3.2	0.4 - 0.2	0.2 - 0.1	0.5 - 0.8
4.2	0.4 - 0.2	0.3 - 0.1	0.8 - 1.2
6.3	0.5 - 0.3	0.3 - 0.2	1.2 - 1.5
8.1	0.5 - 0.3	0.3 - 0.2	1.5 - 2.0
8.1	0.6 - 0.3	0.4 - 0.2	1.5 - 2.0
9.5	0.7 - 0.4	0.4 - 0.3	2.0 - 3.0

*All piston seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!*

**Piston seals / Ordering example:**

K D - 63 x 52 x 4.2 - B R

*Piston seal for piston diameter of  $\varnothing 63$  / PTFE-Bronze / Standard design*

K D - 63 x 47.5 x 6.3 - K

*Piston seal for piston diameter of  $\varnothing 63$  / PTFE-Carbon / Heavy-duty design*

**Material**

PTFE - Bronze BR  
 PTFE - Carbon K  
 PTFE - Carbon fibre KF  
 PTFE - Glass fibre GF

PU - Polyurethane PU  
 PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	øD H9	ød h9	E+0.2	OR
KD - 8 - 3.1 - 2.2 - BR	8	3.1	2.2	006
KD - 10 - 5.1 - 2.2 - BR	10	5.1	2.2	009
KD - 12 - 7.1 - 2.2 - BR	12	7.1	2.2	011
KD - 15 - 7.5 - 3.2 - BR	15	7.5	3.2	109
KD - 16 - 8.5 - 3.2 - BR	16	8.5	3.2	110
KD - 18 - 10.5 - 3.2 - BR	18	10.5	3.2	110
KD - 20 - 12.5 - 3.2 - BR	20	12.5	3.2	112
KD - 22 - 14.5 - 3.2 - BR	22	14.5	3.2	113
KD - 24 - 16.5 - 3.2 - BR	24	16.5	3.2	114
KD - 25 - 17.5 - 3.2 - BR	25	17.5	3.2	115
KD - 28 - 20.5 - 3.2 - BR	28	20.5	3.2	117
KD - 30 - 22.5 - 3.2 - BR	30	22.5	3.2	118
KD - 32 - 24.5 - 3.2 - BR	32	24.5	3.2	119
KD - 35 - 27.5 - 3.2 - BR	35	27.5	3.2	121
KD - 38 - 30.5 - 3.2 - BR	38	30.5	3.2	123
KD - 39 - 31.5 - 3.2 - BR	39	31.5	3.2	124
KD - 40 - 29.0 - 4.2 - BR	40	29.0	4.2	216
KD - 42 - 31.0 - 4.2 - BR	42	31.0	4.2	217
KD - 45 - 34.0 - 4.2 - BR	45	34.0	4.2	219
KD - 48 - 37.0 - 4.2 - BR	48	37.0	4.2	221
KD - 50 - 39.0 - 4.2 - BR	50	39.0	4.2	222
KD - 52 - 41.0 - 4.2 - BR	52	41.0	4.2	223
KD - 55 - 44.0 - 4.2 - BR	55	44.0	4.2	224
KD - 60 - 49.0 - 4.2 - BR	60	49.0	4.2	225
KD - 63 - 52.0 - 4.2 - BR	63	52.0	4.2	226
KD - 64 - 53.0 - 4.2 - BR	64	53.0	4.2	226
KD - 65 - 54.0 - 4.2 - BR	65	54.0	4.2	227
KD - 70 - 59.0 - 4.2 - BR	70	59.0	4.2	228
KD - 70 - 54.5 - 6.3 - BR	70	54.5	6.3	330
KD - 75 - 64.0 - 4.2 - BR	75	64.0	4.2	230
KD - 80 - 64.5 - 6.3 - BR	80	64.5	6.3	333
KD - 80 - 59.0 - 8.1 - BR	80	59.0	8.1	58x7
KD - 85 - 69.5 - 6.3 - BR	85	69.5	6.3	335
KD - 85 - 64.0 - 8.1 - BR	85	64.0	8.1	64x7
KD - 90 - 74.5 - 6.3 - BR	90	74.5	6.3	336

Order designation	øD H9	ød h9	E+0.2	OR
KD - 90 - 69.0 - 8.1 - BR	90	69.0	8.1	68x7
KD - 95 - 79.5 - 6.3 - BR	95	79.5	6.3	338
KD - 95 - 74.0 - 8.1 - BR	95	74.0	8.1	73x7
KD - 100 - 84.5 - 6.3 - BR	100	84.5	6.3	339
KD - 100 - 79.0 - 8.1 - BR	100	79.0	8.1	79x7
KD - 105 - 89.5 - 6.3 - BR	105	89.5	6.3	341
KD - 105 - 84.0 - 8.1 - BR	105	84.0	8.1	83x7
KD - 110 - 94.5 - 6.3 - BR	110	94.5	6.3	343
KD - 110 - 89.0 - 8.1 - BR	110	89.0	8.1	89x7
KD - 115 - 99.5 - 6.3 - BR	115	99.5	6.3	344
KD - 115 - 94.0 - 8.1 - BR	115	94.0	8.1	94x7
KD - 120 - 104.5 - 6.3 - BR	120	104.5	6.3	346
KD - 120 - 99.0 - 8.1 - BR	120	99.0	8.1	99x7
KD - 125 - 109.5 - 6.3 - BR	125	109.5	6.3	347
KD - 125 - 104.0 - 8.1 - BR	125	104.0	8.1	101x7
KD - 127 - 111.5 - 6.3 - BR	127	111.5	6.3	348
KD - 130 - 114.5 - 6.3 - BR	130	114.5	6.3	349
KD - 130 - 109.0 - 8.1 - BR	130	109.0	8.1	106x7
KD - 132 - 116.5 - 6.3 - BR	132	116.5	6.3	350
KD - 135 - 114.0 - 8.1 - BR	135	114.0	8.1	425
KD - 140 - 119.0 - 8.1 - BR	140	119.0	8.1	426
KD - 145 - 124.0 - 8.1 - BR	145	124.0	8.1	428
KD - 150 - 129.0 - 8.1 - BR	150	129.0	8.1	430
KD - 155 - 134.0 - 8.1 - BR	155	134.0	8.1	431
KD - 160 - 139.0 - 8.1 - BR	160	139.0	8.1	433
KD - 165 - 144.0 - 8.1 - BR	165	144.0	8.1	434
KD - 170 - 149.0 - 8.1 - BR	170	149.0	8.1	436
KD - 175 - 154.0 - 8.1 - BR	175	154.0	8.1	437
KD - 180 - 159.0 - 8.1 - BR	180	159.0	8.1	438
KD - 190 - 169.0 - 8.1 - BR	190	169.0	8.1	439
KD - 200 - 179.0 - 8.1 - BR	200	179.0	8.1	441
KD - 210 - 189.0 - 8.1 - BR	210	189.0	8.1	443
KD - 220 - 199.0 - 8.1 - BR	220	199.0	8.1	444
KD - 230 - 209.0 - 8.1 - BR	230	209.0	8.1	445
KD - 220 - 199.0 - 8.1 - BR	220	199.0	8.1	444

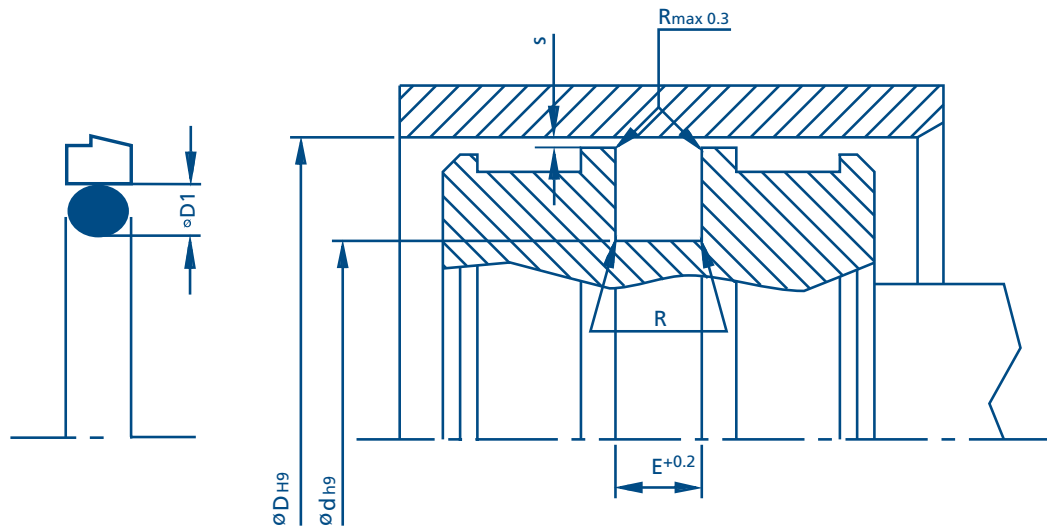
Special dimensions and intermediate size are also available.



Order designation	∅D H9	∅d h9	E+0.2	OR	Order designation	∅D H9	∅d h9	E+0.2	OR
KD - 230 - 209.0 - 8.1 - BR	230	209.0	8.1	445	KD - 440 - 415.5 - 8.1 - BR	440	415.5	8.1	461
KD - 240 - 219.0 - 8.1 - BR	240	219.0	8.1	446	KD - 450 - 425.5 - 8.1 - BR	450	425.5	8.1	462
KD - 250 - 229.0 - 8.1 - BR	250	229.0	8.1	447	KD - 460 - 435.5 - 8.1 - BR	460	435.5	8.1	463
KD - 260 - 239.0 - 8.1 - BR	260	239.0	8.1	447	KD - 470 - 445.5 - 8.1 - BR	470	445.5	8.1	464
KD - 270 - 249.0 - 8.1 - BR	270	249.0	8.1	448	KD - 480 - 455.5 - 8.1 - BR	480	455.5	8.1	464
KD - 280 - 259.0 - 8.1 - BR	280	259.0	8.1	449	KD - 490 - 465.5 - 8.1 - BR	490	465.5	8.1	ASA 93
KD - 290 - 269.0 - 8.1 - BR	290	269.0	8.1	450	KD - 500 - 475.5 - 8.1 - BR	500	475.5	8.1	466
KD - 300 - 279.0 - 8.1 - BR	300	279.0	8.1	451	KD - 510 - 485.5 - 8.1 - BR	510	485.5	8.1	467
KD - 310 - 289.0 - 8.1 - BR	310	289.0	8.1	451	KD - 520 - 495.5 - 8.1 - BR	520	495.5	8.1	468
KD - 320 - 299.0 - 8.1 - BR	320	299.0	8.1	452	KD - 530 - 505.5 - 8.1 - BR	530	505.5	8.1	468
KD - 330 - 305.5 - 8.1 - BR	330	305.5	8.1	453	KD - 540 - 515.5 - 8.1 - BR	540	515.5	8.1	469
KD - 340 - 315.5 - 8.1 - BR	340	315.5	8.1	453	KD - 550 - 525.5 - 8.1 - BR	550	525.5	8.1	469
KD - 350 - 325.5 - 8.1 - BR	350	325.5	8.1	454	KD - 560 - 535.5 - 8.1 - BR	560	535.5	8.1	470
KD - 360 - 335.5 - 8.1 - BR	360	335.5	8.1	455	KD - 570 - 545.5 - 8.1 - BR	570	545.5	8.1	ASA 100
KD - 370 - 345.5 - 8.1 - BR	370	345.5	8.1	456	KD - 580 - 555.5 - 8.1 - BR	580	555.5	8.1	ASA 100
KD - 380 - 355.5 - 8.1 - BR	380	355.5	8.1	457	KD - 590 - 565.5 - 8.1 - BR	590	565.5	8.1	471
KD - 390 - 365.5 - 8.1 - BR	390	365.5	8.1	457	KD - 600 - 575.5 - 8.1 - BR	600	575.5	8.1	471
KD - 400 - 375.5 - 8.1 - BR	400	375.5	8.1	458	KD - 610 - 585.5 - 8.1 - BR	610	585.5	8.1	472
KD - 410 - 385.5 - 8.1 - BR	410	385.5	8.1	459	KD - 620 - 595.5 - 8.1 - BR	620	595.5	8.1	472
KD - 420 - 395.5 - 8.1 - BR	420	395.5	8.1	460	KD - 630 - 605.5 - 8.1 - BR	630	605.5	8.1	ASA 104
KD - 430 - 405.5 - 8.1 - BR	430	405.5	8.1	461	KD - 640 - 615.5 - 8.1 - BR	640	615.5	8.1	473
					KD - 650 - 625.5 - 8.1 - BR	650	625.5	8.1	473

Special dimensions and intermediate size are also available.





**Selection**

**Diameter DH9**

Standard design	Light-duty design	Heavy-duty design	Groove root ød h9	Groove width E+0.2	O-Ring Cord thickness øD1
8 - 16.9	17 - 26.9		øD - 4.9	2.2	1.78
17 - 26.9	27 - 59.9		øD - 7.3	3.2	2.62
27 - 59.9	60 - 199.9	17 - 26.9	øD - 10.7	4.2	3.53
60 - 199.9	200 - 255.9	27 - 59.9	øD - 15.1	6.3	5.33
200 - 255.9	256 - 669.9	60 - 199.9	øD - 20.5	8.1	7.00
256 - 669.9	670 - 999.9	200 - 255.9	øD - 24.0	8.1	7.00
670 - 999.9		256 - 669.9	øD - 27.3	9.5	8.50

**Gap dimension "s" / radius "R"**

Groove width E+0.2	Gap "s" 0 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
2.2	0.3 - 0.2	0.2 - 0.1	0.3 - 0.5
3.2	0.4 - 0.2	0.2 - 0.1	0.5 - 0.8
4.2	0.4 - 0.2	0.3 - 0.1	0.8 - 1.2
6.3	0.5 - 0.3	0.3 - 0.2	1.2 - 1.5
8.1	0.5 - 0.3	0.3 - 0.2	1.5 - 2.0
8.1	0.6 - 0.3	0.4 - 0.2	1.5 - 2.0
9.5	0.7 - 0.4	0.4 - 0.3	2.0 - 3.0

All piston seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

**Piston seals / Ordering example:**

KE - 80 x 64.9 x 6.3 - BR

Piston seal for piston diameter of ø 80 / PTFE-Bronze / Standard design

KE - 80 x 69.3 x 4.2 - K

Piston seal for piston diameter of ø 80 / PTFE-Carbon / Light-duty design

**Material**

PTFE - Bronze BR  
PTFE - Carbon K  
PTFE - Carbon fibre KF  
PTFE - Glass fibre GF

PU - Polyurethane PU  
PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	∅D H9	∅d h9	E+0.2	OR
KE - 8 - 3.1 - 2.2 - BR	8	3.1	2.2	006
KE - 10 - 5.1 - 2.2 - BR	10	5.1	2.2	009
KE - 12 - 7.1 - 2.2 - BR	12	7.1	2.2	011
KE - 15 - 10.1 - 3.2 - BR	15	10.1	2.2	012
KE - 16 - 11.1 - 2.2 - BR	16	11.1	2.2	013
KE - 18 - 10.7 - 3.2 - BR	18	10.7	3.2	110
KE - 20 - 12.7 - 3.2 - BR	20	12.7	3.2	112
KE - 22 - 14.7 - 3.2 - BR	22	14.7	3.2	113
KE - 24 - 16.7 - 3.2 - BR	24	16.7	3.2	114
KE - 25 - 17.7 - 3.2 - BR	25	17.7	3.2	115
KE - 28 - 17.3 - 4.2 - BR	28	17.3	4.2	203
KE - 30 - 19.3 - 4.2 - BR	30	19.3	4.2	210
KE - 32 - 21.3 - 4.2 - BR	32	21.3	4.2	211
KE - 35 - 24.3 - 4.2 - BR	35	24.3	4.2	213
KE - 38 - 27.3 - 4.2 - BR	38	27.3	4.2	215
KE - 39 - 28.3 - 4.2 - BR	39	28.3	4.2	215
KE - 40 - 29.3 - 4.2 - BR	40	29.3	4.2	216
KE - 42 - 31.3 - 4.2 - BR	42	31.3	4.2	217
KE - 45 - 34.3 - 4.2 - BR	45	34.3	4.2	219
KE - 48 - 37.3 - 4.2 - BR	48	37.3	4.2	221
KE - 50 - 39.3 - 4.2 - BR	50	39.3	4.2	222
KE - 52 - 41.3 - 4.2 - BR	52	41.3	4.2	223
KE - 55 - 44.3 - 4.2 - BR	55	44.3	4.2	224
KE - 60 - 44.9 - 6.3 - BR	60	44.9	6.3	327
KE - 63 - 47.9 - 6.3 - BR	63	47.9	6.3	328
KE - 64 - 48.9 - 6.3 - BR	64	48.9	6.3	328
KE - 65 - 49.9 - 6.3 - BR	65	49.9	6.3	328
KE - 70 - 54.9 - 6.3 - BR	70	54.9	6.3	330
KE - 75 - 59.9 - 6.3 - BR	75	59.9	6.3	332
KE - 80 - 64.9 - 6.3 - BR	80	64.9	6.3	333
KE - 85 - 69.9 - 6.3 - BR	85	69.9	6.3	335
KE - 90 - 74.9 - 6.3 - BR	90	74.9	6.3	336
KE - 95 - 79.9 - 6.3 - BR	95	79.9	6.3	338
KE - 100 - 84.9 - 6.3 - BR	100	84.9	6.3	339
KE - 105 - 89.9 - 6.3 - BR	105	89.9	6.3	341

Order designation	∅D H9	∅d h9	E+0.2	OR
KE - 110 - 94.9 - 6.3 - BR	110	94.9	6.3	343
KE - 115 - 99.9 - 6.3 - BR	115	99.9	6.3	344
KE - 120 - 104.9 - 6.3 - BR	120	104.9	6.3	346
KE - 125 - 109.9 - 6.3 - BR	125	109.9	6.3	347
KE - 127 - 111.9 - 6.3 - BR	127	111.9	6.3	348
KE - 130 - 114.9 - 6.3 - BR	130	114.9	6.3	349
KE - 132 - 116.9 - 6.3 - BR	132	116.9	6.3	350
KE - 135 - 119.9 - 6.3 - BR	135	119.9	6.3	351
KE - 140 - 124.9 - 6.3 - BR	140	124.9	6.3	352
KE - 145 - 129.9 - 6.3 - BR	145	129.9	6.3	353
KE - 150 - 134.9 - 6.3 - BR	150	134.9	6.3	355
KE - 155 - 139.9 - 6.3 - BR	155	139.9	6.3	356
KE - 160 - 144.9 - 6.3 - BR	160	144.9	6.3	358
KE - 165 - 149.9 - 6.3 - BR	165	149.9	6.3	360
KE - 170 - 154.9 - 6.3 - BR	170	154.9	6.3	361
KE - 175 - 159.9 - 6.3 - BR	175	159.9	6.3	362
KE - 180 - 164.9 - 6.3 - BR	180	164.9	6.3	363
KE - 190 - 174.9 - 6.3 - BR	190	174.9	6.3	364
KE - 200 - 179.5 - 8.1 - BR	200	179.5	8.1	441
KE - 210 - 189.5 - 8.1 - BR	210	189.5	8.1	443
KE - 220 - 199.5 - 8.1 - BR	220	199.5	8.1	444
KE - 230 - 209.5 - 8.1 - BR	230	209.5	8.1	445
KE - 220 - 199.5 - 8.1 - BR	220	199.5	8.1	444
KE - 230 - 209.5 - 8.1 - BR	230	209.5	8.1	445
KE - 240 - 219.5 - 8.1 - BR	240	219.5	8.1	446
KE - 250 - 229.5 - 8.1 - BR	250	229.5	8.1	447
KE - 260 - 236.0 - 8.1 - BR	260	236.0	8.1	447
KE - 270 - 246.0 - 8.1 - BR	270	246.0	8.1	448
KE - 280 - 256.0 - 8.1 - BR	280	256.0	8.1	449
KE - 290 - 266.0 - 8.1 - BR	290	266.0	8.1	450
KE - 300 - 276.0 - 8.1 - BR	300	276.0	8.1	451
KE - 310 - 286.0 - 8.1 - BR	310	286.0	8.1	451
KE - 320 - 296.0 - 8.1 - BR	320	296.0	8.1	452
KE - 330 - 306.0 - 8.1 - BR	330	306.0	8.1	453
KE - 340 - 315.5 - 8.1 - BR	340	315.5	8.1	453

Special dimensions and intermediate size are also available.



**Piston Seals made of PTFE**

A double piston sealing of **type KDAQ** is proven and tested for sealing pistons for double-acting hydraulic cylinders, for media separation liquid/liquid or liquid/gas in particular. The compact design with two or more NBR-O-rings as pretension element on the static side well as a X-ring for media separation on the dynamic side, guarantee for a perfect sealing system. The various material combination for the sealing element as well as the selection of the material for the pretension and sealing element on the static and the dynamic side alike, provide for a large number of variation options and thus for a nearly unlimited usage for a wide variety of applications.

The piston sealing has a rectangular profile, the edges on the dynamic side a slightly trimmed. The sealing has radial grooves on both front sides in order to guarantee for a direct pressure on the sealing in case of a quick load change as well as to prevent any back pressure.

The **KDAQ\*** design with two O-rings as a pretension element allows for higher deployment limits. Hence, this sealing can be recommended for heavy duty deployment as well as for larger diameters.

**Benefits**

- Excellent friction behaviour
- No stick-slip effect, even with lower speeds
- High sealing effect with media separation
- Very good thermal and chemical durability
- Higher gliding characteristics (KDAQ\*)
- Simple groove design

**Application ranges**

Velocity:	back and forth up to 2 m/s / 3 m/s*
Temperature:	- 30° C bis + 200° C <small>depends on material combination and O-Ring material</small>
Pressure:	up to 40 MPa (400 bar) up to 60 MPa (600 bar)*
Groove root:	$R_a \leq 1,6 \mu\text{m} / R_t \leq 16 \mu\text{m}$
Groove flanks:	$R_a \leq 1,6 \mu\text{m} / R_t \leq 16 \mu\text{m}$
Contact area::	$R_a \leq 0,3 \mu\text{m} / R_t \leq 3 \mu\text{m}$

**Installation**

**Type KDAQ** piston sealings can easily be installed in divided and undivided grooves.

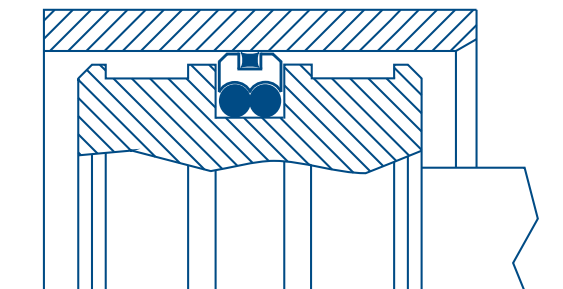
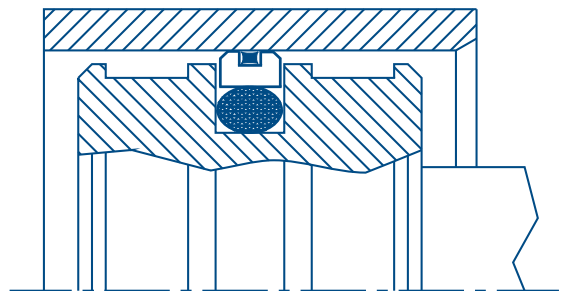
In order to make installation easier, the sealing may be heated in oil at approx. 80 C° before installation. After installing the pretension and sealing element, the PTFE piston sealing needs to be calibrated. Here, the cylinder pipe's feed with an angle of approx. 15 C° and a length of between 2 mm and 8 mm, depending on the design of the sealing height, may be used. However, a calibration quill may be used as well. Generally, any sharp edges should be deflashed before attaching radiuses or bevels. Thread tips should be covered. Chippings, dirt and other foreign particles should be removed before installation.

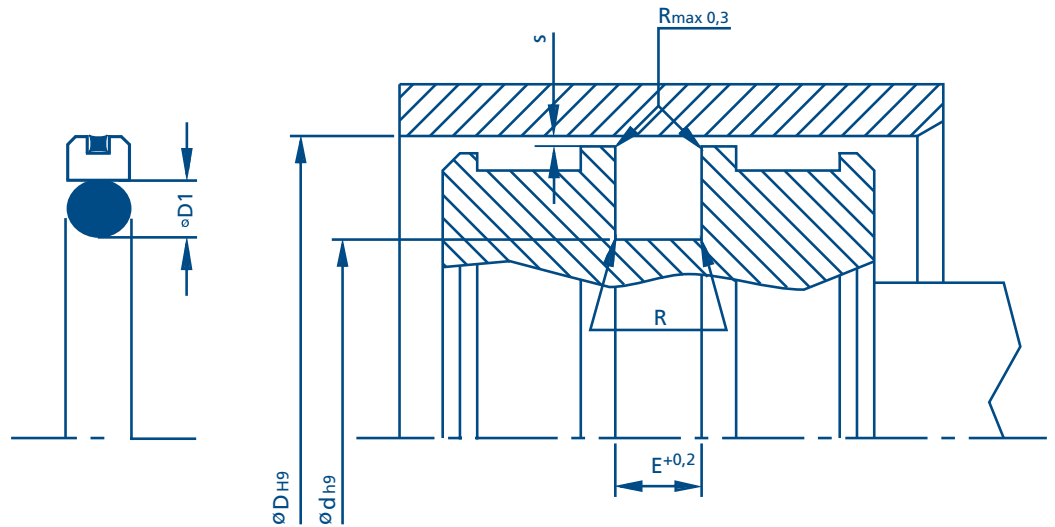
After installation and calibration of the sealing, a X-ring is to be installed in the respective groove on the dynamic side.

In order to guarantee the sealing's functionality and to not influence its life-cycle in a negative way, the surface quality of the area running in the opposite direction is decisive.

Generally, please make sure there are not marks, scratches or cavities as well as concentric or spiral toolmarks.

Key values such as Ra, Rz, Rt and Rmax, usually used to describe surfaces, are specified in compliance with DIN 4762 and DIN 4768 (DIN = German Industrial Standard).





**Selections**

**Diameter D<sub>H9</sub>**

Standard design	Light-duty Design	Groove base $\varnothing d_{h9}$	Groove width $E^{+0,2}$	O-Ring Cord thickness $\varnothing D1$	X-Ring Cord thickness
16 - 39.9	40 - 79.9	$\varnothing D - 11.0$	4.2	3.53	1.78
40 - 79.9	80 - 132.9	$\varnothing D - 15.5$	6.3	5.33	1.78
80 - 132.9	133 - 252.9	$\varnothing D - 21.0$	8.1	7.00	2.62
133 - 252.9		$\varnothing D - 24.5$	8.1	7.00	2.62
253 - 462.9		$\varnothing D - 28.0$	9.5	8.40	3.53
463 - 700.0		$\varnothing D - 35.0$	11.5	10.00	5.33

**Gap dimensions "s" / radius "R"**

Groove width $E^{+0,2}$	Gap "s" 0 - 10 MPa	Gap "s" 10 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
4.2	0.25	0.15	0.10	1.0
6.3	0.30	0.20	0.15	1.3
8.1	0.30	0.20	0.15	1.8
8.1	0.30	0.20	0.15	1.8
9.5	0.45	0.30	0.25	2.5
11.5	0.55	0.40	0.35	3.0

*All piston seals are supplied as standard with an O-ring, X-ring of NBR, 70 Shore. O-rings and X-rings of special materials such as Viton must be separately specified!*

**Piston seals / Ordering example:**

K D A Q - 6 3 x 4 7 . 5 x 6 . 3 - B R

*Piston seal for piston  $\varnothing 63$  / PTFE-Bronze / Standard design*

K D A Q - 6 3 x 5 2 x 4 . 2 - K

*Piston seal for piston  $\varnothing 63$  / PTFE-Carbon / light design*

**Material**

PTFE - Bronze BR  
PTFE - Carbon K  
PTFE - Carbon fibre KF

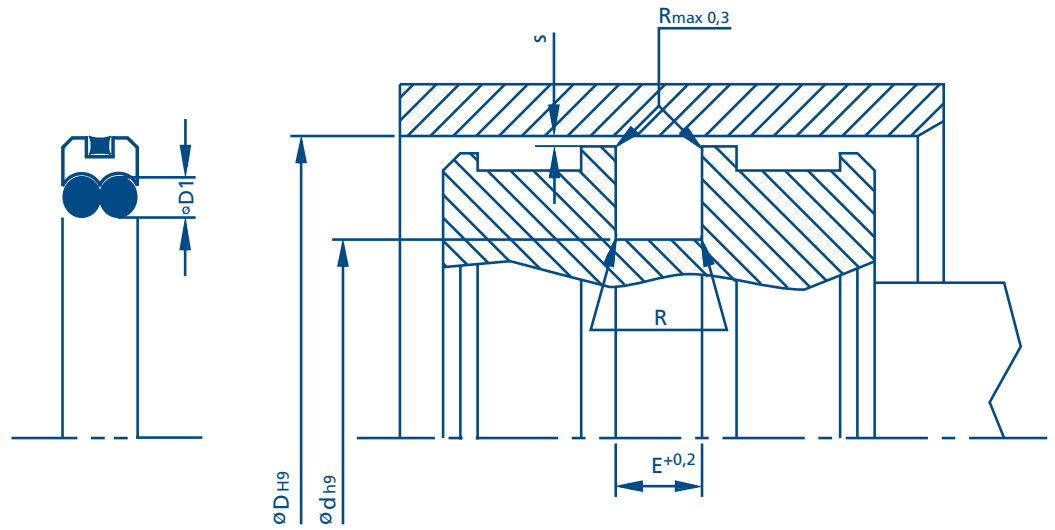
PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	∅D H9	∅d h9	E+0,2	Order designation	∅D H9	∅d h9	E+0,2
KDAQ - 16 - 5.0 - 4.2 - BR	16	5.0	4.2	KDAQ - 90 - 69.0 - 8.1 - BR	90	69.0	8.1
KDAQ - 18 - 7.0 - 4.2 - BR	18	7.0	4.2	KDAQ - 95 - 79.5 - 6.3 - BR	95	79.5	6.3
KDAQ - 20 - 9.0 - 4.2 - BR	20	9.0	4.2	KDAQ - 95 - 74.0 - 8.1 - BR	95	74.0	8.1
KDAQ - 22 - 11.0 - 4.2 - BR	22	11.0	4.2	KDAQ - 100 - 84.5 - 6.3 - BR	100	84.5	6.3
KDAQ - 25 - 14.0 - 4.2 - BR	25	14.0	4.2	KDAQ - 100 - 79.0 - 8.1 - BR	100	79.0	8.1
KDAQ - 28 - 17.0 - 4.2 - BR	28	17.0	4.2	KDAQ - 105 - 89.5 - 6.3 - BR	105	89.5	6.3
KDAQ - 30 - 19.0 - 4.2 - BR	30	19.0	4.2	KDAQ - 105 - 84.0 - 8.1 - BR	105	84.0	8.1
KDAQ - 32 - 21.0 - 4.2 - BR	32	21.0	4.2	KDAQ - 110 - 94.5 - 6.3 - BR	110	94.5	6.3
KDAQ - 40 - 29.0 - 4.2 - BR	40	29.0	4.2	KDAQ - 110 - 89.0 - 8.1 - BR	110	89.0	8.1
KDAQ - 42 - 31.0 - 4.2 - BR	42	31.0	4.2	KDAQ - 115 - 99.5 - 6.3 - BR	115	99.5	6.3
KDAQ - 45 - 34.0 - 4.2 - BR	45	34.0	4.2	KDAQ - 115 - 94.0 - 8.1 - BR	115	94.0	8.1
KDAQ - 48 - 37.0 - 4.2 - BR	48	37.0	4.2	KDAQ - 120 - 104.5 - 6.3 - BR	120	104.5	6.3
KDAQ - 50 - 39.0 - 4.2 - BR	50	39.0	4.2	KDAQ - 120 - 99.0 - 8.1 - BR	120	99.0	8.1
KDAQ - 50 - 34.5 - 6.3 - BR	50	34.5	6.3	KDAQ - 125 - 109.5 - 6.3 - BR	125	109.5	6.3
KDAQ - 52 - 41.0 - 4.2 - BR	52	41.0	4.2	KDAQ - 125 - 104.0 - 8.1 - BR	125	104.0	8.1
KDAQ - 55 - 44.0 - 4.2 - BR	55	44.0	4.2	KDAQ - 130 - 114.5 - 6.3 - BR	130	114.5	6.3
KDAQ - 60 - 49.0 - 4.2 - BR	60	49.0	4.2	KDAQ - 130 - 109.0 - 8.1 - BR	130	109.0	8.1
KDAQ - 63 - 52.0 - 4.2 - BR	63	52.0	4.2	KDAQ - 135 - 114.0 - 8.1 - BR	135	114.0	8.1
KDAQ - 63 - 47.5 - 6.3 - BR	63	47.5	6.3	KDAQ - 140 - 119.0 - 8.1 - BR	140	119.0	8.1
KDAQ - 64 - 53.0 - 4.2 - BR	64	53.0	4.2	KDAQ - 150 - 129.0 - 8.1 - BR	150	129.0	8.1
KDAQ - 65 - 54.0 - 4.2 - BR	65	54.0	4.2	KDAQ - 160 - 139.0 - 8.1 - BR	160	139.0	8.1
KDAQ - 70 - 59.0 - 4.2 - BR	70	59.0	4.2	KDAQ - 170 - 149.0 - 8.1 - BR	170	149.0	8.1
KDAQ - 70 - 54.5 - 6.3 - BR	70	54.5	6.3	KDAQ - 180 - 159.0 - 8.1 - BR	180	159.0	8.1
KDAQ - 75 - 64.0 - 4.2 - BR	75	64.0	4.2	KDAQ - 190 - 169.0 - 8.1 - BR	190	169.0	8.1
KDAQ - 80 - 64.5 - 6.3 - BR	80	64.5	6.3	KDAQ - 200 - 179.0 - 8.1 - BR	200	179.0	8.1
KDAQ - 80 - 59.0 - 8.1 - BR	80	59.0	8.1	KDAQ - 210 - 189.0 - 8.1 - BR	210	189.0	8.1
KDAQ - 85 - 69.5 - 6.3 - BR	85	69.5	6.3	KDAQ - 220 - 199.0 - 8.1 - BR	220	199.0	8.1
KDAQ - 85 - 64.0 - 8.1 - BR	85	64.0	8.1	KDAQ - 230 - 209.0 - 8.1 - BR	230	209.0	8.1
KDAQ - 90 - 74.5 - 6.3 - BR	90	74.5	6.3	KDAQ - 240 - 219.0 - 8.1 - BR	240	219.0	8.1
KDAQ - 90 - 69.0 - 8.1 - BR	90	69.0	8.1	KDAQ - 250 - 225.5 - 8.1 - BR	250	225.5	8.1
KDAQ - 95 - 79.5 - 6.3 - BR	95	79.5	6.3	KDAQ - 250 - 229.0 - 8.1 - BR	250	229.0	8.1
KDAQ - 95 - 74.0 - 8.1 - BR	95	74.0	8.1	KDAQ - 280 - 252.0 - 9.5 - BR	280	252.0	9.5
KDAQ - 100 - 84.5 - 6.3 - BR	100	84.5	6.3	KDAQ - 300 - 272.0 - 9.5 - BR	300	272.0	9.5
KDAQ - 100 - 79.0 - 8.1 - BR	100	79.0	8.1	KDAQ - 350 - 322.0 - 9.5 - BR	350	322.0	9.5
KDAQ - 105 - 89.5 - 6.3 - BR	105	89.5	6.3	KDAQ - 400 - 372.0 - 9.5 - BR	400	372.0	9.5

Special dimensions and intermediate size are also available.



**Selections**

**Diameter DH9**

Standard design	Light-duty design	Groove root $\varnothing d_{h9}$	Groove width $E^{+0,2}$	O-Ring Cord thickness $\varnothing D1$	X-Ring Cord thickness
40 - 79.9	25 - 140.0	$\varnothing D - 10.0$	6.3	2.62	1.78
80 - 132.9	50 - 250.0	$\varnothing D - 13.0$	8.3	3.53	2.62
133 - 462.9	100 - 480.0	$\varnothing D - 18.0$	12.3	5.33	3.53
463 - 700.0	425 - 700.0	$\varnothing D - 31.0$	16.3	7.00	5.33

**Gap dimension "s" / radius "R"**

Groove width $E^{+0,2}$	Gap "s" 0 - 10 MPa	Gap "s" 10 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
6.3	0.30	0.20	0.15	0.6
8.3	0.40	0.30	0.15	1.0
12.3	0.40	0.30	0.20	1.3
16.3	0.50	0.40	0.30	1.8

All piston seals are supplied as standard with an O-ring, X-ring of NBR, 70 Shore. O-rings and X-rings of special materials such as Viton must be separately specified!

**Piston seals / Ordering example:**

K D A Q - 80 x 67 x 8.3 - B R

*Piston seal for piston  $\varnothing 80$  / PTFE-Bronze / standard design*

K D A Q - 80 x 70 x 6.3 - K

*Piston seal for piston  $\varnothing 80$  / PTFE-Carbon / light design*

**Material**

- PTFE - Bronze BR
- PTFE - Carbon K
- PTFE - Carbon fibre KF
- PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	∅D H9	∅d h9	E+0,2
KDAQ - 40 - 30.0 - 6.3 - BR	40	30.0	6.3
KDAQ - 42 - 32.0 - 6.3 - BR	42	32.0	6.3
KDAQ - 45 - 35.0 - 6.3 - BR	45	35.0	6.3
KDAQ - 50 - 40.0 - 6.3 - BR	50	40.0	6.3
KDAQ - 55 - 45.0 - 6.3 - BR	55	45.0	6.3
KDAQ - 60 - 50.0 - 6.3 - BR	60	50.0	6.3
KDAQ - 63 - 53.0 - 6.3 - BR	63	53.0	6.3
KDAQ - 65 - 55.0 - 6.3 - BR	65	55.0	6.3
KDAQ - 70 - 60.0 - 6.3 - BR	70	60.0	6.3
KDAQ - 75 - 65.0 - 6.3 - BR	75	65.0	6.3
KDAQ - 80 - 67.0 - 8.3 - BR	80	67.0	8.3
KDAQ - 85 - 72.0 - 8.3 - BR	85	72.0	8.3
KDAQ - 90 - 77.0 - 8.3 - BR	90	77.0	8.3
KDAQ - 95 - 82.0 - 8.3 - BR	95	82.0	8.3
KDAQ - 100 - 87.0 - 8.3 - BR	100	87.0	8.3
KDAQ - 105 - 92.0 - 8.3 - BR	105	92.0	8.3
KDAQ - 110 - 97.0 - 8.3 - BR	110	97.0	8.3
KDAQ - 115 - 102.0 - 8.3 - BR	115	102.0	8.3
KDAQ - 120 - 107.0 - 8.3 - BR	120	107.0	8.3
KDAQ - 125 - 112.0 - 8.3 - BR	125	112.0	8.3
KDAQ - 130 - 117.0 - 8.3 - BR	130	117.0	8.3
KDAQ - 140 - 122.0 - 12.3 - BR	140	122.0	12.3
KDAQ - 150 - 132.0 - 12.3 - BR	150	132.0	12.3
KDAQ - 160 - 142.0 - 12.3 - BR	160	142.0	12.3
KDAQ - 170 - 152.0 - 12.3 - BR	170	152.0	12.3
KDAQ - 180 - 162.0 - 12.3 - BR	180	162.0	12.3
KDAQ - 190 - 172.0 - 12.3 - BR	190	172.0	12.3
KDAQ - 200 - 182.0 - 12.3 - BR	200	182.0	12.3

Order designation	∅D H9	∅d h9	E+0,2
KDAQ - 210 - 192.0 - 12.3 - BR	210	192.0	12.3
KDAQ - 220 - 202.0 - 12.3 - BR	220	202.0	12.3
KDAQ - 230 - 212.0 - 12.3 - BR	230	212.0	12.3
KDAQ - 240 - 222.0 - 12.3 - BR	240	222.0	12.3
KDAQ - 250 - 232.0 - 12.3 - BR	250	232.0	12.3
KDAQ - 280 - 262.0 - 12.3 - BR	280	262.0	12.3
KDAQ - 300 - 282.0 - 12.3 - BR	300	282.0	12.3
KDAQ - 320 - 302.0 - 12.3 - BR	320	302.0	12.3
KDAQ - 350 - 332.0 - 12.3 - BR	350	332.0	12.3
KDAQ - 400 - 382.0 - 12.3 - BR	400	382.0	12.3
KDAQ - 420 - 402.0 - 12.3 - BR	400	402.0	12.3
KDAQ - 450 - 432.0 - 12.3 - BR	450	432.0	12.3
KDAQ - 480 - 449.0 - 16.3 - BR	400	449.0	16.3
KDAQ - 500 - 469.0 - 16.3 - BR	500	469.0	16.3
KDAQ - 550 - 519.0 - 16.3 - BR	550	519.0	16.3
KDAQ - 600 - 569.0 - 16.3 - BR	600	569.0	16.3
KDAQ - 650 - 619.0 - 16.3 - BR	650	619.0	16.3
KDAQ - 700 - 669.0 - 16.3 - BR	700	669.0	16.3

Special dimensions and intermediate size are also available.







## Rod seals of PTFE

The classic **type SE** rod seal has a proven track record as a low-friction component that has been successfully employed over many years for the sealing of piston rods in hydraulic cylinders. The compact design featuring an NBR O-ring as the preload element and a special geometry, is ideal as the optimum sealing system for many applications in hydraulics. The specially shaped sealing edge profile offers optimum flow-back while at the same time preventing pressure build-up between tandem-arranged rod seals.

Depending on the application and operating conditions, the combination of different materials for primary and secondary sealing can improve both the operational behaviour and the service lifetime of the sealing system.

In the case of particularly tough service conditions, it may be advisable to select a PTFE compound as the primary seal and a thermoplastic material for the secondary seal. Such redundant sealing systems should be combined with a double-wiper.

The wide range of material combinations available for the sealing system and selection of the appropriate material for the preload element provides for significant variation possibilities, so enabling virtually unlimited suitability for different applications.

### Benefits

- Outstanding friction behaviour
- No stick-slip effect, even at low velocities
- Good static and dynamic sealing
- High abrasion resistance
- Very good thermal and chemical resistance
- Individual size ranges possible
- Simple groove design

### Application ranges

Velocity:	reciprocating up to 15 m/s frequency up to 5 Hz
Temperature:	-60°C to +200°C depending on material combination and O-ring material
Pressure:	up to 80 MPa (800 bar)
Groove root:	$R_a \leq 1.8 \mu\text{m} / R_t \leq 10 \mu\text{m}$
Groove flanks:	$R_a \leq 3.0 \mu\text{m} / R_t \leq 16 \mu\text{m}$
Contact area:	$R_a \leq 0.3 \mu\text{m} / R_t \leq 3.0 \mu\text{m}$

### Installation

The **type SE** and **SD** rod seals can be fitted without problem in continuous grooves. To facilitate mounting, the seal can be rendered more pliable by heating it in oil at a temperature of approx. 80°C prior to fitting.

In order to fit the rod seal in the groove, it needs to be deformed into a kidney shape – ensuring there is no kinking – and then inserted in this form. Once inserted, the seal can be reformed back to its ring shape in the groove. Once the preload and sealing elements have been fitted, the PTFE rod seal must be sized with a mandrel featuring a bevel of approx. 10° - 20° and a length of approx. 30 mm. The piston rod can also be used for the sizing operation provided that it has a sufficient insertion bevel.

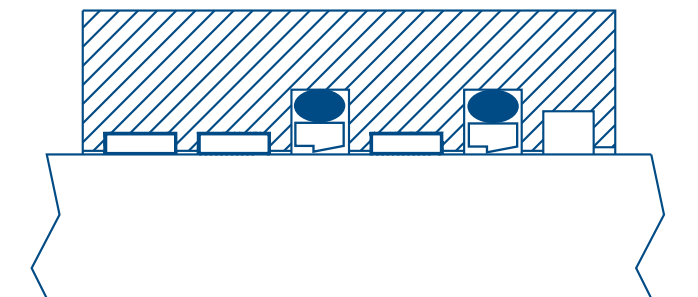
It must always be ensured that sharp edges are removed by rounding or bevelling. Thread tips should be covered. Before fitting, ensure that all machining residues such as swarf, chips, dirt and other foreign particles have been removed.

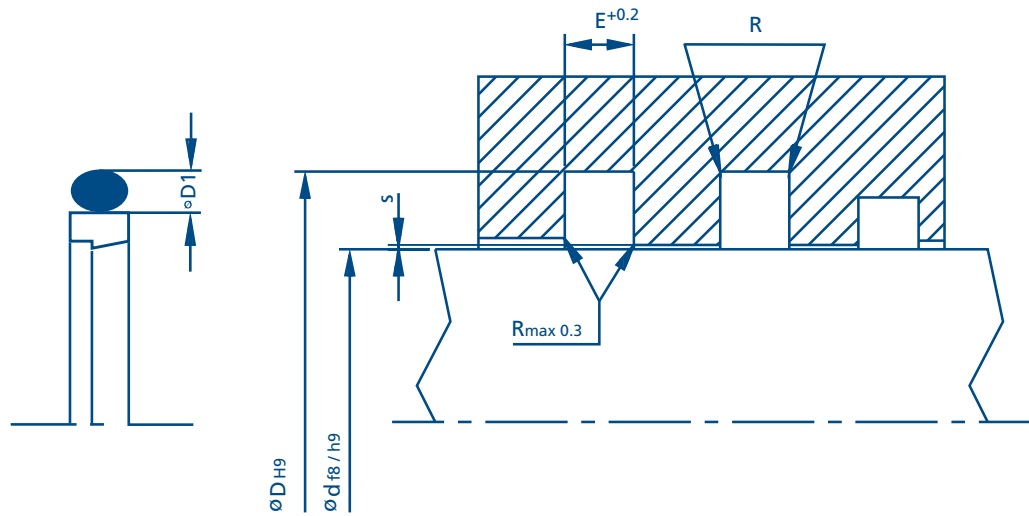
When employing these seals in a tandem arrangement, it should generally be ensured that there is sufficient space between the two seal assemblies to receive the hydraulic fluid. The surface quality of the mating faces being sealed is of decisive importance for the functional reliability and service life of the seal.

It is important to ensure that there are no ridges, scratches or recesses, nor any concentric or spiral machining marks on the surface.

The parameters usually applied for surface description such as  $R_a$ ,  $R_z$ ,  $R_t$  and  $R_{\text{max}}$  are defined in DIN 4762 and DIN 4768.

In order to properly assess surface quality for sealing applications, the material ratio (bearing curve  $t_p$ ) should also be taken into account. This profile shape parameter is influenced by the machining process applied. The material ratio ( $M_r$ ) should lie between 50 and 70% as determined at a slice depth of approx.  $0.25 \times R_z$  based on a reference percentage of approx. 5%.





**Selection**

**Diameter d f8/h9**

Standard design	Light-duty design	Heavy-duty design	Groove root øDH9	Groove width E+0.2	O-Ring Cord thickness øD1
	8 - 18.9		ød + 4.9	2.2	1.78
8 - 18.9	19 - 37.9		ød + 7.3	3.2	2.62
19 - 37.9	38 - 199.9	8 - 18.9	ød + 10.7	4.2	3.53
38 - 199.9	200 - 255.9	19 - 37.9	ød + 15.1	6.3	5.33
200 - 255.9	256 - 649.9	38 - 199.9	ød + 20.5	8.1	6.99
256 - 649.9	650 - 999.9	200 - 255.9	ød + 24.0	8.1	7.00
650 - 999.9		256 - 649.9	ød + 27.3	9.5	8.40

**Gap dimension "s" / radius "R"**

Groove width E+0.2	Gap "s" 0 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
2.2	0.3 - 0.2	0.2 - 0.1	0.4
3.2	0.3 - 0.2	0.2 - 0.1	0.6
4.2	0.4 - 0.3	0.3 - 0.1	1.0
6.3	0.4 - 0.3	0.3 - 0.2	1.3
8.1	0.5 - 0.3	0.3 - 0.2	1.8
8.1	0.5 - 0.3	0.4 - 0.2	1.8
9.5	0.6 - 0.4	0.4 - 0.3	2.5

*All rod seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!*

**Rod seals / Ordering example:**

SE - 40 x 50.7 x 4.2 - BR

*Rod seal for rod diameter of ø 40 / PTFE-Bronze / Standard design*

SE - 40 x 55.1 x 6.3 - PG

*Rod seal for rod diameter of ø 40 / Polyurethan+graphite / Heavy-duty design*

**Material**

PTFE - Bronze BR  
 PTFE - Carbon K  
 PTFE - Carbon fibre KF  
 PTFE - Glass fibre GF

PU - Polyurethane PU  
 PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	∅d f8/h9	∅D H9	E+0.2	OR
SE - 6 - 10.9 - 2.2 - BR	6	10.9	2.2	011
SE - 7 - 11.9 - 2.2 - BR	7	11.9	2.2	012
SE - 8 - 15.3 - 3.2 - BR	8	15.3	3.2	111
SE - 8 - 12.9 - 2.2 - BR	8	12.9	2.2	012
SE - 10 - 17.3 - 3.2 - BR	10	17.3	3.2	113
SE - 10 - 14.9 - 2.2 - BR	10	14.9	2.2	014
SE - 12 - 19.3 - 3.2 - BR	12	19.3	3.2	114
SE - 12 - 16.9 - 2.2 - BR	12	16.9	2.2	015
SE - 14 - 21.3 - 3.2 - BR	14	21.3	3.2	115
SE - 14 - 18.9 - 2.2 - BR	14	18.9	2.2	016
SE - 15 - 22.3 - 3.2 - BR	15	22.3	3.2	116
SE - 15 - 19.9 - 2.2 - BR	15	19.9	2.2	017
SE - 16 - 23.3 - 3.2 - BR	16	23.3	3.2	116
SE - 16 - 20.9 - 2.2 - BR	16	20.9	2.2	017
SE - 18 - 25.3 - 3.2 - BR	18	25.3	3.2	118
SE - 18 - 22.9 - 2.2 - BR	18	22.9	2.2	019
SE - 20 - 30.7 - 4.2 - BR	20	30.7	4.2	214
SE - 20 - 27.3 - 3.2 - BR	20	27.3	3.2	119
SE - 22 - 32.7 - 4.2 - BR	22	32.7	4.2	215
SE - 22 - 29.3 - 3.2 - BR	22	29.3	3.2	120
SE - 25 - 35.7 - 4.2 - BR	25	35.7	4.2	217
SE - 25 - 32.3 - 3.2 - BR	25	32.3	3.2	122
SE - 28 - 38.7 - 4.2 - BR	28	38.7	4.2	219
SE - 28 - 35.3 - 3.2 - BR	28	35.3	3.2	124
SE - 30 - 40.7 - 4.2 - BR	30	40.7	4.2	220
SE - 30 - 37.3 - 3.2 - BR	30	37.3	3.2	125
SE - 32 - 42.7 - 4.2 - BR	32	42.7	4.2	221
SE - 32 - 39.3 - 3.2 - BR	32	39.3	3.2	126
SE - 35 - 45.7 - 4.2 - BR	35	45.7	4.2	222
SE - 35 - 42.3 - 3.2 - BR	35	42.3	3.2	128
SE - 36 - 46.7 - 4.2 - BR	36	46.7	4.2	223
SE - 36 - 43.3 - 3.2 - BR	36	43.3	3.2	129
SE - 38 - 53.1 - 6.3 - BR	38	53.1	6.3	327
SE - 38 - 48.7 - 4.2 - BR	38	48.7	4.2	224
SE - 40 - 50.7 - 4.2 - BR	40	50.7	4.2	224

Order designation	∅d f8/h9	∅D H9	E+0.2	OR
SE - 45 - 60.1 - 6.3 - BR	45	60.1	6.3	329
SE - 45 - 55.7 - 4.2 - BR	45	55.7	4.2	226
SE - 50 - 65.1 - 6.3 - BR	50	65.1	6.3	331
SE - 50 - 60.7 - 4.2 - BR	50	60.7	4.2	227
SE - 56 - 71.1 - 6.3 - BR	56	71.1	6.3	333
SE - 56 - 66.7 - 4.2 - BR	56	66.7	4.2	229
SE - 60 - 75.1 - 6.3 - BR	60	75.1	6.3	334
SE - 60 - 70.7 - 4.2 - BR	60	70.7	4.2	230
SE - 63 - 78.1 - 6.3 - BR	63	78.1	6.3	335
SE - 65 - 80.1 - 6.3 - BR	65	80.1	6.3	336
SE - 70 - 85.1 - 6.3 - BR	70	85.1	6.3	337
SE - 75 - 90.1 - 6.3 - BR	75	90.1	6.3	339
SE - 80 - 95.1 - 6.3 - BR	80	95.1	6.3	340
SE - 85 - 100.1 - 6.3 - BR	85	100.1	6.3	342
SE - 90 - 105.1 - 6.3 - BR	90	105.1	6.3	344
SE - 95 - 110.1 - 6.3 - BR	95	110.1	6.3	345
SE - 100 - 115.1 - 6.3 - BR	100	115.1	6.3	347
SE - 105 - 120.1 - 6.3 - BR	105	120.1	6.3	348
SE - 110 - 125.1 - 6.3 - BR	110	125.1	6.3	350
SE - 115 - 130.1 - 6.3 - BR	115	130.1	6.3	351
SE - 120 - 135.1 - 6.3 - BR	120	135.1	6.3	353
SE - 125 - 140.1 - 6.3 - BR	125	140.1	6.3	355
SE - 130 - 145.1 - 6.3 - BR	130	145.1	6.3	356
SE - 135 - 150.1 - 6.3 - BR	135	150.1	6.3	358
SE - 140 - 155.1 - 6.3 - BR	140	155.1	6.3	359
SE - 150 - 165.1 - 6.3 - BR	150	165.1	6.3	362
SE - 160 - 175.1 - 6.3 - BR	160	175.1	6.3	363
SE - 170 - 185.1 - 6.3 - BR	170	185.1	6.3	365
SE - 180 - 195.1 - 6.3 - BR	180	195.1	6.3	366
SE - 190 - 205.1 - 6.3 - BR	190	205.1	6.3	368
SE - 200 - 220.5 - 8.1 - BR	200	220.5	8.1	445
SE - 210 - 230.5 - 8.1 - BR	210	230.5	8.1	446
SE - 220 - 240.5 - 8.1 - BR	220	240.5	8.1	447
SE - 230 - 250.5 - 8.1 - BR	230	250.5	8.1	448
SE - 240 - 260.5 - 8.1 - BR	240	260.5	8.1	449

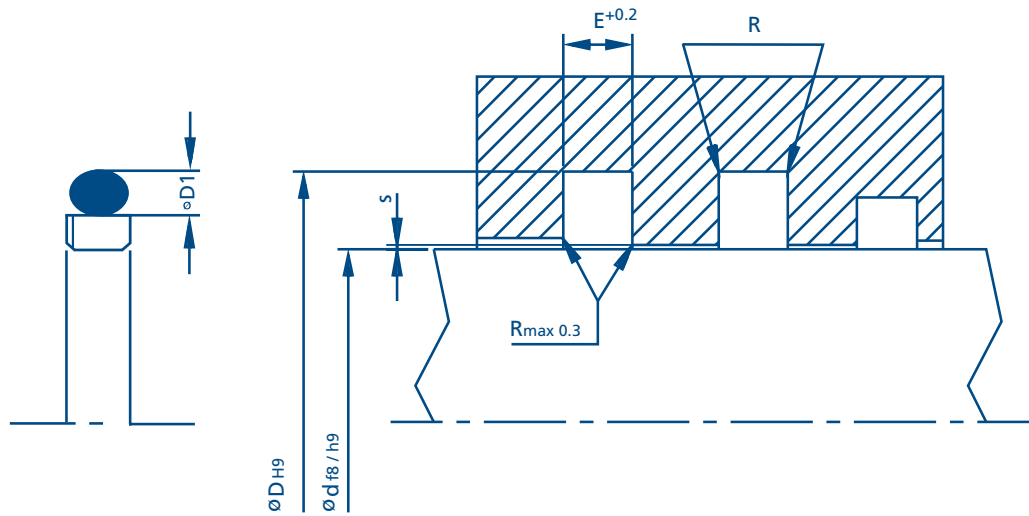
Special dimensions and intermediate size are also available.



Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	OR
SE - 250 - 270.5 - 8.1 - BR	250	270.5	8.1	449
SE - 260 - 284.5 - 8.1 - BR	260	284.5	8.1	450
SE - 270 - 294.0 - 8.1 - BR	270	294.0	8.1	451
SE - 280 - 304.0 - 8.1 - BR	280	304.0	8.1	452
SE - 290 - 314.0 - 8.1 - BR	290	314.0	8.1	453
SE - 300 - 324.0 - 8.1 - BR	300	324.0	8.1	454
SE - 310 - 334.0 - 8.1 - BR	310	334.0	8.1	454
SE - 320 - 344.0 - 8.1 - BR	320	344.0	8.1	455
SE - 330 - 354.0 - 8.1 - BR	330	354.0	8.1	456
SE - 340 - 364.0 - 8.1 - BR	340	364.0	8.1	457
SE - 350 - 374.0 - 8.1 - BR	350	374.0	8.1	458
SE - 360 - 384.0 - 8.1 - BR	360	384.0	8.1	458
SE - 370 - 394.0 - 8.1 - BR	370	394.0	8.1	459
SE - 380 - 404.0 - 8.1 - BR	380	404.0	8.1	460
SE - 390 - 414.0 - 8.1 - BR	390	414.0	8.1	461
SE - 400 - 424.0 - 8.1 - BR	400	424.0	8.1	461
SE - 410 - 434.0 - 8.1 - BR	410	434.0	8.1	462
SE - 420 - 444.0 - 8.1 - BR	420	444.0	8.1	463
SE - 430 - 454.0 - 8.1 - BR	430	454.0	8.1	464
SE - 440 - 464.0 - 8.1 - BR	440	464.0	8.1	464

Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	OR
SE - 450 - 474.0 - 8.1 - BR	450	474.0	8.1	465
SE - 460 - 484.0 - 8.1 - BR	460	484.0	8.1	466
SE - 470 - 494.0 - 8.1 - BR	470	494.0	8.1	467
SE - 480 - 504.0 - 8.1 - BR	480	504.0	8.1	468
SE - 490 - 514.0 - 8.1 - BR	490	514.0	8.1	469
SE - 500 - 524.0 - 8.1 - BR	500	524.0	8.1	469
SE - 510 - 534.0 - 8.1 - BR	510	534.0	8.1	469
SE - 520 - 544.0 - 8.1 - BR	520	544.0	8.1	470
SE - 530 - 554.0 - 8.1 - BR	530	554.0	8.1	470
SE - 540 - 564.0 - 8.1 - BR	540	564.0	8.1	471
SE - 550 - 574.0 - 8.1 - BR	550	574.0	8.1	471
SE - 560 - 584.0 - 8.1 - BR	560	584.0	8.1	471
SE - 570 - 594.0 - 8.1 - BR	570	594.0	8.1	472
SE - 580 - 604.4 - 8.1 - BR	580	604.0	8.1	472
SE - 590 - 614.0 - 8.1 - BR	590	614.0	8.1	473
SE - 600 - 624.0 - 8.1 - BR	600	624.0	8.1	473
SE - 610 - 634.0 - 8.1 - BR	610	634.0	8.1	473
SE - 620 - 644.0 - 8.1 - BR	620	644.0	8.1	474
SE - 630 - 654.0 - 8.1 - BR	630	654.0	8.1	474
SE - 640 - 664.0 - 8.1 - BR	640	664.0	8.1	475

Special dimensions and intermediate size are also available.



**Selection**

**Diameter  $d_{f8/h9}$**

Standard design	Light-duty design	Heavy-duty design	Groove root $\varnothing D_{H9}$	Groove width $E^{+0.2}$	O-Ring Cord thickness $\varnothing D1$
	8 - 18.9		$\varnothing d + 4.9$	2.2	1.78
8 - 18.9	19 - 37.9		$\varnothing d + 7.3$	3.2	2.62
19 - 37.9	38 - 199.9	8 - 18.9	$\varnothing d + 10.7$	4.2	3.53
38 - 199.9	200 - 255.9	19 - 37.9	$\varnothing d + 15.1$	6.3	5.33
200 - 255.9	256 - 649.9	38 - 199.9	$\varnothing d + 20.5$	8.1	6.99
256 - 649.9	650 - 999.9	200 - 255.9	$\varnothing d + 24.0$	8.1	7.00
650 - 999.9		256 - 649.9	$\varnothing d + 27.3$	9.5	8.40

**Gap dimension "s" / radius "R"**

Groove width $E^{+0.2}$	Gap "s" 0 - 20 MPa	Gap "s" 20 - 40 MPa	Radius R
2.2	0.3 - 0.2	0.2 - 0.1	0.4
3.2	0.3 - 0.2	0.2 - 0.1	0.6
4.2	0.4 - 0.3	0.3 - 0.1	1.0
6.3	0.4 - 0.3	0.3 - 0.2	1.3
8.1	0.5 - 0.3	0.3 - 0.2	1.8
8.1	0.5 - 0.3	0.4 - 0.2	1.8
9.5	0.6 - 0.4	0.4 - 0.3	2.5

All rod seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

**Rod seals / Ordering example:**

S D - 4 0 x 5 0 . 7 x 4 . 2 - B R

Rod seal for rod diameter of  $\varnothing 40$  / PTFE-Bronze / Standard design

S D - 4 0 x 5 5 . 1 x 6 . 3 - K

Rod seal for rod diameter of  $\varnothing 40$  / PTFE-Carbon / Heavy-duty design

**Material**

PTFE - Bronze BR  
 PTFE - Carbon K  
 PTFE - Carbon fibre KF  
 PTFE - Glass fibre GF

PU - Polyurethane PU  
 PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



Order designation	∅d f8/h9	∅D H9	E+0.2	OR
SD - 6 - 10.9 - 2.2 - BR	6	10.9	2.2	011
SD - 7 - 11.9 - 2.2 - BR	7	11.9	2.2	012
SD - 8 - 15.3 - 3.2 - BR	8	15.3	3.2	111
SD - 8 - 12.9 - 2.2 - BR	8	12.9	2.2	012
SD - 10 - 17.3 - 3.2 - BR	10	17.3	3.2	113
SD - 10 - 14.9 - 2.2 - BR	10	14.9	2.2	014
SD - 12 - 19.3 - 3.2 - BR	12	19.3	3.2	114
SD - 12 - 16.9 - 2.2 - BR	12	16.9	2.2	015
SD - 14 - 21.3 - 3.2 - BR	14	21.3	3.2	115
SD - 14 - 18.9 - 2.2 - BR	14	18.9	2.2	016
SD - 15 - 22.3 - 3.2 - BR	15	22.3	3.2	116
SD - 15 - 19.9 - 2.2 - BR	15	19.9	2.2	017
SD - 16 - 23.3 - 3.2 - BR	16	23.3	3.2	116
SD - 16 - 20.9 - 2.2 - BR	16	20.9	2.2	017
SD - 18 - 25.3 - 3.2 - BR	18	25.3	3.2	118
SD - 18 - 22.9 - 2.2 - BR	18	22.9	2.2	019
SD - 20 - 30.7 - 4.2 - BR	20	30.7	4.2	214
SD - 20 - 27.3 - 3.2 - BR	20	27.3	3.2	119
SD - 22 - 32.7 - 4.2 - BR	22	32.7	4.2	215
SD - 22 - 29.3 - 3.2 - BR	22	29.3	3.2	120
SD - 25 - 35.7 - 4.2 - BR	25	35.7	4.2	217
SD - 25 - 32.3 - 3.2 - BR	25	32.3	3.2	122
SD - 28 - 38.7 - 4.2 - BR	28	38.7	4.2	219
SD - 28 - 35.3 - 3.2 - BR	28	35.3	3.2	124
SD - 30 - 40.7 - 4.2 - BR	30	40.7	4.2	220
SD - 30 - 37.3 - 3.2 - BR	30	37.3	3.2	125
SD - 32 - 42.7 - 4.2 - BR	32	42.7	4.2	221
SD - 32 - 39.3 - 3.2 - BR	32	39.3	3.2	126
SD - 35 - 45.7 - 4.2 - BR	35	45.7	4.2	222
SD - 35 - 42.3 - 3.2 - BR	35	42.3	3.2	128
SD - 36 - 46.7 - 4.2 - BR	36	46.7	4.2	223
SD - 36 - 43.3 - 3.2 - BR	36	43.3	3.2	129
SD - 38 - 53.1 - 6.3 - BR	38	53.1	6.3	327
SD - 38 - 48.7 - 4.2 - BR	38	48.7	4.2	224
SD - 40 - 50.7 - 4.2 - BR	40	50.7	4.2	224

Order designation	∅d f8/h9	∅D H9	E+0.2	OR
SD - 45 - 60.1 - 6.3 - BR	45	60.1	6.3	329
SD - 45 - 55.7 - 4.2 - BR	45	55.7	4.2	226
SD - 50 - 65.1 - 6.3 - BR	50	65.1	6.3	331
SD - 50 - 60.7 - 4.2 - BR	50	60.7	4.2	227
SD - 56 - 71.1 - 6.3 - BR	56	71.1	6.3	333
SD - 56 - 66.7 - 4.2 - BR	56	66.7	4.2	229
SD - 60 - 75.1 - 6.3 - BR	60	75.1	6.3	334
SD - 60 - 70.7 - 4.2 - BR	60	70.7	4.2	230
SD - 63 - 78.1 - 6.3 - BR	63	78.1	6.3	335
SD - 65 - 80.1 - 6.3 - BR	65	80.1	6.3	336
SD - 70 - 85.1 - 6.3 - BR	70	85.1	6.3	337
SD - 75 - 90.1 - 6.3 - BR	75	90.1	6.3	339
SD - 80 - 95.1 - 6.3 - BR	80	95.1	6.3	340
SD - 85 - 100.1 - 6.3 - BR	85	100.1	6.3	342
SD - 90 - 105.1 - 6.3 - BR	90	105.1	6.3	344
SD - 95 - 110.1 - 6.3 - BR	95	110.1	6.3	345
SD - 100 - 115.1 - 6.3 - BR	100	115.1	6.3	347
SD - 105 - 120.1 - 6.3 - BR	105	120.1	6.3	348
SD - 110 - 125.1 - 6.3 - BR	110	125.1	6.3	350
SD - 115 - 130.1 - 6.3 - BR	115	130.1	6.3	351
SD - 120 - 135.1 - 6.3 - BR	120	135.1	6.3	353
SD - 125 - 140.1 - 6.3 - BR	125	140.1	6.3	355
SD - 130 - 145.1 - 6.3 - BR	130	145.1	6.3	356
SD - 135 - 150.1 - 6.3 - BR	135	150.1	6.3	358
SD - 140 - 155.1 - 6.3 - BR	140	155.1	6.3	359
SD - 150 - 165.1 - 6.3 - BR	150	165.1	6.3	362
SD - 160 - 175.1 - 6.3 - BR	160	175.1	6.3	363
SD - 170 - 185.1 - 6.3 - BR	170	185.1	6.3	365
SD - 180 - 195.1 - 6.3 - BR	180	195.1	6.3	366
SD - 190 - 205.1 - 6.3 - BR	190	205.1	6.3	368
SD - 200 - 220.5 - 8.1 - BR	200	220.5	8.1	445
SD - 210 - 230.5 - 8.1 - BR	210	230.5	8.1	446
SD - 220 - 240.5 - 8.1 - BR	220	240.5	8.1	447
SD - 230 - 250.5 - 8.1 - BR	230	250.5	8.1	448
SD - 240 - 260.5 - 8.1 - BR	240	260.5	8.1	449

Special dimensions and intermediate size are also available.



Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	OR
SD - 250 - 270.5 - 8.1 - BR	250	270.5	8.1	449
SD - 260 - 284.5 - 8.1 - BR	260	284.5	8.1	450
SD - 270 - 294.0 - 8.1 - BR	270	294.0	8.1	451
SD - 280 - 304.0 - 8.1 - BR	280	304.0	8.1	452
SD - 290 - 314.0 - 8.1 - BR	290	314.0	8.1	453
SD - 300 - 324.0 - 8.1 - BR	300	324.0	8.1	454
SD - 310 - 334.0 - 8.1 - BR	310	334.0	8.1	454
SD - 320 - 344.0 - 8.1 - BR	320	344.0	8.1	455
SD - 330 - 354.0 - 8.1 - BR	330	354.0	8.1	456
SD - 340 - 364.0 - 8.1 - BR	340	364.0	8.1	457
SD - 350 - 374.0 - 8.1 - BR	350	374.0	8.1	458
SD - 360 - 384.0 - 8.1 - BR	360	384.0	8.1	458
SD - 370 - 394.0 - 8.1 - BR	370	394.0	8.1	459
SD - 380 - 404.0 - 8.1 - BR	380	404.0	8.1	460
SD - 390 - 414.0 - 8.1 - BR	390	414.0	8.1	461
SD - 400 - 424.0 - 8.1 - BR	400	424.0	8.1	461
SD - 410 - 434.0 - 8.1 - BR	410	434.0	8.1	462
SD - 420 - 444.0 - 8.1 - BR	420	444.0	8.1	463
SD - 430 - 454.0 - 8.1 - BR	430	454.0	8.1	464
SD - 440 - 464.0 - 8.1 - BR	440	464.0	8.1	464

Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	OR
SD - 450 - 474.0 - 8.1 - BR	450	474.0	8.1	465
SD - 460 - 484.0 - 8.1 - BR	460	484.0	8.1	466
SD - 470 - 494.0 - 8.1 - BR	470	494.0	8.1	467
SD - 480 - 504.0 - 8.1 - BR	480	504.0	8.1	468
SD - 490 - 514.0 - 8.1 - BR	490	514.0	8.1	469
SD - 500 - 524.0 - 8.1 - BR	500	524.0	8.1	469
SD - 510 - 534.0 - 8.1 - BR	510	534.0	8.1	469
SD - 520 - 544.0 - 8.1 - BR	520	544.0	8.1	470
SD - 530 - 554.0 - 8.1 - BR	530	554.0	8.1	470
SD - 540 - 564.0 - 8.1 - BR	540	564.0	8.1	471
SD - 550 - 574.0 - 8.1 - BR	550	574.0	8.1	471
SD - 560 - 584.0 - 8.1 - BR	560	584.0	8.1	471
SD - 570 - 594.0 - 8.1 - BR	570	594.0	8.1	472
SD - 580 - 604.4 - 8.1 - BR	580	604.0	8.1	472
SD - 590 - 614.0 - 8.1 - BR	590	614.0	8.1	473
SD - 600 - 624.0 - 8.1 - BR	600	624.0	8.1	473
SD - 610 - 634.0 - 8.1 - BR	610	634.0	8.1	473
SD - 620 - 644.0 - 8.1 - BR	620	644.0	8.1	474
SD - 630 - 654.0 - 8.1 - BR	630	654.0	8.1	474
SD - 640 - 664.0 - 8.1 - BR	640	664.0	8.1	475

Special dimensions and intermediate size are also available.







## Wipers of PTFE

Wipers of the series **AS**, **AD** and **ADD** serve to protect the downstream sealing system. They prevent contaminants and foreign particles, which adhere to the piston rod, from coming into contact with the sealing system as the rod is retracted.

The wipers are essentially installed together with an O-ring as the preload element. The elasticity of the O-ring ensures effective contact of the wiper lips with the mating surface while compensating for any deflection in the piston rod. The **type AS** constitutes the classic design. The wiping function is ensured by its profiled contour and the unilaterally extending wiper lip.

The **types AD** and **ADD** are double wipers that serve to remove contamination from the retracting piston rod while also retaining any residual fluid film on the medium side so as to prevent entrainment by the extending piston rod. This variant is used in conjunction with PTFE rod seals with hydrodynamic flow-back. The profile shape of the **type ADD** is designed for heavy-duty applications in, for example, construction machinery, presses etc.

The broad spectrum of material combinations available for the wiping element and selection of the appropriate material for the preload element ensure almost unlimited suitability in a wide range of different applications.

### Advantages

- Outstanding sliding properties
- No stick-slip effect, even at low velocities
- High wear resistance, long service life
- Very good thermal and chemical resistance
- Effective compensation of rod deflection
- Very good wiping efficiency

### Application ranges

Speed: up to 15 m/s (for PTFE materials)  
up to 2 m/s (for PU materials)

Temperature: -60°C to +200°C  
depending on material combination  
and O-ring material

Groove root:	$R_a \leq 1.6 \mu\text{m}$	$R_t \leq 10 \mu\text{m}$
Groove flanks:	$R_a \leq 3.0 \mu\text{m}$	$R_t \leq 16 \mu\text{m}$
Contact area:	$R_a \leq 0.4 \mu\text{m}$	$R_t \leq 4.2 \mu\text{m}$

### Installation

Wipers of the series **AS**, **AD** or **ADD** can be installed in continuous grooves, with selection depending on the rod diameter, the profile cross section of the wiper and the cord thickness of the O-ring.

The piston rod should exhibit an insertion bevel. It must always be ensured that sharp edges are removed by rounding or bevelling. Thread tips should be covered. Before fitting, ensure that all machining residues such as swarf, chips, dirt and other foreign particles have been removed.

To facilitate fitting, the wipers can be lightly greased or oiled, provided that the lubricant used is compatible with the materials involved and the hydraulic fluid.

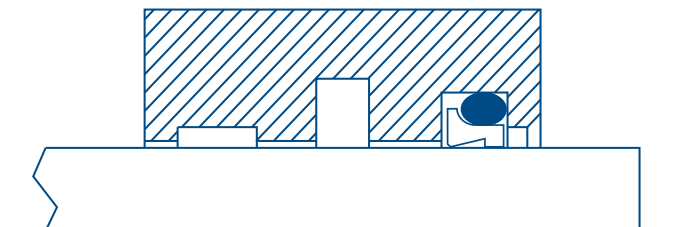
Wipers should be covered prior to any painting operation.

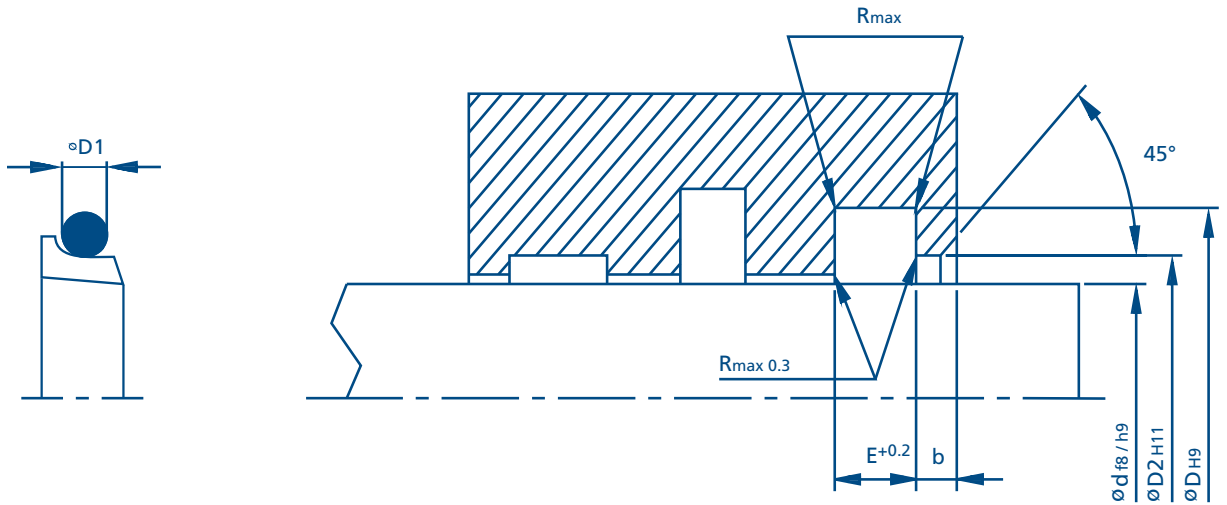
The surface quality of the mating faces involved is of decisive importance for the functional reliability and service life of the wiper.

It is important to ensure that there are no ridges, scratches or recesses, nor any concentric or spiral machining marks on the surface.

The parameters usually applied for surface description such as  $R_a$ ,  $R_z$ ,  $R_t$  and  $R_{\text{max}}$  are defined in DIN 4762 and DIN 4768.

In order to properly assess surface quality for sealing applications, the material ratio (bearing curve tp) should also be taken into account. This profile shape parameter is influenced by the machining process applied. The material ratio ( $M_r$ ) should lie between 50 and 70% as determined at a slice depth of approx.  $0.25 \times R_z$  based on a reference percentage of approx. 5%.





### Recommended housing dimensions

Standard design	Groove roots $\varnothing D_{H9}$	Groove width $E^{+0.2}$	Radius $R_{max}$	Land width $b$ (min.)	O-Ring Cord thickness $\varnothing D1$
8 - 11.9	$\varnothing d + 4.8$	3.7	0.2	2.0	1.78
12 - 64.9	$\varnothing d + 6.8$	5.0	0.4	2.0	2.62
65 - 250.9	$\varnothing d + 8.8$	6.0	0.8	3.0	3.53
251 - 420.9	$\varnothing d + 12.2$	8.4	1.0	4.0	5.33
421 - 650.9	$\varnothing d + 16.0$	11.0	1.0	5.0	7.00

### Wiper / Ordering example:

A S - 80 x 88.8 x 6.0 - B R

Wiper for rod diameter of  $\varnothing 80$  / PTFE-Bronze / Standard design

A S - 50 x 56.8 x 5.0 - P G

Wiper for rod diameter of  $\varnothing 50$  / Polyurethan+graphite

All wipers are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

### Material

PTFE - Bronze BR  
 PTFE - Carbon K  
 PTFE - Carbon fibre KF  
 PTFE - Glass fibre GF

PU - Polyurethane PU  
 PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



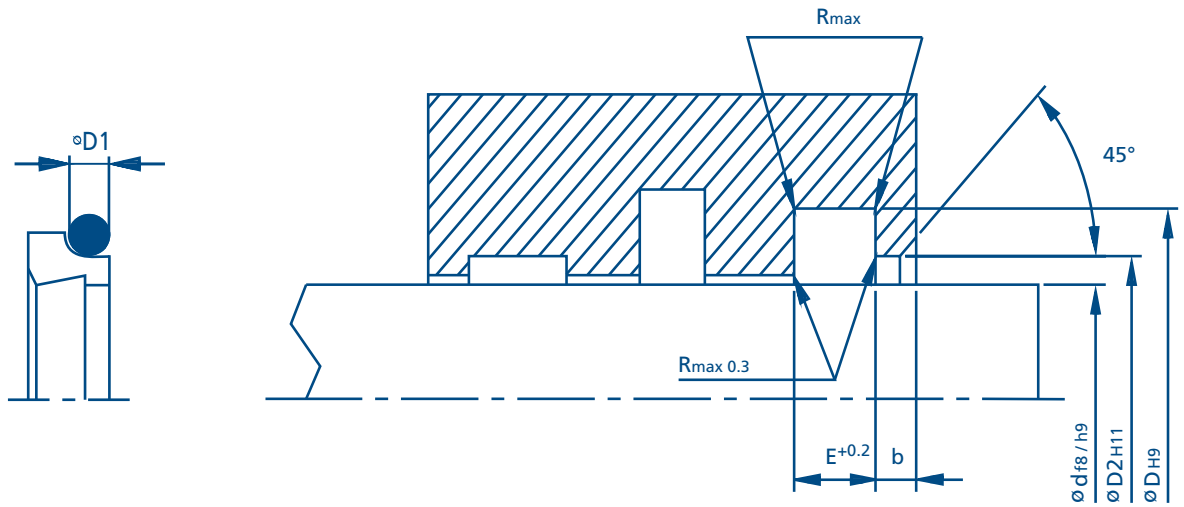
Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	$\varnothing D_{2H11}$	OR
AS - 10 - 14.8 - 3.7 - BR	10	14.8	3.7	12.7	013
AS - 20 - 26.8 - 5.0 - BR	20	26.8	5.0	23.5	118
AS - 22 - 28.8 - 5.0 - BR	22	28.8	5.0	25.5	119
AS - 25 - 31.8 - 5.0 - BR	25	31.8	5.0	28.5	121
AS - 28 - 34.8 - 5.0 - BR	28	34.8	5.0	31.5	123
AS - 30 - 36.8 - 5.0 - BR	30	36.8	5.0	33.5	124
AS - 32 - 38.8 - 5.0 - BR	32	38.8	5.0	35.5	126
AS - 35 - 41.8 - 5.0 - BR	35	41.8	5.0	38.5	127
AS - 36 - 42.8 - 5.0 - BR	36	42.8	5.0	39.5	129
AS - 38 - 44.8 - 5.0 - BR	38	44.8	5.0	41.5	130
AS - 40 - 46.8 - 5.0 - BR	40	46.8	5.0	43.5	131
AS - 42 - 48.8 - 5.0 - BR	42	48.8	5.0	45.5	132
AS - 45 - 51.8 - 5.0 - BR	45	51.8	5.0	48.5	134
AS - 48 - 54.8 - 5.0 - BR	48	54.8	5.0	51.5	136
AS - 50 - 56.8 - 5.0 - BR	50	56.8	5.0	53.5	137
AS - 52 - 58.8 - 5.0 - BR	52	58.8	5.0	55.5	138
AS - 55 - 61.8 - 5.0 - BR	55	61.8	5.0	58.5	140
AS - 56 - 62.8 - 5.0 - BR	56	62.8	5.0	59.5	141
AS - 60 - 66.8 - 5.0 - BR	60	66.8	5.0	63.5	143
AS - 63 - 69.8 - 5.0 - BR	63	69.8	5.0	66.5	145
AS - 65 - 73.8 - 6.0 - BR	65	73.8	6.0	69.0	231
AS - 70 - 78.8 - 6.0 - BR	70	78.8	6.0	74.0	233
AS - 75 - 83.8 - 6.0 - BR	75	83.8	6.0	79.0	234
AS - 80 - 88.8 - 6.0 - BR	80	88.8	6.0	84.0	236
AS - 85 - 93.8 - 6.0 - BR	85	93.8	6.0	89.0	238
AS - 90 - 98.8 - 6.0 - BR	90	98.8	6.0	94.0	239
AS - 95 - 103.8 - 6.0 - BR	95	103.8	6.0	99.0	241
AS - 100 - 108.8 - 6.0 - BR	100	108.8	6.0	104.0	242
AS - 105 - 113.8 - 6.0 - BR	105	113.8	6.0	109.0	244
AS - 110 - 118.8 - 6.0 - BR	110	118.8	6.0	114.0	245

Special dimensions and intermediate size are also available.



Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	$E_{+0.2}$	$\varnothing D_2_{H11}$	OR
AS - 115 - 123.8 - 6.0 - BR	115	123.8	6.0	119.0	247
AS - 120 - 128.8 - 6.0 - BR	120	128.8	6.0	124.0	248
AS - 125 - 133.8 - 6.0 - BR	125	133.8	6.0	129.0	250
AS - 130 - 138.8 - 6.0 - BR	130	138.8	6.0	134.0	252
AS - 135 - 143.8 - 6.0 - BR	135	143.8	6.0	139.0	253
AS - 140 - 148.8 - 6.0 - BR	140	148.8	6.0	144.0	255
AS - 150 - 158.8 - 6.0 - BR	150	158.8	6.0	154.0	258
AS - 155 - 163.8 - 6.0 - BR	155	163.8	6.0	159.0	259
AS - 160 - 168.8 - 6.0 - BR	160	168.8	6.0	164.0	259
AS - 170 - 178.8 - 6.0 - BR	170	178.8	6.0	174.0	261
AS - 175 - 183.8 - 6.0 - BR	175	183.8	6.0	179.0	262
AS - 180 - 188.8 - 6.0 - BR	180	188.8	6.0	184.0	263
AS - 190 - 198.8 - 6.0 - BR	190	198.8	6.0	194.0	264
AS - 200 - 208.8 - 6.0 - BR	200	208.8	6.0	204.0	266
AS - 210 - 218.8 - 6.0 - BR	210	218.8	6.0	214.0	267
AS - 220 - 228.8 - 6.0 - BR	220	228.8	6.0	224.0	269
AS - 230 - 238.8 - 6.0 - BR	230	238.8	6.0	234.0	271
AS - 240 - 248.8 - 6.0 - BR	240	248.8	6.0	244.0	272
AS - 250 - 258.8 - 6.0 - BR	250	258.8	6.0	254.0	274
AS - 260 - 272.2 - 8.4 - BR	260	272.2	8.4	264.5	377
AS - 270 - 282.2 - 8.4 - BR	270	282.2	8.4	274.5	378
AS - 280 - 292.2 - 8.4 - BR	280	292.2	8.4	284.5	379
AS - 290 - 302.2 - 8.4 - BR	290	302.2	8.4	294.5	380
AS - 300 - 312.2 - 8.4 - BR	300	312.2	8.4	304.5	381
AS - 310 - 322.2 - 8.4 - BR	310	322.2	8.4	314.5	381
AS - 320 - 332.2 - 8.4 - BR	320	332.2	8.4	324.5	382
AS - 330 - 342.2 - 8.4 - BR	330	342.2	8.4	334.5	382
AS - 340 - 352.2 - 8.4 - BR	340	352.2	8.4	344.5	382
AS - 350 - 362.2 - 8.4 - BR	350	362.2	8.4	354.5	383

Special dimensions and intermediate size are also available.



**Recommended housing dimensions**

Standard design	Groove roots $\varnothing D$ H9	Groove width $E+0.2$	Radius $R_{max}$	Land width $b$ (min.)	O-Ring Cord thickness $\varnothing D1$
8 - 11.9	$\varnothing d + 4.8$	3.7	0.2	2.0	1.78
12 - 64.9	$\varnothing d + 6.8$	5.0	0.4	2.0	2.62
65 - 250.9	$\varnothing d + 8.8$	6.0	0.8	3.0	3.53
251 - 420.9	$\varnothing d + 12.2$	8.4	1.0	4.0	5.33
421 - 650.9	$\varnothing d + 16.0$	11.0	1.0	5.0	7.00

**Double acting wiper / Ordering example:**

A D - 80 x 88.8 x 6.0 - B R

Double acting wiper for rod diameter of  $\varnothing 80$  / PTFE-Bronze / Standard design

A D - 50 x 56.8 x 5.0 - P G

Double acting wiper for rod diameter of  $\varnothing 50$  / Polyurethan+graphite

All wipers are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

**Material**

PTFE - Bronze BR  
 PTFE - Carbon K  
 PTFE - Carbon fibre KF  
 PTFE - Glass fibre GF

PU - Polyurethane PU  
 PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)



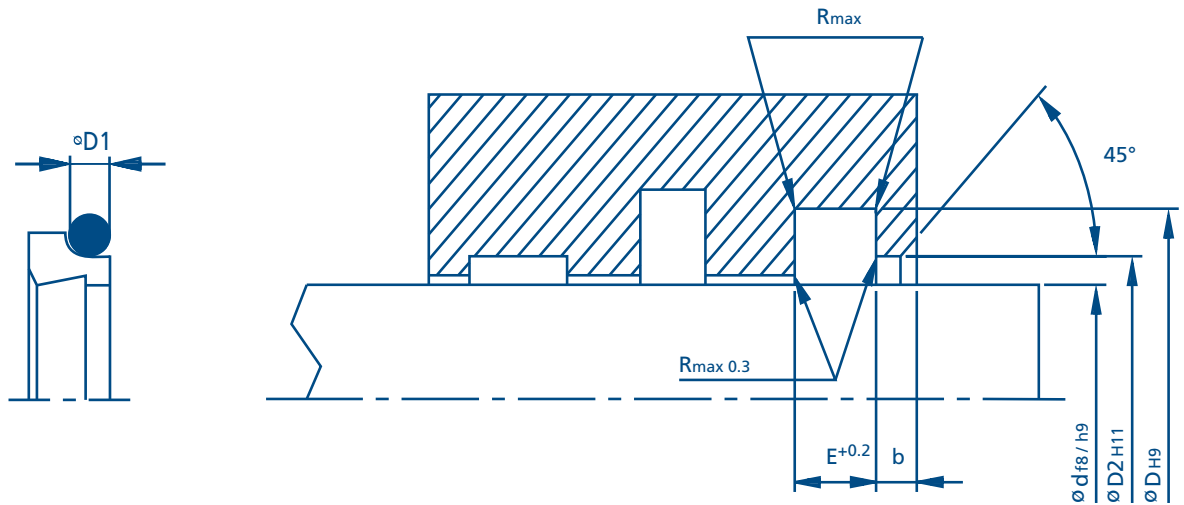
Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	$E_{+0.2}$	$\varnothing D_2_{H11}$	OR
AD - 10 - 14.8 - 3.7 - BR	10	14.8	3.7	11.5	013
AD - 20 - 26.8 - 5.0 - BR	20	26.8	5.0	21.5	118
AD - 22 - 28.8 - 5.0 - BR	22	28.8	5.0	23.5	119
AD - 25 - 31.8 - 5.0 - BR	25	31.8	5.0	26.5	121
AD - 28 - 34.8 - 5.0 - BR	28	34.8	5.0	29.5	123
AD - 30 - 36.8 - 5.0 - BR	30	36.8	5.0	31.5	124
AD - 32 - 38.8 - 5.0 - BR	32	38.8	5.0	33.5	126
AD - 35 - 41.8 - 5.0 - BR	35	41.8	5.0	36.5	127
AD - 36 - 42.8 - 5.0 - BR	36	42.8	5.0	37.5	129
AD - 38 - 44.8 - 5.0 - BR	38	44.8	5.0	39.5	130
AD - 40 - 46.8 - 5.0 - BR	40	46.8	5.0	41.5	131
AD - 42 - 48.8 - 5.0 - BR	42	48.8	5.0	43.5	132
AD - 45 - 51.8 - 5.0 - BR	45	51.8	5.0	46.5	134
AD - 48 - 54.8 - 5.0 - BR	48	54.8	5.0	49.5	136
AD - 50 - 56.8 - 5.0 - BR	50	56.8	5.0	51.5	137
AD - 52 - 58.8 - 5.0 - BR	52	58.8	5.0	53.5	138
AD - 55 - 61.8 - 5.0 - BR	55	61.8	5.0	56.5	140
AD - 56 - 62.8 - 5.0 - BR	56	62.8	5.0	57.5	142
AD - 60 - 66.8 - 5.0 - BR	60	66.8	5.0	61.5	143
AD - 63 - 69.8 - 5.0 - BR	63	69.8	5.0	64.5	145
AD - 65 - 73.8 - 6.0 - BR	65	73.8	6.0	66.5	231
AD - 70 - 78.8 - 6.0 - BR	70	78.8	6.0	71.5	233
AD - 75 - 83.8 - 6.0 - BR	75	83.8	6.0	76.5	235
AD - 80 - 88.8 - 6.0 - BR	80	88.8	6.0	81.5	235
AD - 85 - 93.8 - 6.0 - BR	85	93.8	6.0	86.5	238
AD - 90 - 98.8 - 6.0 - BR	90	98.8	6.0	91.5	239
AD - 95 - 103.8 - 6.0 - BR	95	103.8	6.0	96.5	241
AD - 100 - 108.8 - 6.0 - BR	100	108.8	6.0	101.5	243
AD - 105 - 113.8 - 6.0 - BR	105	113.8	6.0	106.5	243
AD - 110 - 118.8 - 6.0 - BR	110	118.8	6.0	111.5	246

Special dimensions and intermediate size are also available.



Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	$E_{+0.2}$	$\varnothing D_{2 H11}$	OR
AD - 115 - 123.8 - 6.0 - BR	115	123.8	6.0	116.5	247
AD - 120 - 128.8 - 6.0 - BR	120	128.8	6.0	121.5	249
AD - 125 - 133.8 - 6.0 - BR	125	133.8	6.0	126.5	251
AD - 130 - 138.8 - 6.0 - BR	130	138.8	6.0	131.5	252
AD - 135 - 143.8 - 6.0 - BR	135	143.8	6.0	136.5	253
AD - 140 - 148.8 - 6.0 - BR	140	148.8	6.0	141.5	255
AD - 150 - 158.8 - 6.0 - BR	150	158.8	6.0	151.5	258
AD - 155 - 163.8 - 6.0 - BR	155	163.8	6.0	156.5	259
AD - 160 - 168.8 - 6.0 - BR	160	168.8	6.0	161.5	260
AD - 170 - 178.8 - 6.0 - BR	170	178.8	6.0	171.5	261
AD - 175 - 183.8 - 6.0 - BR	175	183.8	6.0	176.5	262
AD - 180 - 188.8 - 6.0 - BR	180	188.8	6.0	181.5	263
AD - 190 - 198.8 - 6.0 - BR	190	198.8	6.0	191.5	264
AD - 200 - 208.8 - 6.0 - BR	200	208.8	6.0	201.5	266
AD - 210 - 218.8 - 6.0 - BR	210	218.8	6.0	211.5	267
AD - 220 - 228.8 - 6.0 - BR	220	228.8	6.0	221.5	269
AD - 230 - 238.8 - 6.0 - BR	230	238.8	6.0	231.5	271
AD - 240 - 248.8 - 6.0 - BR	240	248.8	6.0	241.5	272
AD - 250 - 258.8 - 6.0 - BR	250	258.8	6.0	251.5	274
AD - 260 - 272.2 - 8.4 - BR	260	272.2	8.4	262.0	378
AD - 270 - 282.2 - 8.4 - BR	270	282.2	8.4	272.0	378
AD - 280 - 292.2 - 8.4 - BR	280	292.2	8.4	282.0	379
AD - 290 - 302.2 - 8.4 - BR	290	302.2	8.4	292.0	380
AD - 300 - 312.2 - 8.4 - BR	300	312.2	8.4	302.0	381
AD - 310 - 322.2 - 8.4 - BR	310	322.2	8.4	312.0	381
AD - 320 - 332.2 - 8.4 - BR	320	332.2	8.4	322.0	382
AD - 330 - 342.2 - 8.4 - BR	330	342.2	8.4	332.0	382
AD - 340 - 352.2 - 8.4 - BR	340	352.2	8.4	342.0	382
AD - 350 - 362.2 - 8.4 - BR	350	362.2	8.4	352.0	383

Special dimensions and intermediate size are also available.



**Recommended housing dimensions**

Standard design	Groove roots $\varnothing D_{H9}$	Groove width $E^{+0.2}$	Radius $R_{max}$	Land width $b$ (min.)	O-Ring Cord thickness $\varnothing D1$
19 - 39.9	$\varnothing d + 7.6$	4.2	0.5	3.0	2.62
40 - 69.9	$\varnothing d + 8.8$	6.3	0.8	3.0	2.62
70 - 139.9	$\varnothing d + 12.2$	8.1	1.5	4.0	3.53
140 - 399.9	$\varnothing d + 16.0$	9.5	1.5	5.0	5.33
400 - 649.9	$\varnothing d + 24.0$	14.0	1.5	8.0	7.00
650 - 999.9	$\varnothing d + 27.3$	16.0	2.0	10.0	8.40

**Double acting wiper / Ordering example:**

A D D - 8 0 x 9 2 . 2 x 8 . 1 - B R

*Double acting wiper for rod diameter of  $\varnothing 80$  / PTFE-Bronze / Standard design*

A D D - 5 0 x 5 8 . 8 x 6 . 3 - P U

*Double acting wiper for rod diameter of  $\varnothing 50$  / Polyurethane*

*All wipers are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!*

**Material**

- PTFE - Bronze BR
- PTFE - Carbon K
- PTFE - Carbon fibre KF
- PTFE - Glass fibre GF

- PU - Polyurethane PU
- PUG - Polyurethane+graphite PG

(Special material; note modified material properties and technical specifications)





Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	$\varnothing D_2_{H11}$	OR
ADD- 20 - 27.6 - 4.2 - BR	20	27.6	4.2	21.5	118
ADD- 22 - 29.6 - 4.2 - BR	22	29.6	4.2	23.5	120
ADD- 25 - 32.6 - 4.2 - BR	25	32.6	4.2	26.5	122
ADD- 28 - 35.6 - 4.2 - BR	28	35.6	4.2	29.5	123
ADD- 30 - 37.6 - 4.2 - BR	30	37.6	4.2	31.5	125
ADD- 32 - 39.6 - 4.2 - BR	32	39.6	4.2	33.5	126
ADD- 35 - 42.6 - 4.2 - BR	35	42.6	4.2	36.5	128
ADD- 36 - 43.6 - 4.2 - BR	36	43.6	4.2	37.5	129
ADD- 38 - 45.6 - 4.2 - BR	38	45.6	4.2	39.5	130
ADD- 40 - 48.8 - 6.3 - BR	40	48.8	6.3	41.5	132
ADD- 42 - 50.8 - 6.3 - BR	42	50.8	6.3	43.5	133
ADD- 45 - 53.8 - 6.3 - BR	45	53.8	6.3	46.5	135
ADD- 48 - 56.8 - 6.3 - BR	48	56.8	6.3	49.5	137
ADD- 50 - 58.8 - 6.3 - BR	50	58.8	6.3	51.5	138
ADD- 52 - 60.8 - 6.3 - BR	52	60.8	6.3	53.5	139
ADD- 54 - 62.8 - 6.3 - BR	54	62.8	6.3	55.5	141
ADD- 55 - 63.8 - 6.3 - BR	55	63.8	6.3	56.5	141
ADD- 56 - 64.8 - 6.3 - BR	56	64.8	6.3	57.5	142
ADD- 57 - 65.8 - 6.3 - BR	58	65.8	6.3	58.5	142
ADD- 60 - 68.8 - 6.3 - BR	60	68.8	6.3	61.5	144
ADD- 63 - 71.8 - 6.3 - BR	63	71.8	6.3	64.5	146
ADD- 65 - 73.8 - 6.3 - BR	65	73.8	6.3	66.5	147
ADD- 70 - 82.2 - 8.1 - BR	70	82.2	8.1	72.0	234
ADD- 75 - 87.2 - 8.1 - BR	75	87.2	8.1	77.0	235
ADD- 80 - 92.2 - 8.1 - BR	80	92.2	8.1	82.0	237
ADD- 85 - 97.2 - 8.1 - BR	85	97.2	8.1	87.0	239
ADD- 90 - 102.2 - 8.1 - BR	90	102.2	8.1	92.0	240
ADD- 95 - 107.2 - 8.1 - BR	95	107.2	8.1	97.0	242
ADD- 100 - 112.2 - 8.1 - BR	100	112.2	8.1	102.0	243
ADD- 105 - 117.2 - 8.1 - BR	105	117.2	8.1	107.0	245
ADD- 110 - 122.2 - 8.1 - BR	110	122.2	8.1	112.0	246
ADD- 115 - 127.2 - 8.1 - BR	115	127.2	8.1	117.0	248

Special dimensions and intermediate size are also available.



Order designation	$\varnothing d_{f8/h9}$	$\varnothing D_{H9}$	E+0.2	$\varnothing D_2_{H11}$	OR
ADD- 120 -132.2- 8.1 - BR	120	132.2	8.1	122.0	249
ADD- 125 -137.2- 8.1 - BR	125	137.2	8.1	127.0	251
ADD- 130 -142.2- 8.1 - BR	130	142.2	8.1	132.0	253
ADD- 135 -147.2- 8.1 - BR	135	147.2	8.1	137.0	254
ADD- 140 -156.0- 9.5 - BR	140	156.0	9.5	142.5	359
ADD- 150 -166.0- 9.5 - BR	150	166.0	9.5	152.5	361
ADD- 160 -176.0- 9.5 - BR	160	176.0	9.5	162.5	363
ADD- 170 -186.0- 9.5 - BR	170	186.0	9.5	172.5	365
ADD- 180 -196.0- 9.5 - BR	180	196.0	9.5	182.5	366
ADD- 190 -206.0- 9.5 - BR	190	206.0	9.5	192.5	368
ADD- 200 -216.0- 9.5 - BR	200	216.0	9.5	202.5	369
ADD- 205 -221.0- 9.5 - BR	205	221.0	9.5	207.5	370
ADD- 210 -226.0- 9.5 - BR	210	226.0	9.5	212.5	371
ADD- 220 -236.0- 9.5 - BR	220	236.0	9.5	222.5	373
ADD- 230 -246.0- 9.5 - BR	230	246.0	9.5	232.5	374
ADD- 235 -251.0- 9.5 - BR	235	251.0	9.5	237.5	375
ADD- 240 -256.0- 9.5 - BR	240	256.0	9.5	242.5	376
ADD- 250 -266.0- 9.5 - BR	250	266.0	9.5	252.5	377
ADD- 260 -276.0- 9.5 - BR	260	276.0	9.5	262.5	378
ADD- 270 -286.0- 9.5 - BR	270	286.0	9.5	272.5	379
ADD- 280 -296.0- 9.5 - BR	280	296.0	9.5	282.5	379
ADD- 290 -296.0- 9.5 - BR	290	306.0	9.5	292.5	380
ADD- 300 -316.0- 9.5 - BR	300	316.0	9.5	302.5	381
ADD- 310 -326.0- 9.5 - BR	310	326.0	9.5	312.5	381
ADD- 320 -336.0- 9.5 - BR	320	336.0	9.5	322.5	382
ADD- 350 -366.0- 9.5 - BR	350	366.0	9.5	352.5	383
ADD- 360 -376.0- 9.5 - BR	360	376.0	9.5	362.5	383
ADD- 370 -386.0- 9.5 - BR	370	386.0	9.5	372.5	384
ADD- 400 -424.0- 14 - BR	400	424.0	14.0	402.5	461
ADD- 440 -464.0- 14 - BR	440	464.0	14.0	442.5	464
ADD- 500 -524.0- 14 - BR	500	524.0	14.0	502.5	469
ADD- 550 -574.0- 14 - BR	550	574.0	14.0	552.5	471

Special dimensions and intermediate size are also available.

## Rotary seals

Rotary seals *inside*

Rotary seals *outside*







## Rotary seal of PTFE

The rotary seals **type RI** as the internal sealing version and **type RA** as the external sealing version are used to seal shafts, axles, rods, pins and rotary glands in rotational and swivel motion applications. They have a proven track record as low-friction components and have been successfully employed over many years. The geometry of the seal enables it to be used for double action duty with both alternating pressurisation and simultaneous differential pressurisation.

The contact surface profile has been designed to ensure reliable use at high pressures and low sliding velocities. Depending on the design and cross section, the contact surface may feature one or two circumferential grooves to enable better transmission of the contact pressure onto the sealed mating surface. Lubricant is stored in the grooves for additionally reducing friction. On the static side, the face for receiving the O-ring serving as the preload element is concave in shape. This increases the contact area while reducing the danger of seal co-rotation. Notches are incorporated in the side faces of the rotary seals to improve the response behaviour with the preload element.

A wide range of different material combinations for the sealing element and appropriate selection of the right material for the preload element ensure effective variability of the system for virtually unlimited use in different applications.

### Benefits

- Outstanding friction behaviour
- No stick-slip effect, even at low velocities
- High wear resistance, long service life
- Very good thermal and chemical resistance
- Individual size ranges possible
- Simple groove design
- Lubricant reservoir

### Application ranges

Velocity:	up to 1-2 m/s depending on material combination
Temperature:	-6°C to +200°C depending on material combination and O-ring material
Pressure:	up to 30 MPa (300 bar)  static loads up to 60 MPa (600 bar) depending on material combination

### Installation

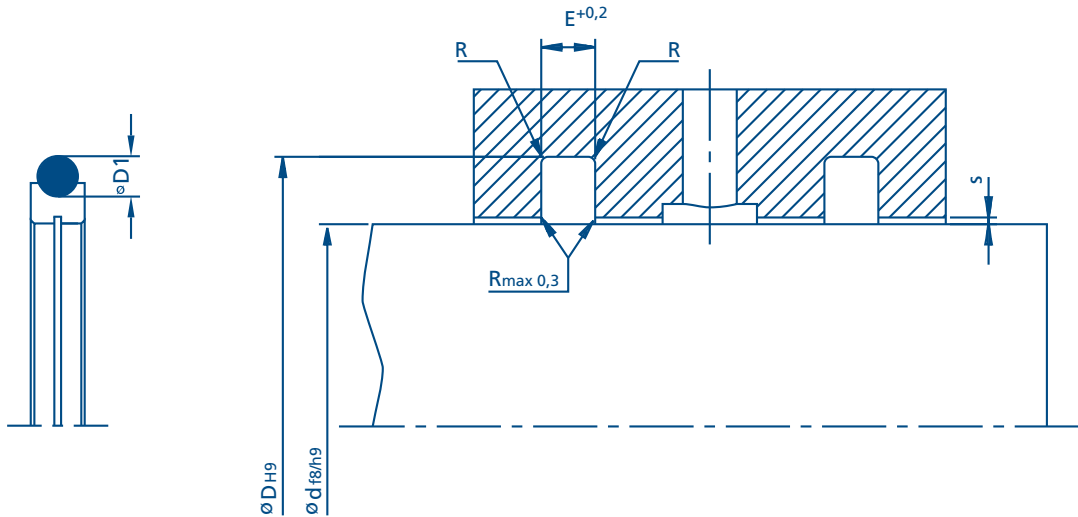
The **type RI** (internal) and **type RA** (external) rotary seals can be fitted without problem in continuous grooves. To facilitate mounting, it may be advisable to warm the seal in oil at a temperature of approx. 80°C prior to fitting. After fitting the preload and sealing elements, PTFE rotary seals have to be sized. In the case of the externally sealing **type RA**, this can be done by using the insertion bevel on the cylinder barrel which should have an angle of between 15° and 20° and a length of between 2 mm and 8 mm depending on the as-designed sealing height. The internally sealing **type RI** has to be deformed into a kidney shape – ensuring that there is no kinking – prior to fitting and then inserted in this form. Once inserted, the seal can be reformed back into its ring shape in the groove. Once the preload and sealing elements have been fitted, the PTFE rotary seal must be sized with a mandrel featuring a bevel of approx. 10°-15° and a length of approx. 30 mm. The piston rod can likewise be used for this sizing operation provided that it has a sufficient insertion bevel. Likewise, a separate sizing sleeve or a sizing pin can be used. It must always be ensured that sharp edges are removed by rounding or bevelling. Thread tips should be covered. Before fitting, ensure that all machining residues such as swarf, chips, dirt and other foreign particles have been removed.

The surface quality of the mating faces being sealed is of decisive importance for the functional reliability and service life of the seal. Where rotary sealing applications are concerned, we recommend that the mating surface exhibit a hardness of approx. 55 HRC with a depth of hardness of at least 0.3 mm. In the case of coated/plated surfaces, it must be ensured that no ablation has taken place. Adequate heat conduction/dissipation must also be ensured by the coating. Unhardened mating surfaces should have a Brinell hardness of at least 1800 N/mm<sup>2</sup>.

It is important to ensure that there are no ridges, scratches or recesses, nor any concentric or spiral machining marks on the surface. The parameters usually applied for surface description such as Ra, Rz, Rt and Rmax are defined in DIN 4762 and DIN 4768.

In order to properly assess surface quality for sealing applications, the material ratio (bearing curve tp) should also be taken into account. This profile shape parameter is influenced by the machining process applied. The material ratio (Mr) should lie between 50 and 70% as determined at a slice depth of approx. 0.25 x Rz based on a reference percentage of approx. 5%.

Groove root:	$R_a \leq 0.8 - 1.6 \mu\text{m}$	$R_t \leq 6.3 - 10 \mu\text{m}$
Groove flanks:	$R_a \leq 1.6 \mu\text{m}$	$R_t \leq 10 - 16 \mu\text{m}$
Contact area:	$R_a \leq 0.05 - 0.2 \mu\text{m}$	$R_t \leq 0.5 - 2 \mu\text{m}$



### Selection

Diameter shaft  $\varnothing d_{f8/h9}$

Diameter shaft $\varnothing d_{f8/h9}$	Groove root $\varnothing D_{H9}$	Groove width $E_{+0.2}$	O-Ring Cord thickness $\varnothing D1$	number of grooves
5 - 18.9	$\varnothing d + 4.9$	2.2	1.78	0
19 - 37.9	$\varnothing d + 7.5$	3.2	2.62	1
38 - 199.9	$\varnothing d + 11.0$	4.2	3.53	1
200 - 255.9	$\varnothing d + 15.5$	6.3	5.33	2
256 - 649.9	$\varnothing d + 21.0$	8.1	7.00	2
650 - 999.9	$\varnothing d + 28.0$	9.5	8.50	2

### Gap dimension "s" / radius "R"

Groove width $E_{+0.2}$	Gap "s" 10 MPa	Gap "s" 20 MPa	Radius R
2.2	0.15	0.10	0.3 - 0.5
3.2	0.20	0.20	0.5 - 0.7
4.2	0.25	0.20	0.8 - 1.0
6.3	0.30	0.25	1.2 - 1.5
8.1	0.30	0.25	1.5 - 2.0
9.5	0.40	0.30	2.0 - 2.8

All rotary seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

### Material

PTFE - Bronze	BR
PTFE - Carbon	K
PTFE - Carbon fibre	KF
PU - Polyurethane	PU
PUG - Polyurethane+graphite	PG
Special material	SO

### Rotary seals / Ordering example:

RI - 80 x 95.1 x 6.3 - C

Rotary seal internal for shaft diameter of  $\varnothing 80$  / PTFE-Carbon / Standard design

RI - 80 x 91.0 x 4.2 - G F

Rotary seal internal for shaft diameter of  $\varnothing 80$  / PTFE-glass fibre / Special dimension and material

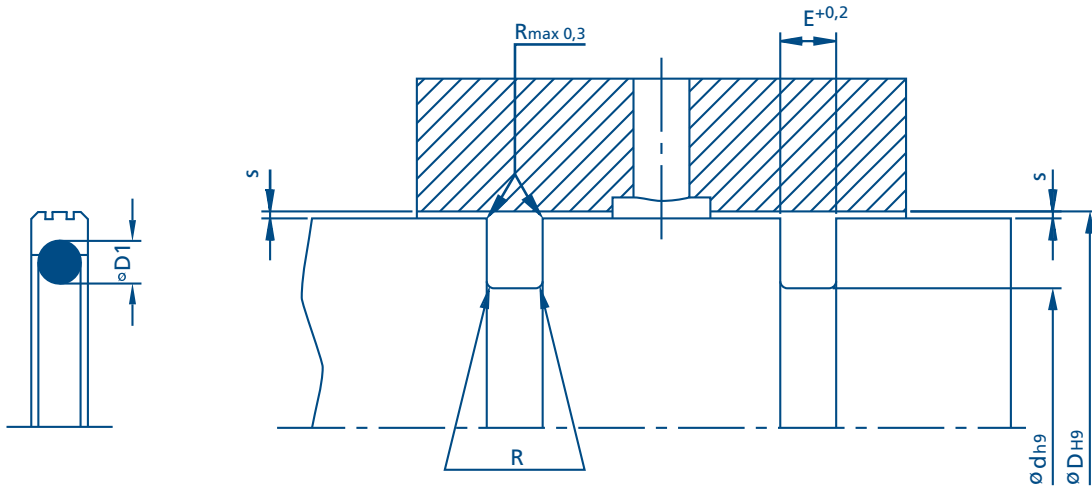
In standard design the rotary seals will be supplied in material PTFE-Carbon, special groove dimension (up to 10 MPa are recommended) see in the above-mentioned table.



Order designation	∅d <sub>f8/h9</sub>	∅D <sub>H9</sub>	E+0.2	OR
RI - 6 - 10,9 - 2,2 - K	6	10,9	2,2	011
RI - 8 - 12,9 - 2,2 - K	8	12,9	2,2	012
RI - 10 - 14,9 - 2,2 - K	10	14,9	2,2	014
RI - 12 - 16,9 - 2,2 - K	12	16,9	2,2	015
RI - 14 - 18,9 - 2,2 - K	14	18,9	2,2	016
RI - 15 - 19,9 - 2,2 - K	15	19,9	2,2	017
RI - 16 - 20,9 - 2,2 - K	16	20,9	2,2	017
RI - 18 - 22,9 - 2,2 - K	18	22,9	2,2	019
RI - 20 - 27,5 - 3,2 - K	20	27,5	3,2	119
RI - 22 - 29,5 - 3,2 - K	22	29,5	3,2	120
RI - 25 - 32,5 - 3,2 - K	25	32,5	3,2	122
RI - 28 - 35,5 - 3,2 - K	28	35,5	3,2	124
RI - 30 - 37,5 - 3,2 - K	30	37,5	3,2	125
RI - 32 - 39,5 - 3,2 - K	32	39,5	3,2	126
RI - 35 - 42,5 - 3,2 - K	35	42,5	3,2	128
RI - 36 - 43,5 - 3,2 - K	36	43,5	3,2	129
RI - 38 - 48,7 - 4,2 - K	38	48,7	4,2	224
RI - 40 - 51,0 - 4,2 - K	40	51,0	4,2	224
RI - 45 - 56,0 - 4,2 - K	45	56,0	4,2	226
RI - 50 - 61,0 - 4,2 - K	50	60,7	4,2	227
RI - 52 - 63,0 - 4,2 - K	52	63,0	4,2	227
RI - 55 - 66,0 - 4,2 - K	55	66,0	4,2	228
RI - 56 - 66,0 - 4,2 - K	56	66,0	4,2	229
RI - 60 - 71,0 - 4,2 - K	60	71,0	4,2	230
RI - 63 - 74,0 - 4,2 - K	63	74,0	4,2	231
RI - 65 - 76,0 - 4,2 - K	65	76,0	4,2	232
RI - 70 - 81,0 - 4,2 - K	70	81,0	4,2	233
RI - 75 - 86,0 - 4,2 - K	75	86,0	4,2	234
RI - 80 - 91,0 - 4,2 - K	80	91,0	4,2	236
RI - 85 - 96,0 - 4,2 - K	85	96,0	4,2	238
RI - 90 - 101,0 - 4,2 - K	90	101,0	6,3	239
RI - 95 - 106,0 - 4,2 - K	95	106,0	4,2	240
RI - 100 - 111,0 - 4,2 - K	100	111,0	4,2	242
RI - 105 - 116,0 - 4,2 - K	105	116,0	4,2	244
RI - 110 - 121,0 - 4,2 - K	110	121,0	4,2	246

Order designation	∅d <sub>f8/h9</sub>	∅D <sub>H9</sub>	E+0.2	OR
RI - 115 - 126.0 - 4.2 - K	115	126.0	4.2	247
RI - 120 - 131.0 - 4.2 - K	120	131.0	4.2	249
RI - 125 - 136.0 - 4.2 - K	125	136.0	4.2	250
RI - 130 - 141.0 - 4.2 - K	130	141.0	4.2	252
RI - 135 - 146.0 - 4.2 - K	135	146.0	4.2	253
RI - 140 - 151.0 - 4.2 - K	140	151.0	4.2	255
RI - 145 - 156.0 - 4.2 - K	150	156.0	4.2	256
RI - 150 - 161.0 - 4.2 - K	150	161.0	4.2	258
RI - 160 - 171.0 - 4.2 - K	160	171.0	4.2	259
RI - 170 - 181.0 - 4.2 - K	170	181.0	4.2	261
RI - 180 - 191.0 - 4.2 - K	180	191.0	4.2	263
RI - 190 - 201.0 - 4.2 - K	190	201.0	4.2	264
RI - 200 - 215.5 - 6.3 - K	200	215.5	6.3	369
RI - 210 - 225.5 - 6.3 - K	210	225.5	6.3	371
RI - 220 - 235.5 - 6.3 - K	220	235.5	6.3	373
RI - 230 - 245.5 - 6.3 - K	230	245.5	6.3	373
RI - 240 - 255.5 - 6.3 - K	240	255.5	6.3	375
RI - 250 - 265.5 - 6.3 - K	250	265.5	6.3	377
RI - 260 - 281.0 - 8.1 - K	260	281.0	8.1	452
RI - 280 - 301.0 - 8.1 - K	280	301.0	8.1	452
RI - 300 - 321.0 - 8.1 - K	300	321.0	8.1	454
RI - 320 - 341.0 - 8.1 - K	320	341.0	8.1	455
RI - 330 - 351.0 - 8.1 - K	330	351.0	8.1	456
RI - 350 - 371.0 - 8.1 - K	350	371.0	8.1	457
RI - 360 - 381.0 - 8.1 - K	360	381.0	8.1	458
RI - 380 - 401.0 - 8.1 - K	380	401.0	8.1	460
RI - 400 - 421.0 - 8.1 - K	400	421.0	8.1	461
RI - 420 - 441.0 - 8.1 - K	420	441.0	8.1	462
RI - 450 - 471.0 - 8.1 - K	450	471.0	8.1	465
RI - 480 - 504.0 - 8.1 - K	480	504.0	8.1	468
RI - 500 - 521.0 - 8.1 - K	500	521.0	8.1	469
RI - 530 - 551.0 - 8.1 - K	530	551.0	8.1	470
RI - 550 - 571.0 - 8.1 - K	550	571.0	8.1	471
RI - 600 - 621.0 - 8.1 - K	600	621.0	8.1	473
RI - 650 - 678.0 - 9.5 - K	650	678.0	9.5	660x8.4

Special dimensions and intermediate size are also available.



**Selection**

**Diameter DH9**

Diameter $\varnothing D_{H9}$	Groove root $\varnothing d_{h9}$	Groove width $E^{+0.2}$	O-Ring Cord thickness $\varnothing D1$	number of grooves
8 - 39.9	$\varnothing D - 4.9$	2.2	$\varnothing 1.78$	0
40 - 79.9	$\varnothing D - 7.5$	3.2	$\varnothing 2.62$	1
80 - 132.9	$\varnothing D - 11.0$	4.2	$\varnothing 3.53$	1
133 - 329.9	$\varnothing D - 15.5$	6.3	$\varnothing 5.33$	2
330 - 669.9	$\varnothing D - 21.0$	8.1	$\varnothing 7.00$	2
670 - 999.9	$\varnothing D - 28.0$	9.5	$\varnothing 8.50$	2

**Gap dimension "s" / radius "R"**

Groove width $E^{+0.2}$	Gap "s" 10 MPa	Gap "s" 20 MPa	Radius R
2.2	0.15	0.10	0.3 - 0.5
3.2	0.20	0.20	0.5 - 0.7
4.2	0.25	0.20	0.8 - 1.0
6.3	0.30	0.25	1.2 - 1.5
8.1	0.30	0.25	1.5 - 2.0
9.5	0.40	0.30	2.0 - 2.8

All rotary seals are supplied as standard with an O-ring of NBR, 70 Shore. O-rings of special materials such as Viton must be separately specified!

**Rotary seals / Ordering example:**

RA - 80 x 69.0 x 4.2 - K

Rotary seal external for outside diameter of  $\varnothing 80$  / PTFE-Carbon / Standard design

RA - 80 x 64.5 x 6.3 - BR

Rotary seal external for outside diameter of  $\varnothing 80$  / PTFE-Bronze / Special dimension and

**Material**

PTFE - Bronze	BR
PTFE - Carbon	K
PTFE - Carbon fibre	KF
PU - Polyurethane	PU
PUG - Polyurethane+graphite	PG
Special material	SO

In standard design the rotary seals will be supplied in material PTFE-Carbon, special groove dimension (up to 10 MPa are recommended) see in the above-mentioned table.





Order designation	øD H9	ød h9	E+0.2	OR
RA - 8 - 3.1 - 2.2 - K	8	3.1	2.2	006
RA - 10 - 5.1 - 2.2 - K	10	5.1	2.2	009
RA - 12 - 7.1 - 2.2 - K	12	7.1	2.2	011
RA - 15 - 10.5 - 2.2 - K	15	10.5	2.2	012
RA - 16 - 11.1 - 2.2 - K	16	11.1	2.2	013
RA - 18 - 13.1 - 2.2 - K	18	13.1	2.2	014
RA - 20 - 15.1 - 2.2 - K	20	15.1	2.2	016
RA - 22 - 17.1 - 2.2 - K	22	17.1	2.2	017
RA - 25 - 20.1 - 2.2 - K	25	20.1	2.2	019
RA - 28 - 23.1 - 2.2 - K	28	23.1	2.2	021
RA - 30 - 25.1 - 2.2 - K	30	25.1	2.2	022
RA - 32 - 27.1 - 2.2 - K	32	27.1	2.2	023
RA - 35 - 30.1 - 2.2 - K	35	30.1	2.2	025
RA - 38 - 33.1 - 2.2 - K	38	33.1	2.2	027
RA - 40 - 32.5 - 3.2 - K	40	32.5	3.2	125
RA - 42 - 34.5 - 3.2 - K	42	34.5	3.2	126
RA - 45 - 37.5 - 3.2 - K	45	37.5	3.2	128
RA - 48 - 40.5 - 3.2 - K	48	40.5	3.2	130
RA - 50 - 42.5 - 3.2 - K	50	42.5	3.2	131
RA - 52 - 44.5 - 3.2 - K	52	44.5	3.2	132
RA - 55 - 47.5 - 3.2 - K	55	47.5	3.2	134
RA - 60 - 52.5 - 3.2 - K	60	52.5	3.2	137
RA - 63 - 55.5 - 3.2 - K	63	55.5	3.2	139
RA - 65 - 57.5 - 3.2 - K	65	57.5	3.2	141
RA - 70 - 62.5 - 3.2 - K	70	62.5	3.2	144
RA - 75 - 67.5 - 3.2 - K	75	67.5	3.2	147
RA - 80 - 69.0 - 4.2 - K	80	69.0	4.2	232
RA - 85 - 74.0 - 4.2 - K	85	74.0	4.2	234
RA - 90 - 79.0 - 4.2 - K	90	79.0	4.2	235
RA - 95 - 84.0 - 4.2 - K	95	84.0	4.2	236
RA - 100 - 89.0 - 4.2 - K	100	89.0	4.2	238
RA - 105 - 94.0 - 4.2 - K	105	94.0	4.2	240
RA - 110 - 99.0 - 4.2 - K	110	99.0	4.2	241
RA - 115 - 104.0 - 4.2 - K	115	104.0	4.2	243
RA - 120 - 109.0 - 4.2 - K	120	109.0	4.2	244

Order designation	øD H9	ød h9	E+0.2	OR
RA - 125 - 114.0 - 4.2 - K	125	114.0	4.2	246
RA - 135 - 119.5 - 6.3 - K	135	119.5	6.3	350
RA - 140 - 124.5 - 6.3 - K	140	124.5	6.3	352
RA - 150 - 134.5 - 6.3 - K	150	134.5	6.3	355
RA - 160 - 144.5 - 6.3 - K	160	144.5	6.3	358
RA - 170 - 154.5 - 6.3 - K	170	154.5	6.3	361
RA - 180 - 164.5 - 6.3 - K	180	164.5	6.3	363
RA - 190 - 174.5 - 6.3 - K	190	174.5	6.3	364
RA - 200 - 184.5 - 6.3 - K	200	184.5	6.3	366
RA - 210 - 194.5 - 6.3 - K	210	194.5	6.3	367
RA - 220 - 204.5 - 6.3 - K	220	204.5	6.3	369
RA - 230 - 214.5 - 6.3 - K	230	214.5	6.3	371
RA - 240 - 224.5 - 6.3 - K	240	224.5	6.3	372
RA - 250 - 234.5 - 6.3 - K	250	234.5	6.3	374
RA - 260 - 244.5 - 6.3 - K	260	244.5	6.3	375
RA - 270 - 254.5 - 6.3 - K	270	254.5	6.3	377
RA - 280 - 264.5 - 6.3 - K	280	264.5	6.3	377
RA - 290 - 274.5 - 6.3 - K	290	274.5	6.3	378
RA - 300 - 284.5 - 6.3 - K	300	284.5	6.3	379
RA - 310 - 294.5 - 6.3 - K	310	294.5	6.3	380
RA - 320 - 304.5 - 6.3 - K	320	304.5	6.3	381
RA - 330 - 309.0 - 8.1 - K	330	309.0	8.1	453
RA - 340 - 319.0 - 8.1 - K	340	319.0	8.1	454
RA - 350 - 329.0 - 8.1 - K	350	329.0	8.1	455
RA - 360 - 339.0 - 8.1 - K	360	339.0	8.1	456
RA - 370 - 349.0 - 8.1 - K	370	349.0	8.1	456
RA - 380 - 359.0 - 8.1 - K	380	359.0	8.1	457
RA - 390 - 369.0 - 8.1 - K	390	369.0	8.1	458
RA - 400 - 379.0 - 8.1 - K	400	379.0	8.1	458
RA - 410 - 389.0 - 8.1 - K	410	389.0	8.1	459
RA - 420 - 399.0 - 8.1 - K	420	399.0	8.1	460
RA - 440 - 419.0 - 8.1 - K	440	419.0	8.1	462
RA - 450 - 429.0 - 8.1 - K	450	429.0	8.1	463
RA - 480 - 459.0 - 8.1 - K	480	459.0	8.1	465
RA - 500 - 479.0 - 8.1 - K	500	479.0	8.1	467

Special dimensions and intermediate size are also available.

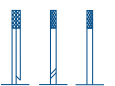


## ***Back up rings***

spiral

cutted

uncutted





## Backup rings

Backup (support) rings are used for both static and dynamic applications, preventing the migration or extrusion of the O or X-ring in the gap as pressurisation and de-pressurisation/pressure cycling occur. The profile shape of the backup rings is usually rectangular but may also be concave at the face mating with the O-ring. Manufactured in various PTFE compounds, backup rings may be **continuous, slotted or spiralled**.

The **continuous STE design** is predominantly used for internal, radial-static and dynamic applications. The **slotted STG design** is for external sealing, radial-static and reciprocating applications.

The **spiralled STS design** can be used for both external sealing and internal sealing applications. Compared with the other two designs, this form offers the advantage that, in service conditions involving high temperature fluctuations, the ring is able to compensate for larger tolerance changes without problem through spiral contraction or extension.

**Type ST...** backup rings are manufactured as standard from unfilled PTFE. This material is ideally suited to light to medium-duty applications. In the case of heavier-duty requirements, the PTFE material must be filled. As a rule, the filler material takes the form of fibreglass, although the PTFE may also be reinforced by bronze or carbon.

The **STE** continuous and **STG** slotted designs can also be manufactured in other materials such as PU, POM, PA etc. where necessary.

The **STM** types for metric size ranges and **STI** designs for inch sizes are manufactured from a special polyester elastomer in the injection moulding process. Owing to its high resilience, this material offers the advantage that it can also be used for external sealing in continuous grooves. These backup rings are likewise available in polyurethane. Simple snap-fitting and automatic installation are likewise possible with the above-mentioned materials. Selection of the appropriate material combinations also ensures that these backup rings exhibit a high level of extrusion resistance.

### Benefits

- Wide range of different materials
- Very good thermal and chemical resistance
- Individual size ranges possible
- Simple groove design
- Capability to bridge large seal gaps
- Easy to fit

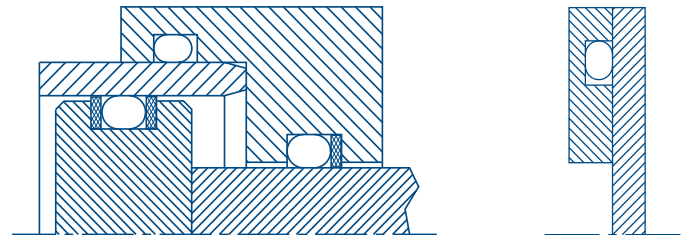
## Installation

It is recommended to provide backup rings where relatively high pressures in excess of approx. 5 MPa (50 bar) are involved, and particularly where relatively large gap dimensions need to be bridged between the components requiring sealing. A backup ring is also advisable in applications involving high velocities and frequencies, heavy pulsation, elevated temperatures and, in particular, temperature fluctuations.

In single-acting applications where pressurisation only takes place on one side, it is usually sufficient to install one backup ring on the non-pressurised side. If reciprocating pressurisation is expected, two backup rings will need to be used, one on either side of the O or X-ring.

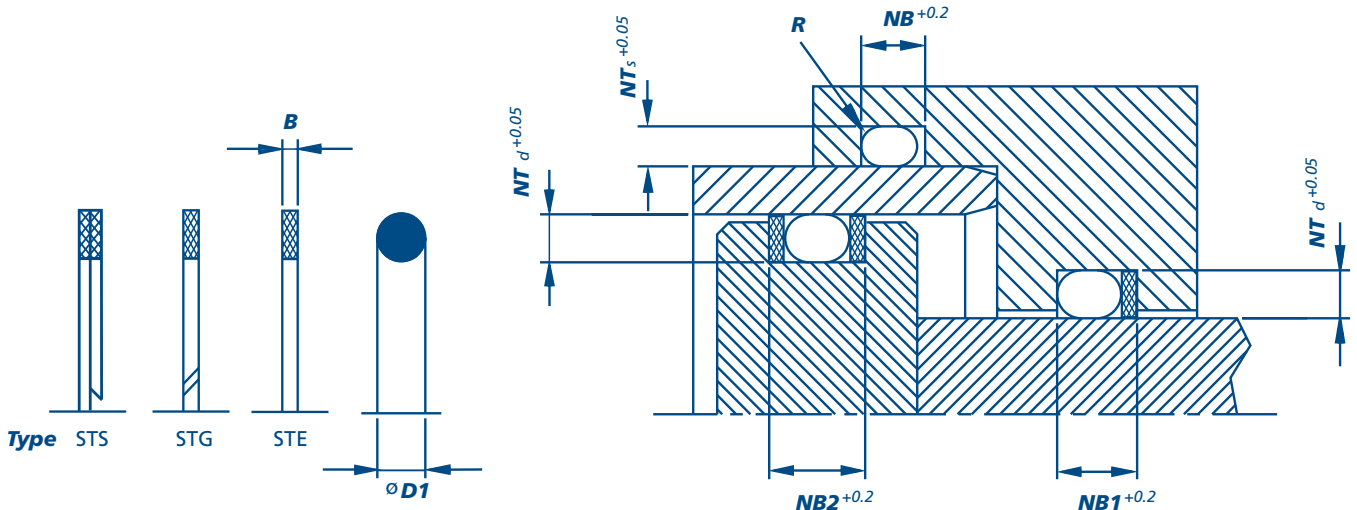
The use of backup rings enables the specified gap dimensions to be somewhat enlarged, although the clearance fit H8/f7 is recommended in order to ensure functional reliability.

The recommendations relating to the groove dimensions and surface finish, i.e. roughness, tolerances, insertion bevels etc. are essentially the same as those applicable to O-rings.



### Application ranges

Velocity:	reciprocating / rotating up to approx. 2 m/s (depending on material)
Temperature:	-60°C to +200°C (depending on material selection)
Pressure:	up to 200 MPa (2000 bar) static load (depending on material selection)
	up to 40 MPa (400 bar) dynamic load (depending on material selection)
	up to 15 MPa (150 bar) rotating load (depending on material selection)



**Housing dimension**

O-Ring Cord thickness	radial deformation		Groove width			Backup ring widthness	Radius		Angle 15° length
	static Groove depth	dynamic Groove depth	without Backup ring	one Backup ring	two Backup rings		without Backup ring	with Backup ring	
$\varnothing D1$	$NT_{s+0.05}$	$NT_{d+0.05}$	$NB^{+0.2}$	$NB1^{+0.2}$	$NB2^{+0.2}$	$B$	$R$		
1.00	0.70	0.80	1.40	-	-	-	0.2	0.2	1.20
1.50	1.10	1.20	1.90	3.10	3.90	1.00	0.2	0.2	1.20
1.78	1.40	1.50	2.40	3.80	5.10	1.40	0.4	0.2	1.20
2.00	1.60	1.70	2.60	4.00	5.40	1.40	0.5	0.2	1.30
2.50	2.00	2.10	3.00	4.40	5.60	1.40	0.5	0.3	1.30
2.62	2.10	2.25	3.10	4.50	5.90	1.40	0.6	0.3	1.40
3.00	2.40	2.55	3.60	5.00	6.40	1.40	0.8	0.4	1.80
3.50/3.53	2.80	3.10	4.20	5.60	7.00	1.40	1.0	0.4	1.90
4.00	3.20	3.50	4.70	6.40	8.10	1.70	1.0	0.4	2.30
4.50	3.70	4.00	5.20	6.90	8.60	1.70	1.0	0.4	2.40
5.00	4.10	4.40	6.00	7.70	9.40	1.70	1.0	0.4	2.40
5.33	4.40	4.70	6.20	7.90	9.60	1.70	1.2	0.6	2.60
5.50	4.50	4.80	6.40	8.10	9.80	1.70	1.2	0.6	2.90
5.70	4.60	5.00	6.70	8.40	10.10	1.70	1.2	0.6	2.90
6.00	4.90	5.30	6.90	8.60	10.30	1.70	1.2	0.6	2.90
6.99	5.80	6.20	8.20	10.70	13.20	2.50	1.5	0.6	3.40
8.00	6.30	7.00	9.30	11.80	14.30	2.50	1.5	0.6	3.50
8.40	6.50	7.50	9.70	12.20	14.70	2.50	2.0	0.6	4.00

**Backup rings design:**

**STE - uncut • STS - spiral • STG - cut**

**Backup rings / Ordering example:**

STE - 40 x 48.5 - 1.4 - P  
Backup ring - uncut diameter / 40x48.5x1.4 / Material PTFE-virginal

STG - 75 x 78.5 - 1.7 - GF  
Backup ring - cutted diameter / 75x78.5x1.7 / Material PTFE-Glass fibre

**Material**

PTFE - virginal	P
PTFE - Glassfibre	GF
PTFE - Bronze	BR
PTFE - Carbon	K
Polyurethane	PU
Polyacetal	POM
Polyamid	PA
Special material	SO

All backup rings are supplied as standard without O-Ring.  
O-Ring you must order separately!

Order design.	O-Ring	Order design.	O-Ring	Order design.	O-Ring
STI - 007	3.68 x 1.78	STI - 034	53.70 x 1.78	STI - 812	20.63 x 2.62
STI - 008	4.47 x 1.78	STI - 035	56.87 x 1.78	STI - 118	21.89 x 2.62
STI - 009	5.28 x 1.78	STI - 036	60.05 x 1.78	STI - 813	22.22 x 2.62
STI - 010	6.07 x 1.78	STI - 037	63.22 x 1.78	STI - 119	23.47 x 2.62
STI - 610	6.75 x 1.78	STI - 038	66.04 x 1.78	STI - 814	23.81 x 2.62
STI - 011	7.65 x 1.78	STI - 039	69.57 x 1.78	STI - 120	25.07 x 2.62
STI - 611	8.73 x 1.78	STI - 040	72.75 x 1.78	STI - 121	26.64 x 2.62
STI - 012	9.25 x 1.78	STI - 041	75.92 x 1.78	STI - 122	28.24 x 2.62
STI - 013	10.82 x 1.78	STI - 042	82.27 x 1.78	STI - 123	29.82 x 2.62
STI - 806	11.11 x 1.78	STI - 043	88.62 x 1.78	STI - 124	31.42 x 2.62
STI - 014	12.42 x 1.78	STI - 044	94.97 x 1.78	STI - 125	32.99 x 2.62
STI - 015	14.00 x 1.78	STI - 045	101.32 x 1.78	STI - 126	34.60 x 2.62
STI - 016	15.60 x 1.78	STI - 046	107.67 x 1.78	STI - 127	36.14 x 2.62
STI - 017	17.17 x 1.78	STI - 047	114.02 x 1.78	STI - 128	37.77 x 2.62
STI - 018	18.77 x 1.78	STI - 048	120.37 x 1.78	STI - 129	39.34 x 2.62
STI - 019	20.35 x 1.78			STI - 130	40.95 x 2.62
STI - 020	21.95 x 1.78	STI - 110	9.19 x 2.62	STI - 131	42.52 x 2.62
STI - 021	23.52 x 1.78	STI - 613	9.92 x 2.62	STI - 132	44.12 x 2.62
STI - 022	25.12 x 1.78	STI - 111	10.77 x 2.62	STI - 133	45.69 x 2.62
STI - 023	26.70 x 1.78	STI - 614	11.91 x 2.62	STI - 134	47.30 x 2.62
STI - 024	28.30 x 1.78	STI - 112	12.37 x 2.62	STI - 135	48.90 x 2.62
STI - 025	29.87 x 1.78	STI - 615	13.10 x 2.62	STI - 136	50.47 x 2.62
STI - 026	31.47 x 1.78	STI - 113	13.94 x 2.62	STI - 137	52.07 x 2.62
STI - 027	33.05 x 1.78	STI - 616	15.08 x 2.62	STI - 138	53.65 x 2.62
STI - 028	34.65 x 1.78	STI - 114	15.54 x 2.62	STI - 139	55.25 x 2.62
STI - 029	37.82 x 1.78	STI - 809	15.88 x 2.62	STI - 140	56.82 x 2.62
STI - 030	41.00 x 1.78	STI - 115	17.12 x 2.62	STI - 141	58.42 x 2.62
STI - 031	44.17 x 1.78	STI - 617	17.86 x 2.62	STI - 142	60.00 x 2.62
STI - 032	47.35 x 1.78	STI - 116	18.72 x 2.62	STI - 143	61.60 x 2.62
STI - 033	50.52 x 1.78	STI - 117	20.29 x 2.62	STI - 144	63.17 x 2.62

O-Ring you must order separately!

## Material polyester 55 shore D

### Backup rings for metric and inch dimensionen / Ordering example:

S T M - 3 5 - 4 0

Backup ring uncut metric. for O-ring 34.2 x 3.0 / O-ring please order separat (OR 34.2x3)

S T I - 1 3 0

Backup ring uncut inch. for O-ring 40.95 x 2.62 / O-ring please order separat (OR 40.95x2.62)

All backup rings are supplied as standard  
without O-Ring.

O-Ring you must order separately!

Inch

Order design.	O-Ring	Order design.	O-Ring	Order design.	O-Ring
STI - 145	64.77 x 2.62	STI - 214	24.99 x 3.53	STI - 842	68.26 x 3.53
STI - 146	66.35 x 2.62	STI - 618	25.80 x 3.53	STI - 232	69.44 x 3.53
STI - 147	67.94 x 2.62	STI - 216	28.17 x 3.53	STI - 843	69.85 x 3.53
STI - 148	69.52 x 2.62	STI - 217	29.75 x 3.53	STI - 844	71.44 x 3.53
STI - 149	71.12 x 2.62	STI - 218	31.34 x 3.53	STI - 233	72.62 x 3.53
STI - 150	72.69 x 2.62	STI - 219	32.92 x 3.53	STI - 845	73.03 x 3.53
STI - 151	75.87 x 2.62	STI - 220	34.52 x 3.53	STI - 846	74.61 x 3.53
STI - 152	82.22 x 2.62	STI - 221	36.09 x 3.53	STI - 234	75.79 x 3.53
STI - 153	88.57 x 2.62	STI - 222	37.69 x 3.53	STI - 235	78.97 x 3.53
STI - 154	94.92 x 2.62	STI - 824	39.69 x 3.53	STI - 236	82.14 x 3.53
STI - 155	101.27 x 2.62	STI - 223	40.87 x 3.53	STI - 237	85.32 x 3.53
STI - 156	107.62 x 2.62	STI - 825	41.28 x 3.53	STI - 238	88.49 x 3.53
STI - 157	113.97 x 2.62	STI - 826	42.86 x 3.53	STI - 239	91.67 x 3.53
STI - 158	120.33 x 2.62	STI - 224	44.04 x 3.53	STI - 240	94.84 x 3.53
STI - 159	126.67 x 2.62	STI - 827	44.45 x 3.53	STI - 241	98.02 x 3.53
STI - 160	133.00 x 2.62	STI - 828	46.04 x 3.53	STI - 242	101.19 x 3.53
STI - 161	139.38 x 2.62	STI - 225	47.22 x 3.53	STI - 243	104.37 x 3.53
STI - 162	145.72 x 2.62	STI - 829	47.63 x 3.53	STI - 244	107.54 x 3.53
STI - 163	152.07 x 2.62	STI - 830	49.21 x 3.53	STI - 245	110.72 x 3.53
STI - 164	158.43 x 2.62	STI - 226	50.39 x 3.53	STI - 246	113.90 x 3.53
STI - 165	164.78 x 2.62	STI - 831	50.80 x 3.53	STI - 247	117.07 x 3.53
STI - 166	171.13 x 2.62	STI - 832	52.39 x 3.53	STI - 248	120.24 x 3.53
STI - 167	177.48 x 2.62	STI - 227	53.57 x 3.53	STI - 249	123.42 x 3.53
STI - 168	183.83 x 2.62	STI - 833	53.98 x 3.53	STI - 250	126.59 x 3.53
STI - 169	190.18 x 2.62	STI - 834	55.56 x 3.53	STI - 251	129.77 x 3.53
STI - 170	196.53 x 2.62	STI - 228	56.74 x 3.53	STI - 252	132.94 x 3.53
STI - 171	202.88 x 2.62	STI - 835	57.15 x 3.53	STI - 253	136.12 x 3.53
STI - 172	209.23 x 2.62	STI - 836	58.74 x 3.53	STI - 254	139.29 x 3.53
STI - 173	215.58 x 2.62	STI - 229	59.92 x 3.53	STI - 255	142.47 x 3.53
STI - 174	221.93 x 2.62	STI - 837	60.33 x 3.53	STI - 256	145.64 x 3.53
STI - 175	228.28 x 2.62	STI - 838	61.91 x 3.53	STI - 257	148.82 x 3.53
		STI - 230	63.09 x 3.53	STI - 258	151.99 x 3.53
STI - 210	18.64 x 3.53	STI - 839	63.50 x 3.53	STI - 259	158.34 x 3.53
STI - 211	20.22 x 3.53	STI - 840	65.09 x 3.53	STI - 260	164.69 x 3.53
STI - 212	21.82 x 3.53	STI - 231	66.27 x 3.53	STI - 261	171.04 x 3.53
STI - 213	23.40 x 3.53	STI - 841	66.68 x 3.53	STI - 262	177.39 x 3.53

O-Ring you must order separately!

Order design.	O-Ring	Order design.	O-Ring	Order design.	O-Ring
STI - 263	183.74 x 3.53	STI - 340	85.09 x 5.34	STI - 362	158.12 x 5.34
STI - 264	190.09 x 3.53	STI - 341	88.27 x 5.34	STI - 363	164.47 x 5.34
STI - 265	196.44 x 3.53	STI - 621	89.69 x 5.34	STI - 364	170.82 x 5.34
STI - 266	202.79 x 3.53	STI - 342	91.44 x 5.34	STI - 365	177.17 x 5.34
STI - 267	209.14 x 3.53	STI - 343	94.62 x 5.34	STI - 866	183.52 x 5.34
STI - 268	215.49 x 3.53	STI - 344	97.79 x 5.34	STI - 367	189.87 x 5.34
STI - 269	221.84 x 3.53	STI - 622	100.00 x 5.34	STI - 368	196.22 x 5.34
STI - 270	228.19 x 3.53	STI - 345	100.97 x 5.34	STI - 369	205.97 x 5.34
STI - 271	234.54 x 3.53	STI - 346	104.14 x 5.34	STI - 370	208.92 x 5.34
STI - 272	240.89 x 3.53	STI - 347	107.32 x 5.34	STI - 371	215.27 x 5.34
STI - 273	247.24 x 3.53	STI - 623	109.50 x 5.34	STI - 372	221.62 x 5.34
STI - 274	253.59 x 3.53	STI - 348	110.50 x 5.34	STI - 373	227.97 x 5.34
STI - 275	266.29 x 3.53	STI - 349	113.67 x 5.34	STI - 374	234.32 x 5.34
STI - 276	278.99 x 3.53	STI - 350	116.84 x 5.34	STI - 375	240.67 x 5.34
STI - 277	291.69 x 3.53	STI - 860	117.50 x 5.34	STI - 376	247.02 x 5.34
STI - 278	304.39 x 3.53	STI - 351	120.02 x 5.34	STI - 377	253.37 x 5.34
STI - 279	329.79 x 3.53	STI - 861	120.79 x 5.34	STI - 378	266.17 x 5.34
STI - 280	355.19 x 3.53	STI - 352	123.20 x 5.34	STI - 379	278.77 x 5.34
		STI - 862	123.80 x 5.34	STI - 380	291.47 x 5.34
STI - 325	37.47 x 5.34	STI - 353	126.37 x 5.34	STI - 381	304.17 x 5.34
STI - 326	40.65 x 5.34	STI - 863	127.00 x 5.34	STI - 382	329.57 x 5.34
STI - 327	43.82 x 5.34	STI - 354	129.54 x 5.34	STI - 383	354.97 x 5.34
STI - 328	47.00 x 5.34	STI - 864	130.20 x 5.34	STI - 384	380.37 x 5.34
STI - 329	50.16 x 5.34	STI - 355	132.72 x 5.34	STI - 385	405.26 x 5.34
STI - 330	53.34 x 5.34	STI - 865	133.40 x 5.34	STI - 386	430.66 x 5.34
STI - 331	56.52 x 5.34	STI - 356	135.90 x 5.34	STI - 387	456.06 x 5.34
STI - 332	59.69 x 5.34	STI - 866	136.50 x 5.34	STI - 388	481.40 x 5.34
STI - 333	62.87 x 5.34	STI - 357	139.07 x 5.34	STI - 389	506.80 x 5.34
STI - 334	66.04 x 5.34	STI - 867	139.70 x 5.34	STI - 390	532.20 x 5.34
STI - 335	69.22 x 5.34	STI - 358	142.24 x 5.34	STI - 391	557.60 x 5.34
STI - 336	72.39 x 5.34	STI - 868	142.90 x 5.34	STI - 392	582.68 x 5.34
STI - 619	74.63 x 5.34	STI - 359	145.42 x 5.34	STI - 393	608.08 x 5.34
STI - 337	75.57 x 5.34	STI - 869	146.10 x 5.34	STI - 394	633.48 x 5.34
STI - 338	78.74 x 5.34	STI - 360	148.60 x 5.34	STI - 395	658.88 x 5.34
STI - 620	79.77 x 5.34	STI - 870	149.20 x 5.34		
STI - 339	81.92 x 5.34	STI - 361	151.77 x 5.34		

*O-Ring you must order separately!*



Order design.	O-Ring
STI - 425	113.67 x 6.99
STI - 624	114.70 x 6.99
STI - 426	116.84 x 6.99
STI - 427	120.02 x 6.99
STI - 428	123.20 x 6.99
STI - 625	124.60 x 6.99
STI - 429	126.27 x 6.99
STI - 430	129.54 x 6.99
STI - 431	132.72 x 6.99
STI - 626	134.50 x 6.99
STI - 432	135.90 x 6.99
STI - 433	139.07 x 6.99
STI - 434	142.24 x 6.99
STI - 435	145.42 x 6.99
STI - 436	148.60 x 6.99
STI - 437	151.77 x 6.99
STI - 872	155.60 x 6.99
STI - 438	158.12 x 6.99
STI - 627	159.95 x 6.99
STI - 874	161.90 x 6.99
STI - 439	164.47 x 6.99
STI - 628	166.70 x 6.99
STI - 876	168.30 x 6.99
STI - 440	170.82 x 6.99
STI - 878	174.60 x 6.99
STI - 441	177.17 x 6.99
STI - 880	181.00 x 6.99
STI - 442	183.52 x 6.99
STI - 882	187.30 x 6.99
STI - 443	189.87 x 6.99
STI - 884	193.70 x 6.99
STI - 444	196.22 x 6.99
STI - 886	200.00 x 6.99

Order design.	O-Ring
STI - 445	202.57 x 6.99
STI - 647	208.92x 6.99
STI - 446	215.27 x 6.99
STI - 676	221.62 x 6.99
STI - 447	227.97 x 6.99
STI - 678	234.32 x 6.99
STI - 448	240.67 x 6.99
STI - 680	247.00 x 6.99
STI - 449	253.30 x 6.99
STI - 682	259.70 x 6.99
STI - 450	266.07 x 6.99
STI - 684	272.40 x 6.99
STI - 451	278.77 x 6.99
STI - 686	285.20 x 6.99
STI - 452	291.47 x 6.99
STI - 688	297.80 x 6.99
STI - 453	304.17 x 6.99
STI - 454	316.87 x 6.99
STI - 455	329.57 x 6.99
STI - 456	342.27 x 6.99
STI - 457	354.97 x 6.99
STI - 458	367.67 x 6.99
STI - 459	380.37 x 6.99
STI - 460	393.07 x 6.99
STI - 461	405.26 x 6.99
STI - 462	417.96 x 6.99
STI - 463	430.66 x 6.99
STI - 464	443.36 x 6.99
STI - 465	456.06 x 6.99
STI - 466	468.76 x 6.99
STI - 467	481.46 x 6.99
STI - 468	494.16 x 6.99

O-Ring you must order separately!

Order design.	O-Ring
STM - 5 - 9	4.3 x 2.4
STM - 6 - 10	5.3 x 2.4
STM - 7 - 11	6.3 x 2.4
STM - 8 - 12	7.3 x 2.4
STM - 9 - 13	8.3 x 2.4
STM - 10 - 14	9.3 x 2.4
STM - 11 - 15	10.3 x 2.4
STM - 12 - 16	11.3 x 2.4
STM - 13 - 17	12.3 x 2.4
STM - 14 - 18	13.3 x 2.4
STM - 15 - 19	14.3 x 2.4
STM - 16 - 20	15.3 x 2.4
STM - 17 - 21	16.3 x 2.4
STM - 18 - 22	17.3 x 2.4
STM - 20 - 25	19.2 x 3.0
STM - 23 - 28	22.2 x 3.0
STM - 25 - 30	24.2 x 3.0
STM - 27 - 32	26.2 x 3.0
STM - 30 - 35	29.2 x 3.0
STM - 33 - 38	32.2 x 3.0
STM - 35 - 40	34.2 x 3.0
STM - 37 - 42	36.2 x 3.0
STM - 40 - 45	39.2 x 3.0
STM - 43 - 48	42.2 x 3.0
STM - 45 - 50	44.2 x 3.0
STM - 48 - 53	
STM - 50 - 55	49.5 x 3.0
STM - 55 - 60	54.5 x 3.0
STM - 58 - 63	
STM - 60 - 65	59.3 x 3.0
STM - 63 - 68	
STM - 65 - 70	64.5 x 3.0
STM - 72 - 77	
STM - 70 - 75	69.5 x 3.0
STM - 75 - 80	74.5 x 3.0
STM - 80 - 85	79.5 x 3.0

Order design.	O-Ring
STM - 85 - 90	84.5 x 3.0
STM - 90 - 95	89.5 x 3.0
STM - 95 - 100	94.5 x 3.0
STM - 100 - 105	99.5 x 3.0
STM - 105 - 110	104.5 x 3.0
STM - 110 - 115	109.5 x 3.0
STM - 113 - 118	
STM - 115 - 120	114.5 x 3.0
STM - 120 - 125	119.5 x 3.0
STM - 125 - 130	124.5 x 3.0
STM - 130 - 135	129.5 x 3.0
STM - 135 - 140	134.5 x 3.0
STM - 140 - 145	139.5 x 3.0
STM - 145 - 150	144.5 x 3.0
STM - 30 - 40	
STM - 40 - 50	
STM - 45 - 55	44.2 x 5.7
STM - 50 - 60	49.2 x 5.7
STM - 53 - 63	
STM - 55 - 65	54.2 x 5.7
STM - 60 - 70	59.2 x 5.7
STM - 65 - 75	64.2 x 5.7
STM - 70 - 80	69.2 x 5.7
STM - 75 - 85	74.2 x 5.7
STM - 80 - 90	79.2 x 5.7
STM - 85 - 95	84.1 x 5.7
STM - 90 - 100	89.1 x 5.7
STM - 95 - 105	94.1 x 5.7
STM - 100 - 110	99.1 x 5.7
STM - 105 - 115	104.1 x 5.7
STM - 110 - 120	109.1 x 5.7
STM - 115 - 125	114.3 x 5.7
STM - 120 - 130	119.3 x 5.7
STM - 125 - 135	124.3 x 5.7
STM - 130 - 140	129.3 x 5.7
STM - 135 - 145	134.3 x 5.7

Order design.	O-Ring
STM - 140 - 150	139.3 x 5.7
STM - 145 - 155	144.3 x 5.7
STM - 150 - 160	149.3 x 5.7
STM - 155 - 165	154.3 x 5.7
STM - 160 - 170	159.3 x 5.7
STM - 165 - 175	164.3 x 5.7
STM - 170 - 180	169.3 x 5.7
STM - 175 - 185	174.3 x 5.7
STM - 180 - 190	179.3 x 5.7
STM - 185 - 195	184.3 x 5.7
STM - 190 - 200	189.3 x 5.7
STM - 195 - 205	194.3 x 5.7
STM - 200 - 210	199.3 x 5.7
STM - 210 - 220	209.3 x 5.7
STM - 220 - 230	219.3 x 5.7
STM - 230 - 240	229.3 x 5.7
STM - 240 - 250	239.3 x 5.7
STM - 250 - 260	249.3 x 5.7
STM - 270 - 280	269.3 x 5.7

*O-Ring you must order separately!*



fabric-base laminate | ptfe compounds | polyurethane | nbr

 S.F. components

## guiding elements and sealings for hydraulics

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