Pneumatic Seals

Contents

Pneumatic Cylinder

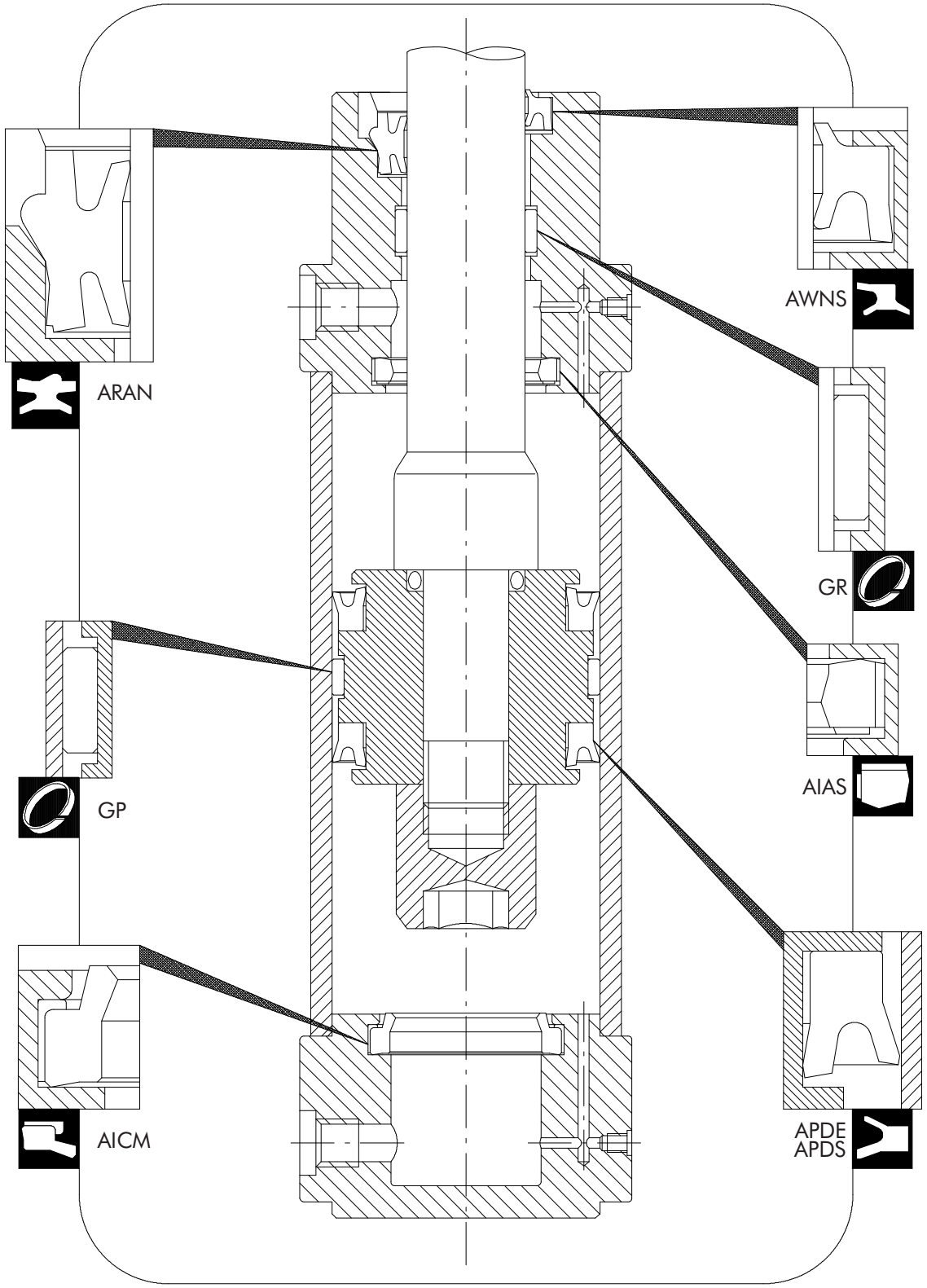


Figure 1 Typical pneumatic cylinder with B+S seals

Sealing solutions in polyurethane for Pneumatics

Table I Rod seals - selection criteria

Seal		Application		Installation		Technical data*			Material
Type	**Page**	**Field of application**	**Function**	**Ø Range mm**	**Groove type corresponding to mm**	**Tempera-ture °C****	**Speed m/s**	**Pres-sure Mpa**	**Standard seal material**
ARUP 	7	Industrial Pneumatics Standard Cylinders	single acting	3-100	closed	-30 to +80	1	1.6	WU9E1

Table II Piston seals - selection criteria

Seal		Application		Installation		Technical data*			Material
Type	**Page**	**Field of application**	**Function**	**Ø Range mm**	**Groove type corresponding to mm**	**Tempera-ture °C****	**Speed m/s**	**Pres-sure Mpa**	**Standard seal material**
APDE 	9	Industrial Pneumatics Standard Cylinders	single acting	6-200	closed	-30 to +80	1	1.6	WU9E1
APDS 	12	Industrial Pneumatics Standard Cylinders	single acting	6-40	closed	-30 to +80	1	1.6	WU9E1
APMP 	14	Industrial Pneumatics Short stroke magnetic and non magnetic cylinders	single or double acting	8-100	open	-30 to +80	1	1.6	WU9E1

* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

** For applications at low temperatures below -30° C and at high temperatures +80° C, please contact us.

Sealing solutions in polyurethane for Pneumatics

Table III Rod seals and rod seal-scraper combinations

Scraper		Application		Installation		Technical data*			Material
Type	**Page**	**Field of application**	**Function**	**Ø Range mm**	**Groove type corresponding to mm**	**Tempera-ture °C****	**Speed m/s**	**Pres-sure Mpa**	**Standard seal material**
AWNS 	17	Industrial Pneumatics Standard Cylinders	double acting	3-70	closed	-30 to +80	1	1.6	WU9E1
AWSD 	20	Industrial Pneumatics Standard Cylinders	double acting	4-100	closed	-30 to +80	1	1.6	WU9E1
ARAN 	23	Industrial Pneumatics Standard Cylinders	double acting	12-63	open	-30 to +80	1	1.6	WU9E1
AWSW 	25	Industrial Pneumatics Standard Cylinders	single acting	6-60	open	-30 to +80	2	1.6	WU9E1

* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

** For applications at low temperatures below -30° C and at high temperatures +80° C, please contact us.

Sealing solutions in polyurethane for Pneumatics

Table IV Cushioning seals - selection criteria

Cushioning seals		Application		Installation		Technical data*			Material
Type	Page	Field of application	Function	Ø Range mm	Groove type corresponding to mm	Tempera-ture °C**	Speed m/s	Pres-sure Mpa	
AICM 	28	Industrial Pneumatics Standard Cylinders	cushioning	6-50	closed	-30 to +80	1	1.6	WU9E1
AIAS 	30	Industrial Pneumatics Standard Cylinders	cushioning	10-50	closed	-30 to +80	1	1.6	WU9E1

Table V Wear rings - selection criteria

Wear Ring		Application		Installation		Technical data*			Material
Type	Page	Field of application	Function	Ø Range mm	Groove type corresponding to mm	Tempera-ture °C**	Speed m/s	Pres-sure Mpa	
GP 	34	Industrial Pneumatics Standard Cylinders	Piston Wear Ring	8-250	closed	-40 to +110	1	-	POM
GR 	37	Industrial Pneumatics Standard Cylinders	Rod Wear Ring	8-50	closed	-40 to +110	1	-	POM

* The data below are maximum values and cannot be used at the same time. The max. pressure depends on temperature and gap dimension.

** For applications at low temperatures below -30° C and at high temperatures +80° C, please contact us.

Surface roughness

Surface roughness DIN EN ISO 4287

The functional reliability and service life of a seal depend to a very great extent on the quality and surface finish of the mating surface to be sealed.

Scores, scratches, pores, concentric or spiral machining marks are not permitted. Higher demands must be made on the surface finish of dynamic surfaces than of static mating surfaces.

The characteristics most frequently used to describe the surface microfinish Ra_a, R_z and R_{max} are defined in DIN EN ISO 4287. These characterics alone, however, are not sufficient for assessing the suitability in seal technology. In addition the material contact area of the surface roughness profile R_{mr} in accordance with DIN EN ISO 4287 should be demanded. The significance ot this surface specification is illustrated in Fig. 4. It shows clearly that specification of R_a and R_z alone does not describe the surface roughness profile accurately enough for the seal technology and is thus not sufficient for assessing the suitability. The material contact area R_{mr} is essential for assessing surfaces, as this parameter is determined by the specific surface roughness profile. This in turn is directly dependent on the machining process employed.

Busak + Shamban recommends that the following surface finishes be observed:

Table V Surface roughness

Surface roughness µm		
Parameter	**Mating surface**	**Groove surface**
	Polyurethane	
R_{max}	1.00 - 4.00	< 16.0
$R_{z\ DIN}$	0.63 - 2.50	< 10.0
R_a	0.10 - 0.40	< 1.6

The material contact area R_{mr} should be approx. 50 to 70%, determined at a cut depth c = 0.25 x R_z, relative to a reference line of $C_{ref.}$ 5%.

Surface profile	R_a	R_z	R_{mr}
closed profile form 	0.1	1.0	70%
open profile form 	0.2	1.0	15%

Figure 2 Profile forms of surfaces

Figure 4 shows two surface profiles, both of which exhibit nearly the same value for R_z in the test procedure. The difference becomes obvious only when the material contact area of the survace roughness profiles are compared. These show that the upper roughness profile with R_{mr} = 70% has the better seal/mating surface ratio.

Rod Seal - Type ARUP

Rod seal type ARUP

Description

The ARUP rod seal has been redesigned with respect to the traditional u-profile used in pneumatics to give significant improvements.
These include:

- A dynamic lip with no sharp edges to facilitates sliding. Increased depth within the u-profile to increase flexibility.
- The use of a urethane resin instead of rubber to increase seal life and facilitate the use of non-lubricated air.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A Material No.: WUBE1

Installation

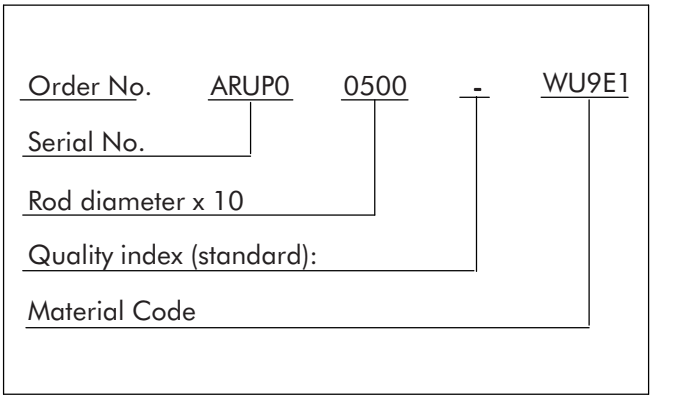
It is important to remove all sharp edges from the groove and shaft to prevent damaging the seal.

The seals can be installed more easily if they are greased or oiled.

Ordering example

Rod Seal,
type ARUP

Rod diameter:	d = 50 mm
Groove width:	L = 7.5 mm
Part No.:	ARUP00500 (Table VII)
Material No.:	WU9E1 (standard)



Rod Seal - Type ARUP

Installation recommendation

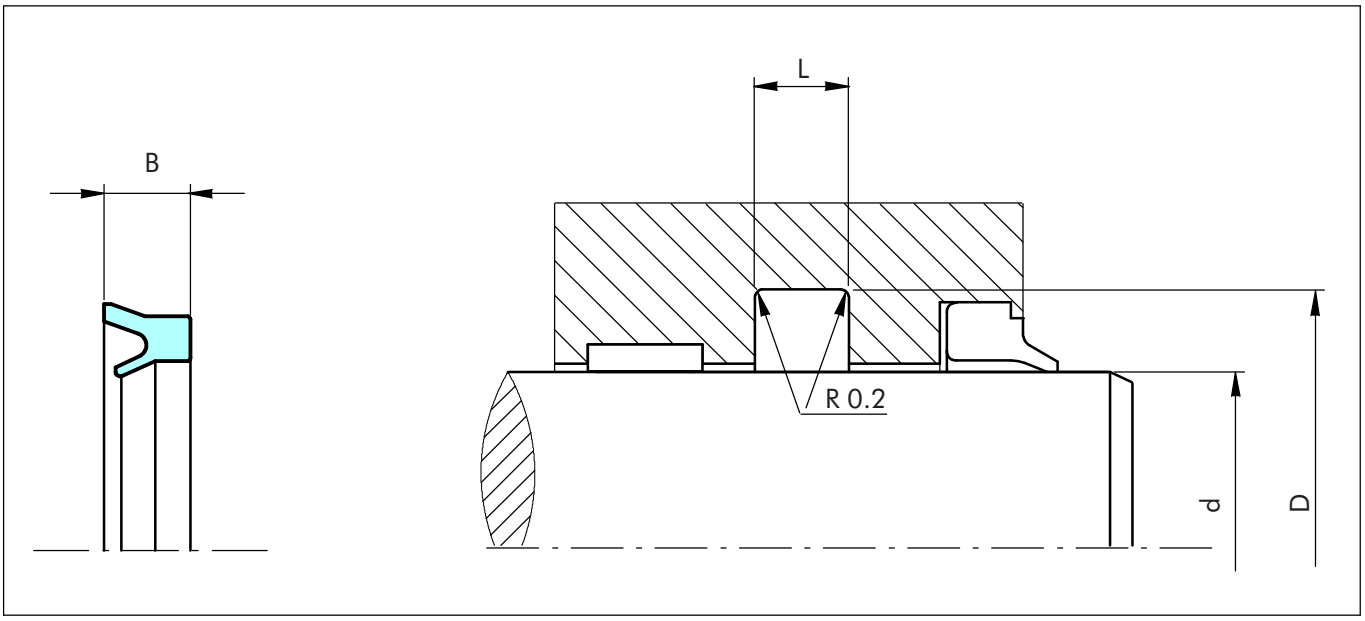


Figure 3 Installation drawing

Table VIII Installation dimensions / Part No.

Rod diam. d f7	Groove diam. D H9	Groove width L +0.5	Ring width B	Part No.
3.0	6.0	3.0	2.5	ARUP00030
4.0	8.0	3.5	3.0	ARUP00040
5.0	9.0	3.0	2.5	ARUP00050
6.0	10.0	3.5	3.0	ARUP00060
6.0	11.0	3.5	3.0	ARUP10060
6.0	12.0	4.5	4.0	ARUP20060
7.0	13.0	4.5	4.0	ARUP00070
8.0	14.0	4.5	4.0	ARUP10080
8.0	14.0	5.0	4.5	ARUP00080
10.0	16.0	5.0	4.5	ARUP00100
10.0	18.0	6.0	5.5	ARUP10100
12.0	20.0	6.0	5.5	ARUP00120
14.0	22.0	6.0	5.5	ARUP00140
16.0	24.0	6.0	5.5	ARUP00160
18.0	26.0	6.0	5.5	ARUP00180
20.0	28.0	6.0	5.5	ARUP00200
22.0	28.0	5.0	4.3	ARUP10220
22.0	30.0	6.0	5.5	ARUP00220
25.0	33.0	6.0	5.5	ARUP00250
28.0	36.0	6.0	5.5	ARUP00280
28.0	38.0	7.5	7.0	ARUP10280
30.0	38.0	6.0	5.5	ARUP00300
30.0	40.0	7.5	7.0	ARUP10300
32.0	40.0	6.0	5.5	ARUP00320

Rod diam. d f7	Groove diam. D H9	Groove width L +0.5	Ring width B	Part No.
35.0	43.0	8.5	8.0	ARUP00350
35.0	45.0	7.5	7.0	ARUP10350
36.0	46.0	7.5	7.0	ARUP00360
40.0	48.0	6.0	5.5	ARUP00400
40.0	50.0	7.5	7.0	ARUP10400
45.0	55.0	7.5	7.0	ARUP00450
50.0	60.0	7.5	7.0	ARUP00500
55.0	65.0	7.5	7.0	ARUP00550
56.0	66.0	7.5	7.0	ARUP00560
60.0	72.0	9.5	8.5	ARUP00600
63.0	73.0	7.5	7.0	ARUP00630
63.0	75.0	9.5	8.5	ARUP10630
65.0	77.0	9.5	8.5	ARUP00650
70.0	82.0	9.5	8.5	ARUP00700
75.0	87.0	9.5	8.5	ARUP00750
80.0	92.0	9.5	8.5	ARUP00800
85.0	97.0	9.5	8.5	ARUP00850
90.0	102.0	9.5	8.5	ARUP00900
95.0	107.0	9.5	8.5	ARUP00950
100.0	115.0	11.0	10.0	ARUP01000
110.0	125.0	11.0	10.0	ARUP01100

Piston Seal - Type APDE

Piston seal type APDE

Description

The APDE seal is designed for use as a piston seal – either single or double acting where two seals are used 'back to back.'

- A dynamic lip with no sharp edges which facilitates sliding. Increased depth within the u-profile to increase flexibility.
- The use of a urethane resin instead of rubber to increase seal life and facilitate the use of non-lubricated air.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A Material No.: WUBE1

Installation

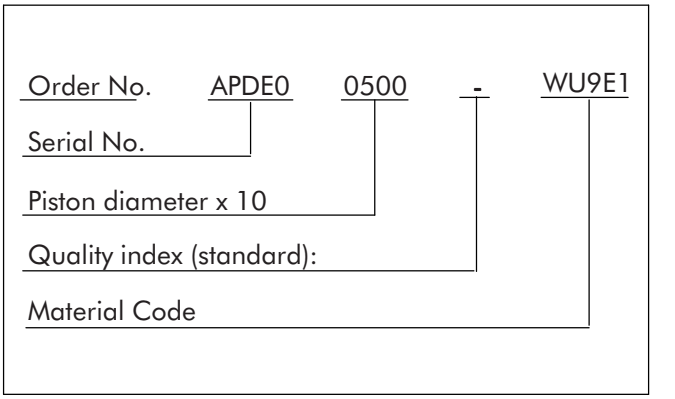
It is important to remove all sharp edges from the groove and piston to prevent damaging the seal.

The seals can be installed more easily if they are greased or oiled.

Ordering example

Piston Seal,
type APDE

Piston diameter:	D = 50 mm
Groove width:	L = 7.5 mm
Part No.:	APDE00500 (Table IX)
Material No.:	WU9E1 (standard)



Piston Seal - Type APDE

Installation recommendation

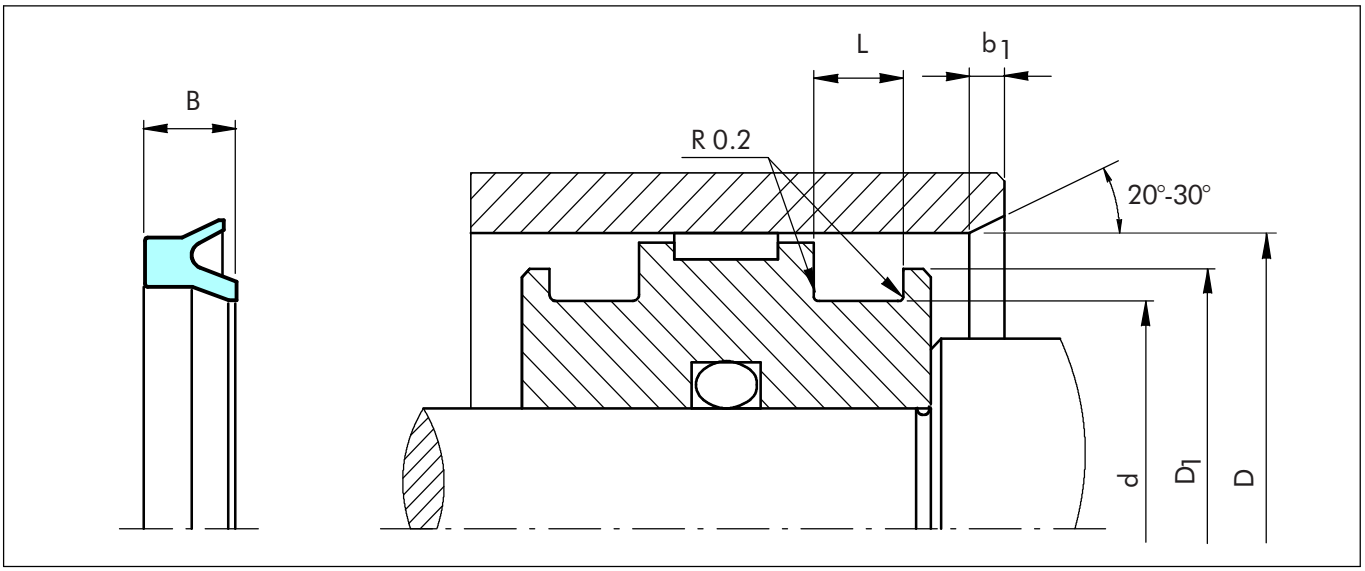


Figure 4 Installation drawing

Table IX Installation dimensions / Part No

Bore diameter	Flange diameter	Groove diameter	Groove width	Ring width	Inlet chamfer	Part No.
D H10	**D_1** h10	**d** h10	**L** +0.2	**B**	**b_1**	
4.0	3.0	1.5	2.0	1.5	1.0	APDE00040
5.0	4.0	2.5	2.0	1.5	1.0	APDE00050
6.0	5.0	3.0	2.5	2.0	1.0	APDE00060
8.0	7.0	4.0	3.0	2.55	1.5	APDE00080
8.0	7.0	4.8	2.7	2.3	1.5	APDE10080
8.0	7.0	4.8	3.0	2.55	1.5	APDE20080
10.0	9.0	6.0	3.0	2.55	1.5	APDE00100
12.0	11.0	7.0	3.0	2.55	1.5	APDE00120
13.0	12.0	8.0	3.0	2.55	1.5	APDE00130
14.0	13.0	8.0	3.0	2.55	1.5	APDE00140
15.0	14.0	9.0	3.0	2.55	1.5	APDE00150
16.0	15.0	10.0	3.0	2.55	2.0	APDE00160
17.0	16.0	11.0	3.0	2.55	2.0	APDE00170
18.0	17.0	12.0	3.0	2.55	2.0	APDE00180
20.0	19.0	12.0	6.0	5.5	2.0	APDE20200
20.0	19.0	14.0	3.0	2.55	2.0	APDE00200
20.0	19.0	14.0	4.5	4.0	2.0	APDE10200
22.0	21.0	16.0	3.0	2.55	2.0	APDE00220
24.0	23.0	18.0	3.0	2.55	2.0	APDE00240
25.0	24.0	17.0	6.0	5.5	2.0	APDE10250
25.0	24.0	19.0	3.5	3.25	2.0	APDE00250
25.0	24.0	19.0	4.5	4.0	2.0	APDE20250
28.0	27.0	18.0	7.5	7.0	2.0	APDE10280
28.0	27.0	22.0	3.5	3.25	2.0	APDE00280

Piston Seal - Type APDE

Bore diameter	Flange diameter	Groove diameter	Groove width	Ring width	Inlet chamfer	Part No.
D H10	**D_1** h10	**d** h10	**L** +0.2	**B**	**b_1**	
30.0	29.0	22.0	3.5	3.25	2.0	APDE00300
32.0	31.0	24.0	3.5	3.25	2.0	APDE00320
32.0	31.0	24.0	6.0	5.5	2.0	APDE10320
35.0	34.0	27.0	3.5	3.25	2.0	APDE00350
36.0	35.0	28.0	3.5	3.25	2.0	APDE00360
38.0	37.0	30.0	3.5	3.25	2.0	APDE00380
38.0	37.0	30.0	6.0	5.5	2.0	APDE10380
40.0	39.0	30.0	7.5	7.0	2.5	APDE00400
40.0	39.0	32.0	3.5	3.25	2.5	APDE10400
42.0	41.0	30.0	6.5	6.0	2.5	APDE10420
42.0	41.0	34.0	3.5	3.25	2.5	APDE00420
45.0	44.0	37.0	3.5	3.25	2.5	APDE00450
50.0	49.0	40.0	7.5	7.0	2.5	APDE00500
50.0	49.0	42.0	3.5	3.25	2.5	APDE10500
52.0	51.0	42.0	4.5	4.25	2.5	APDE00520
55.0	54.0	45.0	7.5	7.0	2.5	APDE00550
58.0	57.0	48.0	4.5	4.25	2.5	APDE00580
60.0	59.0	50.0	5.7	5.0	2.5	APDE00600
60.0	59.0	50.0	7.5	7.0	2.5	APDE10600
63.0	62.0	53.0	4.5	4.25	2.5	APDE10630
63.0	62.0	53.0	7.5	7.0	2.5	APDE00630
65.0	64.0	55.0	7.5	7.0	2.5	APDE00650
68.0	67.0	58.0	5.5	4.7	2.5	APDE00680
70.0	69.0	58.0	9.5	8.5	2.5	APDE00700
75.0	74.0	63.0	9.5	8.5	2.5	APDE00750
80.0	79.0	67.3	7.0	6.35	2.5	ADPE20800
80.0	79.0	68.0	9.5	8.5	2.5	APDE00800
80.0	79.0	70.0	4.5	4.25	2.5	APDE10800
85.0	84.0	73.0	9.5	8.5	2.5	APDE00850
90.0	89.0	78.0	9.5	8.5	2.5	APDE00900
90.0	89.0	80.0	4.5	4.25	2.5	APDE10900
100.0	99.0	88.0	9.5	8.5	2.5	APDE01000
100.0	99.0	90.0	4.5	4.25	2.5	APDE21000
110.0	109.0	95.0	11.0	10.0	3.0	APDE01100
120.0	119.0	105.0	11.0	10.0	3.0	APDE01200
125.0	124.0	105.0	8.5	8.25	3.0	APDE01250
125.0	124.0	110.0	11.0	10.0	3.0	APDE11250
140.0	139.0	120.0	8.5	8.25	3.0	APDE01400
160.0	159.0	140.0	8.5	8.25	3.0	APDE01600
160.0	159.0	145.0	11.0	10.0	3.0	APDE11600
180.0	179.0	160.0	15.0	14.0	3.0	APDE01800
200.0	199.0	180.0	8.5	8.25	3.0	APDE02000
200.0	199.0	180.0	15.0	14.0	3.0	APDE12000
250.0	249.0	230.0	15.0	14.0	3.0	APDE02500

Piston Seal - Type APDS

Piston seal type APDS

Description

The seal type APDS has been specifically designed for use on single acting short stroke cylinders with spring return, having a good guiding system. It has the same profile as the APDE type, but its difference, is in the lower pre-load on the external diameter which reduces both the friction and the break-out pressure.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

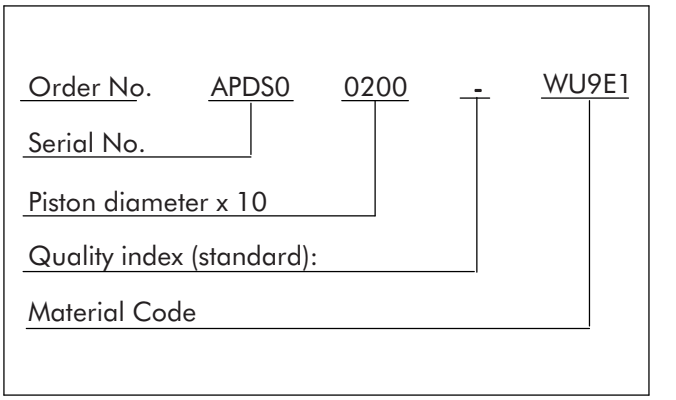
Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A Material No.: WUBE1

Ordering example

Piston Seal,
type APDS
Piston diameter: D = 20 mm
Groove width: L = 3 mm
Part No.: APDS00200 (Table X)
Material No.: WU9E1 (standard)



Piston Seal - Type APDS

Installation recommendation, type APDS

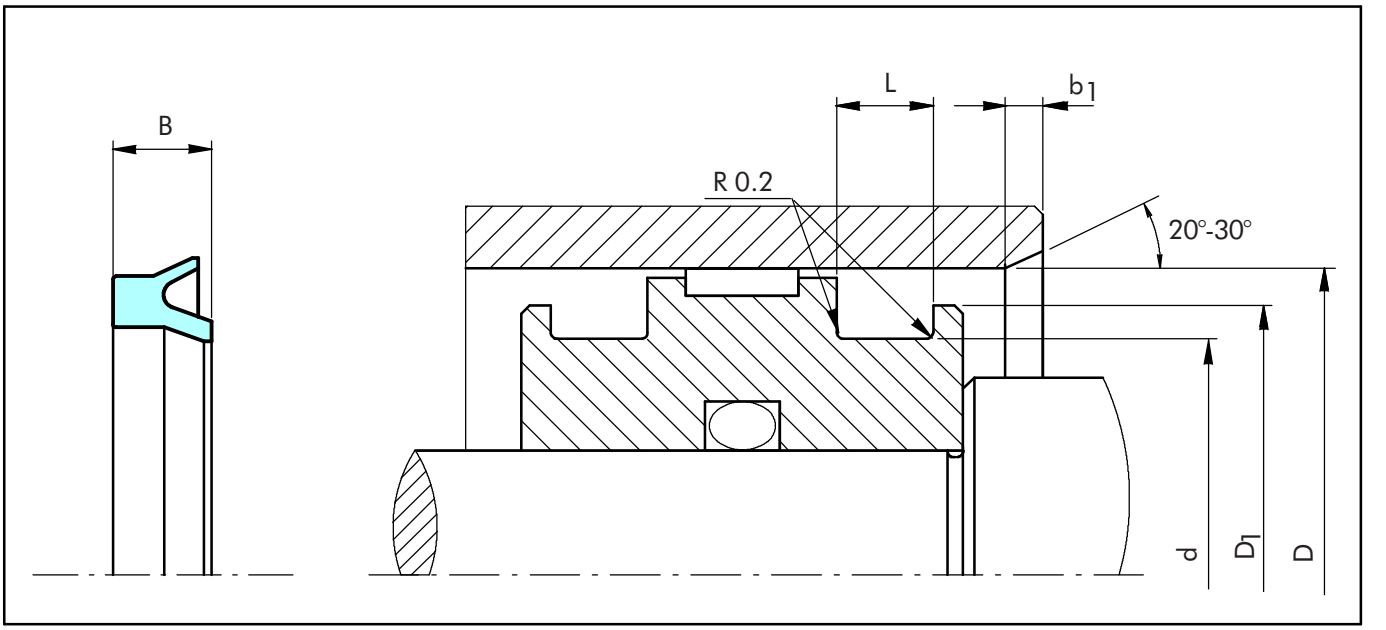


Table X Installation dimensions / Part No.

Bore diameter	Flange diameter	Groove diameter	Groove width	Ring width	Inlet chamfer	Part No.
D H10	**D_1** h10	**d** h10	**L** +0.2	**B**	**b_1**	
6.0	5.0	3.0	2.5	2.0	1.0	APDS00060
8.0	7.0	4.0	3.0	2.55	1.5	APDS00080
8.0	7.0	4.8	2.7	2.3	1.5	APDS10080
8.0	7.0	4.0	3.0	2.55	1.5	APDS20080
10.0	9.0	6.0	3.0	2.55	1.5	APDS00100
12.0	11.0	7.0	3.0	2.55	1.5	APDS00120
13.0	12.0	8.0	3.0	2.55	1.5	APDS00130
14.0	13.0	8.0	3.0	2.55	1.5	APDS00140
15.0	14.0	9.0	3.0	2.55	1.5	APDS00150
16.0	15.0	10.0	3.0	2.55	2.0	APDS00160
17.0	16.0	11.0	3.0	2.55	2.0	APDS00170
18.0	17.0	12.0	3.0	2.55	2.0	APDS00180
20.0	19.0	14.0	3.0	2.55	2.0	APDS00200
22.0	21.0	16.0	3.0	2.55	2.0	APDS00220
24.0	23.0	18.0	3.0	2.55	2.0	APDS00240
25.0	24.0	19.0	3.5	3.25	2.0	APDS00250
28.0	27.0	22.0	3.5	3.25	2.0	APDS00280
30.0	29.0	22.0	3.5	3.25	2.0	APDS00300
32.0	31.0	24.0	3.5	3.25	2.0	APDS00320
35.0	34.0	27.0	3.5	3.25	2.0	APDS00350
40.0	39.0	32.0	3.5	3.25	2.5	APDS10400
50.0	49.0	42.0	3.5	3.25	2.5	APDS00500
63.0	62.0	53.0	4.5	4.25	2.5	APDS00630
80.0	79.0	70.0	4.5	4.25	2.5	APDS00800
100.0	99.0	90.0	4.5	4.25	2.5	APDS01000

Piston Seal - Type APMP

Piston seal type APMP

Description

This seal is suitable for pneumatic cylinders, principally "compact" short stroke single or double acting, or magnetic pistons.

The guiding element for the piston is in the seal itself which is designed with the proper radial and axial gaps to ensure constant lubrication from the entropped grease.

The magnet is housed in a groove between the two opposed seals.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A Material No.: WUBE1

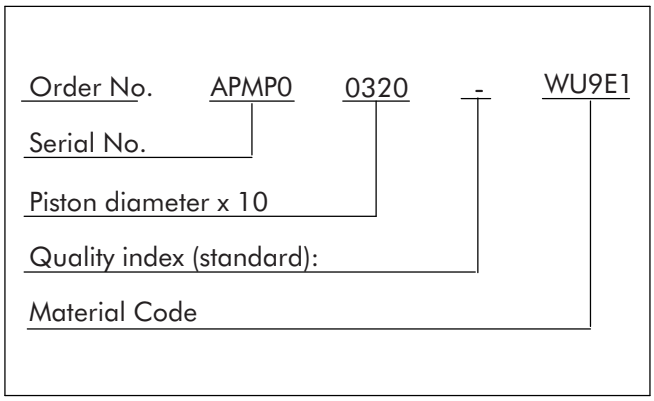
Installation

The installation is done by forced overlapping on the piston diameter, shaped in a proper way, to fit the retainer tooth of the seal.

To increase the sliding effect it is advisable to lubricate the seal.

Ordering example

Piston Seal
type APMP
Piston diameter: D = 32 mm
Magnet groove width: t = 3 mm
Part No.: APMP00320 (Table XII)
Material No.: WU9E1 (standard)



Piston Seal - Type APMP

Installation recommendation, type APMP

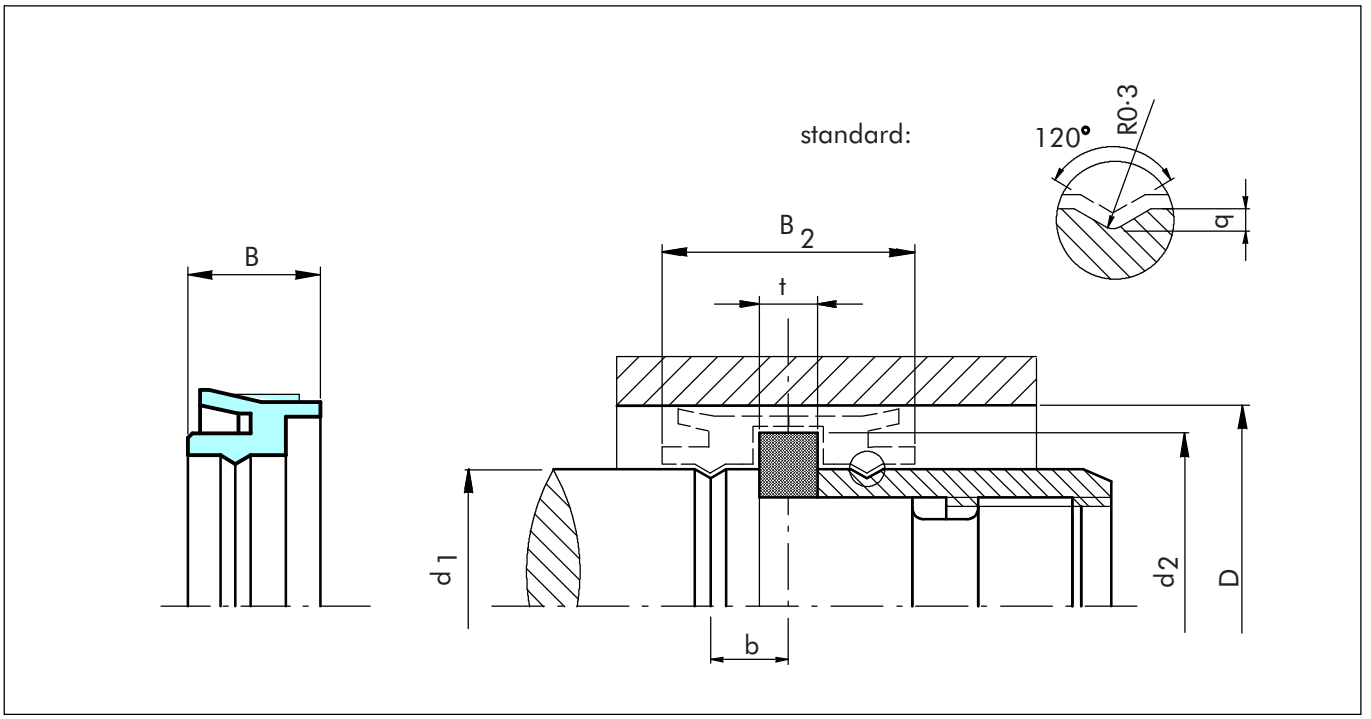


Figure 6 Installation drawing

Table XI Installation dimensions / Part No.

Bore diameter	Piston axial width	Ring width	Magnet groove width	Retainer deviation	Coupling diameter	Retainer depth	Magnet diameter	Part No.
D	B_2	B	t	b	d_1h7	q	d_2	
8.0	12.0	6.0	4.0	4.0	4.0	0.35	6.5	APMP00080
10.0	12.0	6.0	3.0	3.5	4.0	0.35	8.5	APMP00100
12.0	12.0	6.0	3.0	3.5	6.0	0.40	10.5	APMP00120
16.0	12.0	6.0	3.0	3.5	8.0	0.40	14.5	APMP00160
20.0	12.0	6.0	3.0	3.5	10.0	0.50	18.0	APMP00200
25.0	12.0	6.0	3.0	3.5	10.0	0.50	23.0	APMP00250

Piston Seal - Type APMP

Installation recommendation, type APMP

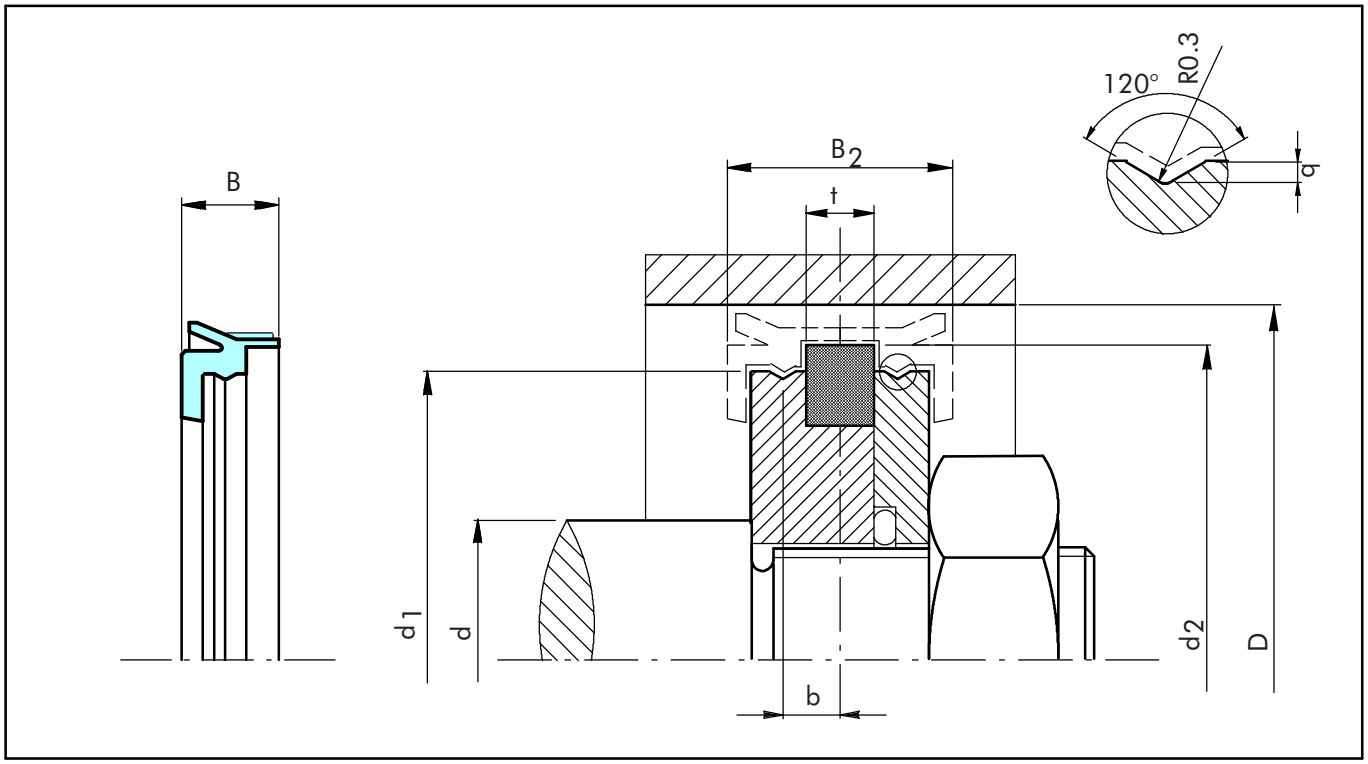


Figure 7 Installation drawing

Table XII Installation dimensions / Part No.

Bore diameter	Seal axial width	Ring width	Magnet groove width	Retainer deviation	Piston diameter	Retainer depth	Rod diameter	Magnet diameter	Part No.
D	B_2	B	t	b	d_1h7	q	dh7	d_2	
32.0	14.0	7.0	3.0	4.0	26.0	0.5	12.0	29.5	APMP00320
32.0	14.0	7.0	5.0	4.0	26.0	0.5	12.0	29.5	APMP10320
40.0	14.5	7.25	5.0	4.25	34.0	0.5	12.0	37.5	APMP00400
50.0	14.5	7.25	5.0	4.25	43.0	0.6	16.0	46.5	APMP00500
63.0	20.0	10.0	5.0	6.0	55.0	0.8	16.0	59.5	APMP00630
80.0	22.0	11.0	5.0	6.5	72.0	0.8	20.0	76.5	APMP00800
100.0	26.0	13.0	5.0	7.5	90.0	0.8	25.0	96.5	APMP01000

Seal-Scraper type AWNS

Description

The seal-scraper type AWNS is designed as a combination asymmetric lip seal with an integral wiper element, and as such, only requires a single groove and not two as in the traditional system.

The reduction of the overall dimensions and the execution of a single groove together with a single polyurethane seal gives considerable economic advantages.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A, Material No.: WUBE1

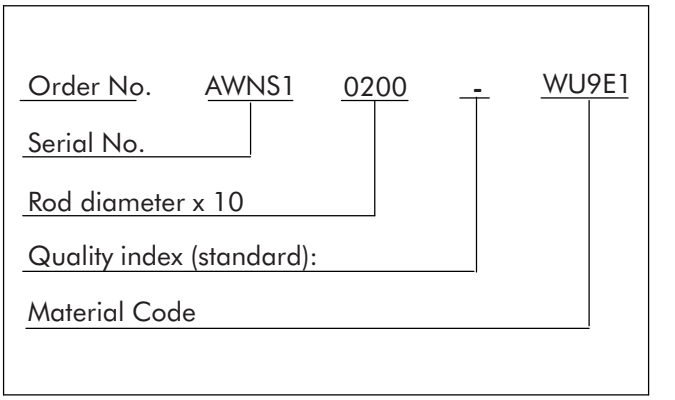
Installation

It is advised to always grease the seal on installation.

Ordering example

Seal-scraper,
type AWNS

Rod diameter:	d = 20 mm
Groove width:	L = 7 mm
Part No.:	AWNS10200 (Table XIII)
Material No.	WU9E1 (standard)



Seal-Scraper - Type AWNS

Installation recommendation, type AWNS

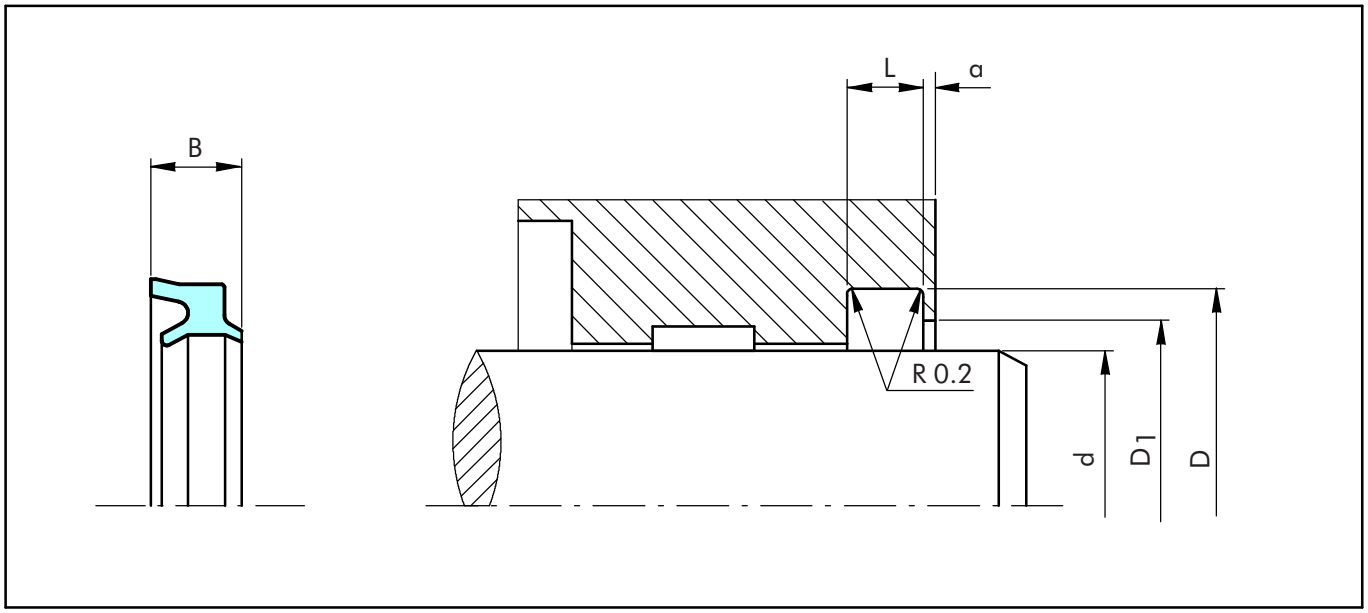


Figure 8 Installation drawing

Table XIII Installation dimensions / Part No.

Rod diameter	Groove diameter	Groove width	Couplin diameter	Ring width	Step width	Part No.
d f7	**D** H10	**L** +0.15	**D_1** H11	**B**	min **a**+0.1	
3.0	8.8	4.5	5.0	5.2	1.2	AWNS00030
4.0	8.8	4.5	6.0	5.2	1.2	AWNS00040
4.0	7.0	2.7	5.4	2.8	1.0	AWNS10040
5.0	8.0	2.7	6.2	2.8	1.0	AWNS00050
6.0	9.0	2.7	7.2	2.8	1.0	AWNS10060
6.0	10.8	4.5	8.0	5.2	1.2	AWNS00060
8.0	11.5	3.0	9.2	3.2	1.0	AWNS10080
8.0	12.8	4.5	10.0	5.2	1.2	AWNS00080
8.0	14.0	4.5	11.0	5.2	1.2	AWNS20080
10.0	14.0	3.2	11.4	3.7	1.0	AWNS10100
10.0	16.0	4.0	12.5	4.6	1.0	AWNS20100
10.0	16.8	4.5	13.0	5.2	1.2	AWNS00100
10.0	18.0	5.0	14.0	6.0	1.6	AWNS30100
12.0	16.5	3.7	13.7	4.0	1.2	AWNS40120
12.0	18.0	4.0	14.5	4.8	1.2	AWNS00120
12.0	20.0	3.7	16.0	5.7	1.6	AWNS60120
12.0	20.0	5.0	16.0	6.0	1.6	AWNS10120
12.0	20.0	5.5	16.0	6.5	1.6	AWNS20120
12.0	22.0	6.0	16.0	6.5	1.5	AWNS30120
12.0	22.0	7.0	16.0	7.5	1.5	AWNS50120
14.0	18.5	3.7	15.7	4.0	1.2	AWNS20140
14.0	20.0	4.0	16.5	4.8	1.2	AWNS00140
14.0	22.0	5.0	18.0	6.0	1.5	AWNS30140

Seal-Scraper - Type AWNS

Rod diameter	Groove diameter	Groove width	Coupling diameter	Ring width	Step width	Part No.
d f7	**D** H 10	**L** +0.15	**D_1** H11	**B**	min **a**+0.1	
14.0	24.0	6.0	18.0	6.5	1.5	AWNS10140
15.0	22.0	4.0	18.0	5.0	1.5	AWNS00150
16.0	20.5	3.7	17.7	4.0	1.2	AWNS20160
16.0	22.0	4.0	18.5	5.0	1.2	AWNS00160
16.0	24.0	5.0	18.5	6.0	1.5	AWNS30160
16.0	26.0	6.0	20.0	6.5	1.5	AWNS10160
18.0	22.5	3.7	19.7	4.0	1.2	AWNS10180
18.0	24.0	4.0	20.5	5.0	1.4	AWNS20180
18.0	26.0	5.0	21.0	6.0	1.6	AWNS30180
18.0	28.0	6.0	22.0	6.5	1.5	AWNS00180
20.0	25.0	4.0	21.9	4.6	1.2	AWNS20200
20.0	26.0	4.0	22.5	4.8	1.2	AWNS00200
20.0	30.0	7.0	24.0	7.5	1.5	AWNS10200
22.0	27.0	4.0	23.9	4.6	1.2	AWNS00220
22.0	28.0	4.0	24.5	5.0	1.4	AWNS10220
22.0	32.0	7.0	26.0	7.5	1.5	AWNS20220
25.0	30.0	4.0	26.9	4.6	1.2	AWNS20250
25.0	31.0	4.0	27.5	4.8	1.2	AWNS00250
25.0	35.0	7.0	29.0	7.5	1.5	AWNS10250
28.0	38.0	7.0	32.0	7.5	1.5	AWNS00280
30.0	35.5	4.55	32.1	5.0	1.2	AWNS10300
30.0	38.0	5.0	33.0	5.8	1.5	AWNS20300
30.0	40.0	7.0	34.0	7.5	1.5	AWNS00300
32.0	37.5	4.55	34.1	5.0	1.2	AWNS20320
32.0	40.0	5.0	35.0	5.8	1.3	AWNS10320
32.0	42.0	7.0	36.0	7.5	1.5	AWNS00320
35.0	45.0	7.0	39.0	7.5	1.5	AWNS00350
36.0	44.0	5.0	39.0	6.0	1.3	AWNS00360
36.0	46.0	7.0	40.0	7.5	1.5	AWNS10360
40.0	46.0	4.9	42.2	5.5	1.4	AWNS10400
40.0	50.0	7.0	44.0	7.5	1.5	AWNS00400
45.0	53.0	5.0	48.0	6.0	1.3	AWNS00450
45.0	55.0	7.0	49.0	7.5	1.5	AWNS10450
50.0	62.0	8.5	55.0	9.0	2.0	AWNS00500
70.0	80.0	6.0	75.0	7.0	1.5	AWNS00700

Seal-Scraper - Type AWSD

Seal-scraper type AWSD

Description

As with seal type AWNS, the AWSD type is also designed as a combination asymmetric lip seal with an integral wiper.
The AWSD type has a step profile that will facilitate the installation especially for the small diameters. This wiper has a rounded wiping lip.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1
Alternative Material	Polyurethane, 85 Shore A Material No.: WUBE1

Installation

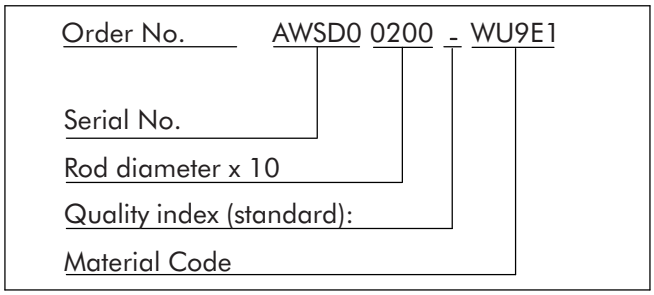
It is important to remove all sharp edges from the groove and cylinder to prevent damage to the seals.

Attention

In the case of high pressure duty applications with misalignment or eccentricity and for all rod diameters above 20 mm, we recommend only the groove design with oversized step (type L_1 in Fig.9, page 21).

Ordering example

Rod wiper, type AWSD	
Rod diameter:	d = 20 mm
Groove width:	L = 4 mm
Part No.:	AWSD 00200 (Table XIV)
Material No.:	WU9E1 (standard)



Seal-Scraper - Type AWSD

Installation recommendation, type AWSD

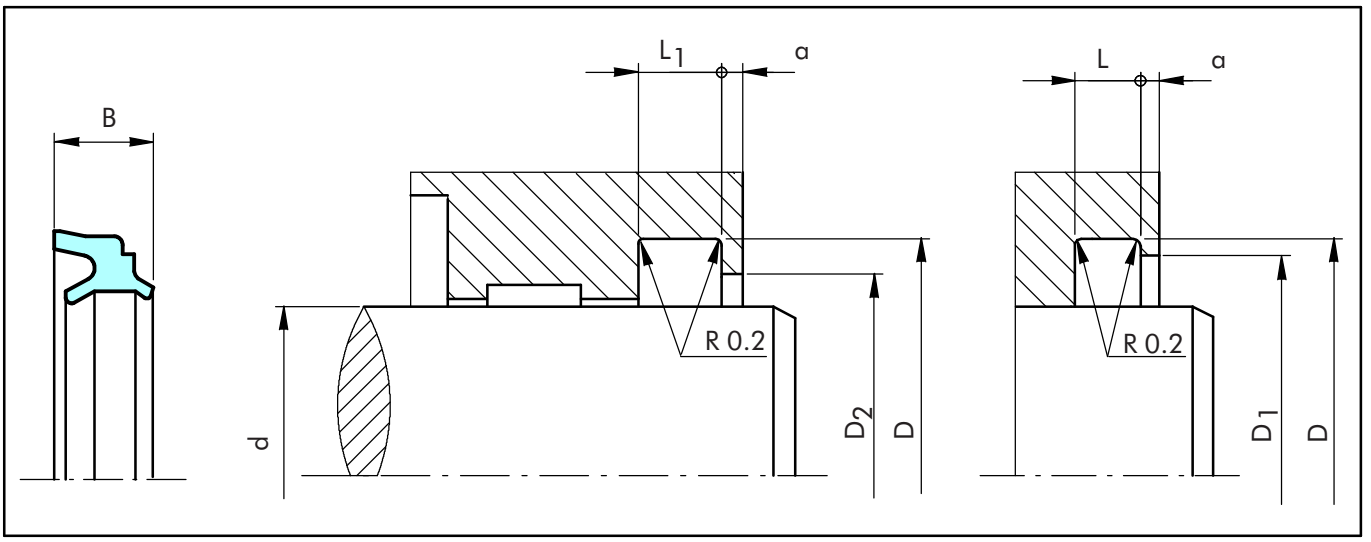


Figure 9 Installation Drawing

Table XIV Installations dimensions / Part No.

Rod diameter	Groove diameter	Groove width	Groove width	Tooth width	Step diameter	Step diameter	Ring width	Part No.
d e9	**D** H10	**L** +0.15	**L_1** +0.15	**a** +0.1	**D_1** H11	**D_2** H11	**B**	
4.0	8.1	3	3.8	0.8	6.7	6.1	4.0	AWSD00040
6.0	11.1	3.6	4.6	1.0	9.1	8.5	5.0	AWSD00060
8.0	14.1	3.6	4.6	1.0	12.1	11.1	5.0	AWSD00080
10.0	16.1	4.2	5.4	1.2	14.1	13.1	6.0	AWSD00100
12.0	18.1	4.2	5.4	1.2	15.5	14.9	6.0	AWSD00120
12.0	20.0	4.0	6.0	2.0	18.0	15.5	8.0	AWSD10120
14.0	22.0	4.0	6.0	2.0	20.0	17.5	8.0	AWSD00140
16.0	24.0	4.0	6.0	2.0	22.0	19.5	8.0	AWSD00160
18.0	26.0	4.0	6.0	2.0	24.0	21.5	8.0	AWSD00180
20.0	28.0	4.0	6.0	2.0	26.0	23.5	8.0	AWSD00200
22.0	30.0	4.0	6.0	2.0	28.0	25.5	8.0	AWSD00220
25.0	33.0	4.0	6.0	2.0	31.0	28.5	8.0	AWSD00250
28.0	36.0	4.0	6.0	2.0	34.0	31.5	8.0	AWSD00280
30.0	38.0	4.0	6.0	2.0	36.0	33.5	8.0	AWSD10300
32.0	40.0	4.0	6.0	2.0	38.0	35.5	8.0	AWSD00320
35.0	43.0	4.0	6.0	2.0	41.0	38.5	8.0	AWSD00350
36.0	44.0	4.0	6.0	2.0	42.0	39.5	8.0	AWSD00360
40.0	48.0	4.0	6.0	2.0	46.0	43.5	8.0	AWSD00400
42.0	50.0	4.0	6.0	2.0	48.0	45.5	8.0	AWSD00420
45.0	53.0	4.0	6.0	2.0	51.0	48.5	8.0	AWSD00450
50.0	58.0	4.0	6.0	2.0	56.0	53.5	8.0	AWSD00500
55.0	63.0	4.0	6.0	2.0	61.0	58.5	8.0	AWSD00550
56.0	64.0	4.0	6.0	2.0	62.0	59.5	8.0	AWSD00560

Seal-Scraper - Type AWSD

Rod diameter	Groove diameter	Groove width	Groove width	Step width	Coupling diameter	Coupling diameter	Ring width	Part No.
d e9	**D** H10	**L** +0.15	L_1 +0.15	**a**+0.1	D_1 H11	D_2 H11	**B**	
60.0	68.0	4.0	6.0	2.0	66.0	63.5	8.0	AWSD00600
63.0	71.0	4.0	6.0	2.0	69.0	66.5	8.0	AWSD00630
65.0	73.0	4.0	6.0	2.0	71.0	68.5	8.0	AWSD00650
70.0	78.0	4.0	6.0	2.0	76.0	73.5	8.0	AWSD00700
75.0	83.0	4.0	6.0	2.0	81.0	78.5	8.0	AWSD00750
80.0	88.0	4.0	6.0	2.0	86.0	83.5	8.0	AWSD00800
85.0	93.0	4.0	6.0	2.0	91.0	88.5	8.0	AWSD00850
90.0	98.0	4.0	6.0	2.0	96.0	93.5	8.0	AWSD00900
100.0	108.0	4.0	6.0	2.0	106.0	103.5	8.0	AWSD01000

Seal-Scraper - Type ARAN

Seal-Scraper type ARAN

Description

The particular profile of this seal and the shape of the groove permits very fast installation either automatically or manually.
Also the installation is facilitated by an axial milling on the external side of the groove.
This profile minimises the risk of ingress of impurities.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1

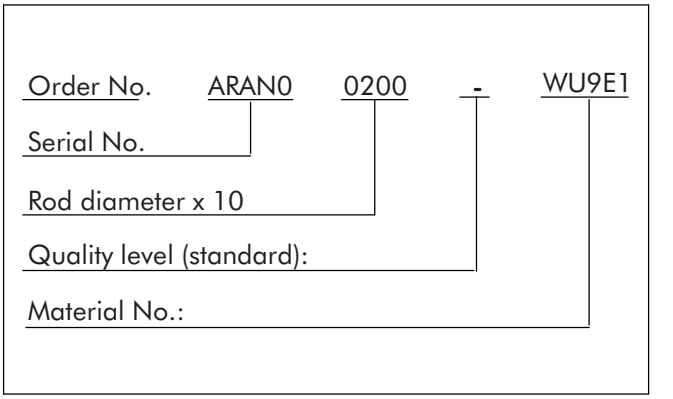
Installation

We recommend the use of a lubricant (grease) on the inside of the wiper, but not on the groove and the elimination of all sharp edges which could damage the seal.

Ordering example

Rod wiper,
type ARAN

Rod diameter:	d = 20 mm
Groove width:	L = 8.8 mm
Part No.:	ARAN00200 (Table XV)
Material No.:	WU9E1 (standard)



Seal-Scraper - Type ARAN

Installation recommendation type ARAN

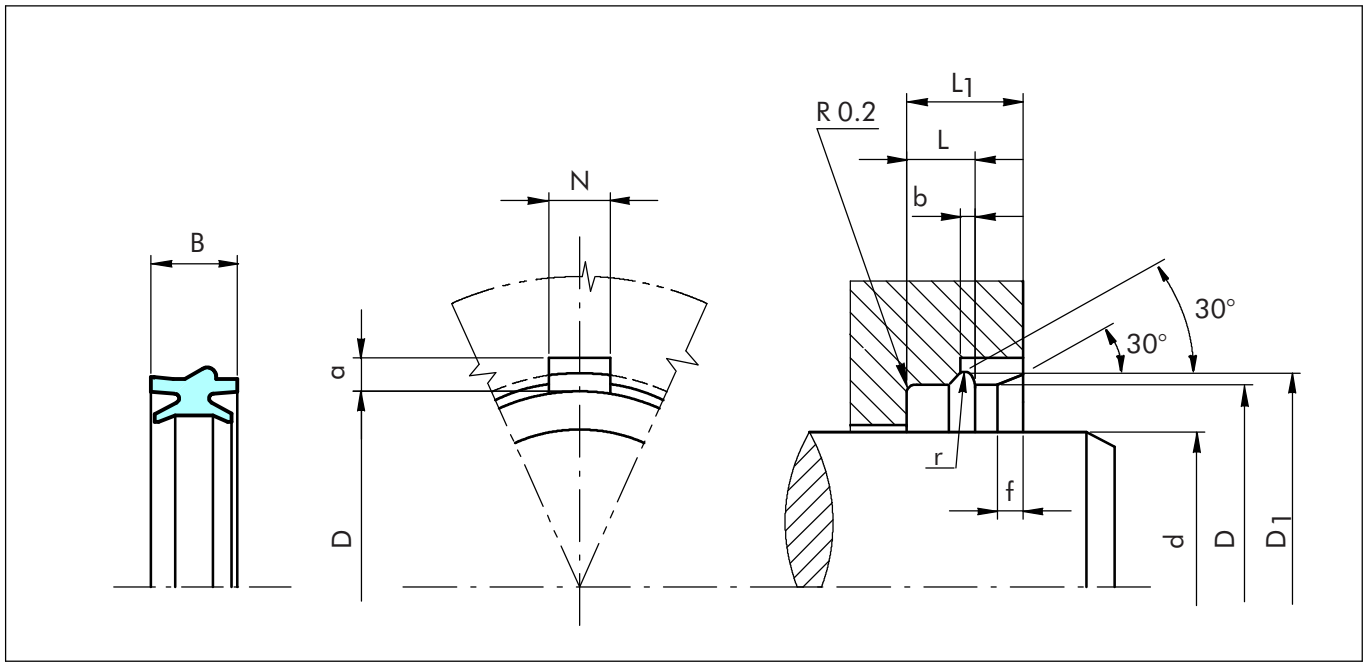


Figure 10 Installation drawing

Table XV Installation dimensions / Part No.

Rod diameter	Groove dimensions									Ring width	Part No.
d e9	**D** H10	**D1** H10	**L1**+0.15	**L**+0.25	**b**	**r**	**a**	**N**	**f**	**B**	
12.0	20.0	22.0	13.0	8.8	2.2	1.1	1.8	4.0	1.5	10.7	ARAN00120
12.0	22.0	24.0	13.0	8.8	2.2	1.1	1.8	4.0	1.5	10.7	ARAN10120
16.0	26.0	28.0	13.0	8.8	2.2	1.1	1.8	5.0	1.5	10.7	ARAN00160
18.0	26.0	28.0	13.0	8.8	2.2	1.1	1.8	5.0	1.5	10.7	ARAN00180
18.0	28.0	30.0	13.0	8.8	2.2	1.1	1.8	5.0	1.5	10.7	ARAN10180
20.0	30.0	32.0	13.0	8.8	2.2	1.1	1.8	5.0	1.5	10.7	ARAN00200
22.0	32.0	34.5	14.0	9.4	2.8	1.4	2.0	7.5	2.0	11.2	ARAN00220
25.0	35.0	37.5	14.0	9.4	2.8	1.4	2.0	7.5	2.0	11.2	ARAN00250
30.0	40.0	42.5	14.0	9.4	2.8	1.4	2.0	7.5	2.0	11.2	ARAN00300
32.0	42.0	44.5	14.0	9.4	2.8	1.4	2.0	7.5	2.0	11.2	ARAN00320
40.0	50.0	52.5	14.0	9.4	2.8	1.4	2.0	7.5	2.0	11.2	ARAN00400
45.0	55.0	58.2	15.0	10.4	3.6	1.8	2.5	10.0	2.0	12.2	ARAN00450
50.0	60.0	63.2	15.0	10.4	3.6	1.8	2.5	10.0	2.0	12.2	ARAN00500
63.0	75.0	78.2	16.0	11.4	3.6	1.8	2.5	10.0	2.0	13.0	ARAN00630

Scraper - Type AWSW

Scraper type AWSW

Description

The type AWSW is a single acting scraper and it is similar to the ASW used in hydraulics.
The radial pre-load on the outside diameter remains unchanged, and this facilitates perfect sealing.
The wiping lip has a rounded profile which reduces the friction on the return stroke and keeps the lubrication on the rod.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1

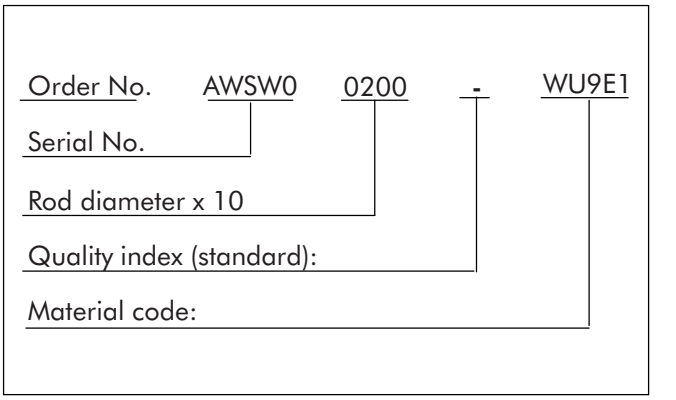
Installation

The installation is very simple; the profile enables automatic installation after lubrication with grease which always gives longer service life.

Ordering example

Rod wiper,
type AWSW

Rod diameter:	d = 20 mm
Groove width:	L = 4 mm
Part No.:	AWSW 00200 (Table. XVI)
Material No.:	WU9E1 (standard)



Scraper - Type AWSW

Installation recommendation, type AWSW

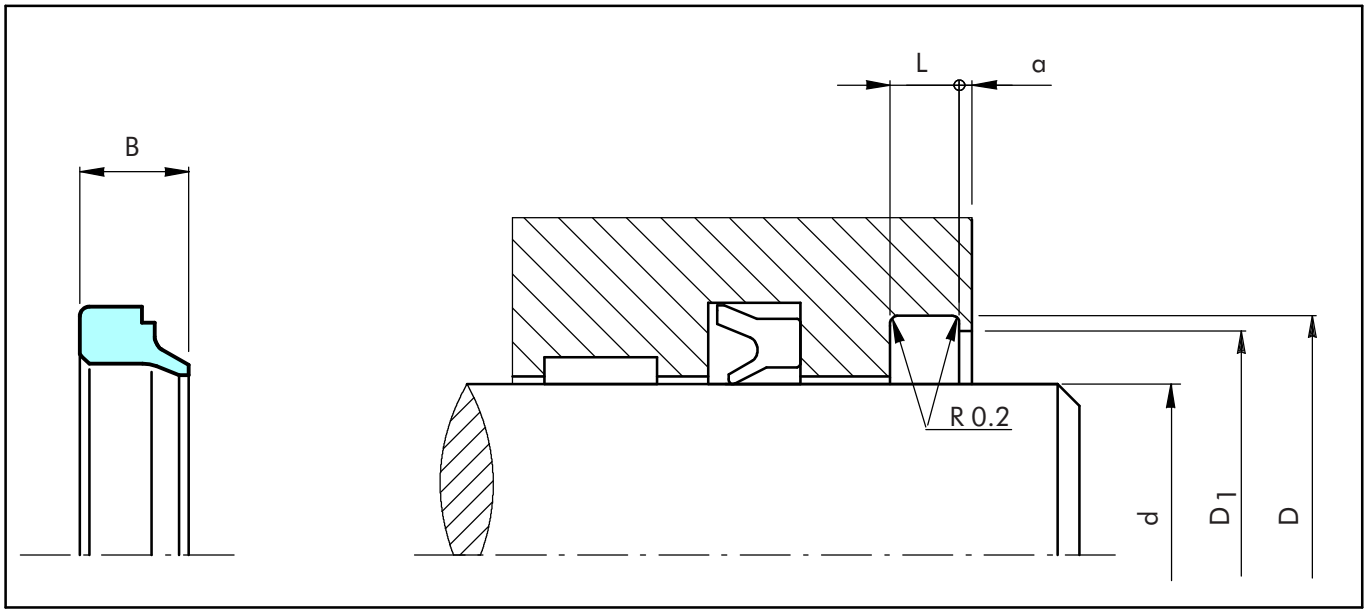


Figure 11 Installation drawing

Table XVI Installation dimensions / Part No.

Rod diameter	Groove diameter	Groove width	Coupling diameter	Step width	Ring width	Part No.
d f7	**D** H11	**L** +0.15	**D_1** H11	**a** min.	**B**	
6.0	10.0	2.0	8.0	1.0	4.0	AWSW00060
8.0	14.0	2.5	12.0	1.0	5.0	AWSW00080
10.0	18.0	4.0	16.0	1.0	7.0	AWSW00100
10.0	16.0	2.5	14.0	1.0	5.0	AWSW10100
12.0	20.0	4.0	18.0	1.0	7.0	AWSW00120
12.0	18.0	2.5	16.0	1.0	5.0	AWSW10120
14.0	22.0	4.0	20.0	1.0	7.0	AWSW00140
14.0	20.0	2.5	18.0	1.0	5.0	AWSW10140
16.0	24.0	4.0	22.0	1.0	7.0	AWSW00160
18.0	26.0	4.0	24.0	1.0	7.0	AWSW00180
20.0	28.0	4.0	26.0	1.0	7.0	AWSW00200
22.0	30.0	4.0	28.0	1.0	7.0	AWSW00220
25.0	33.0	4.0	31.0	1.0	7.0	AWSW00250
28.0	36.0	4.0	34.0	1.0	7.0	AWSW00280
30.0	38.0	4.0	36.0	1.0	7.0	AWSW00300
32.0	40.0	4.0	38.0	1.0	7.0	AWSW00320
35.0	43.0	4.0	41.0	1.0	7.0	AWSW00350
36.0	44.0	4.0	42.0	1.0	7.0	AWSW00360
38.0	46.0	4.0	44.0	1.0	7.0	AWSW00380
40.0	48.0	4.0	46.0	1.0	7.0	AWSW00400
42.0	50.0	4.0	48.0	1.0	7.0	AWSW00420

Scraper - Type AWSW

Rod diameter	Groove diameter	Groove width	Coupling diameter	Step width	Ring width	Part No.
d f7	**D** H11	**L** +0.15	**D_1** H11	**a** min.	**B**	
45.0	53.0	4.0	51.0	1.0	7.0	AWSW00450
50.0	58.0	4.0	56.0	1.0	7.0	AWSW00500
55.0	63.0	4.0	61.0	1.0	7.0	AWSW00550
56.0	64.0	4.0	62.0	1.0	7.0	AWSW00560
60.0	68.0	4.0	66.0	1.0	7.0	AWSW00600

Cushioning Seal - Type AICM

Cushioning seal, type AICM

Description

The cushioning seal has been designed specifically for use in braking systems at the end stroke of the piston, in pneumatic cylinders.
The profile eliminates the limitations in this particular application that some seal types, like O-rings and lip seals have.
The inlet chamfer on the sealing lip and the groove on the sealing border at the bottom makes the cushioning very effective.
Another advantage is the utilisation of polyurethane, which with its high impact and abrasion resistance gives the part a very long life.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

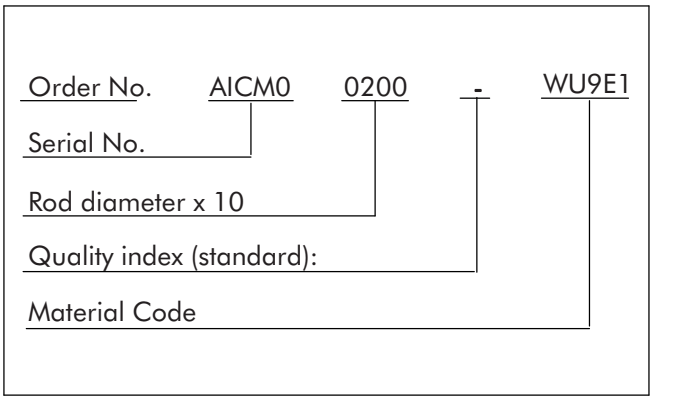
Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1

Installation

The installation is simple, we recommend lubricating the seal with grease.

Ordering example

Cushioning seal,
type AICM
Rod diameter: d = 20 mm
Groove width: L = 7 mm
Part No.: AICM00200 (Tab. XVIII)
Material No.: WU9E1 (standard)



Cushioning Seal - Type AICM

Installation recommendation, type AICM

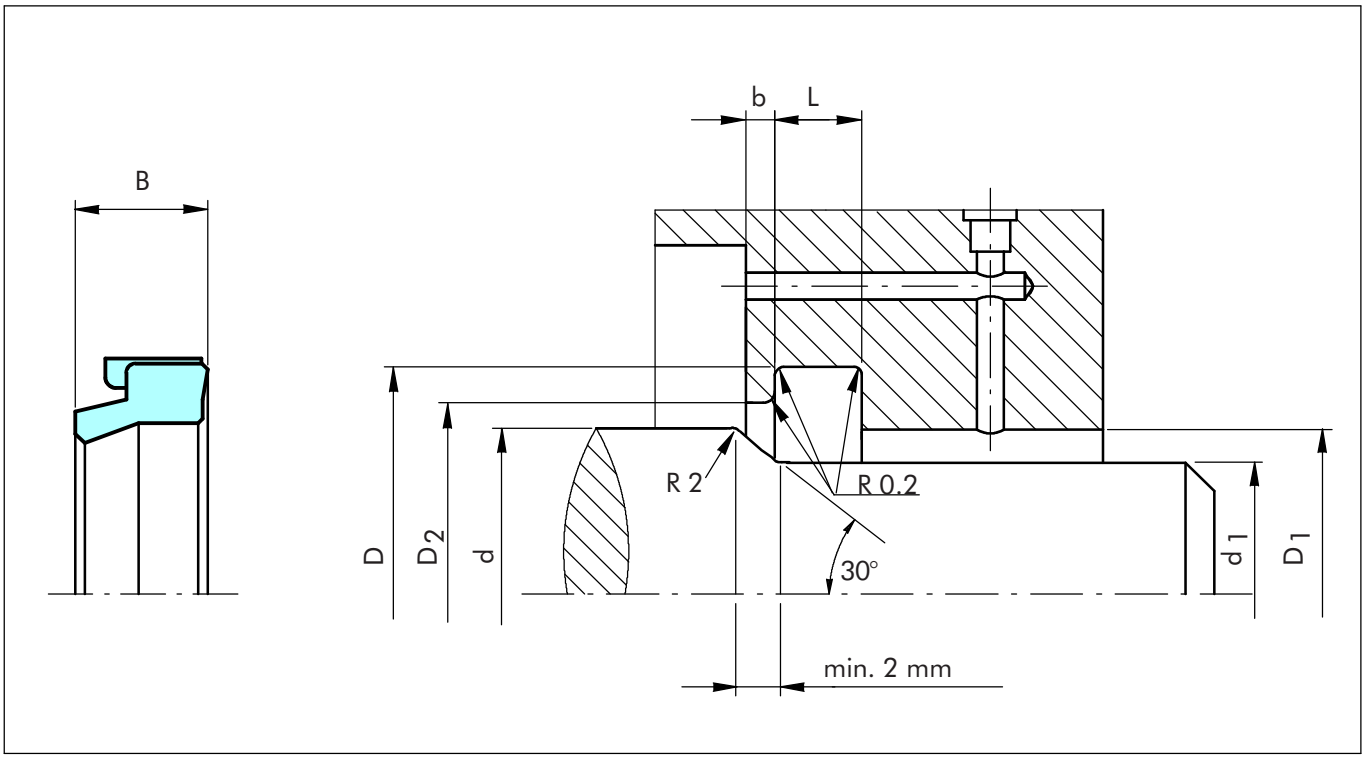


Figure 13 Installation drawing

Table XVIII Installation dimensions / Part No.

Rod diameter	Groove dimensions						Ring width	Part No.
d h10	**D** H11	**D_1** H11	**D_2** H11	**L** ±0.1	**d_1** h11	**b** +0.2	**B**	
6.0	10.0	6.5	8.0	3.7	4.5	2.0	4.0	AICM00060
8.0	11.6	8.5	10.0	3.3	7.0	2.0	3.5	AICM00080
9.5	15.0	10.0	12.0	4.5	8.0	2.0	4.5	AICM00095
10.0	18.0	11.0	15.0	7.0	8.0	2.0	7.8	AICM00100
12.0	18.0	13.0	15.5	4.8	10.0	2.0	5.0	AICM10120
12.0	20.0	13.0	17.0	7.0	10.0	2.0	7.8	AICM00120
14.0	22.0	15.0	19.0	7.0	12.0	2.0	7.8	AICM00140
16.0	22.0	17.0	19.5	5.2	14.0	2.0	5.5	AICM10160
16.0	24.0	17.0	21.0	7.0	14.0	2.0	7.8	AICM00160
18.0	26.0	19.0	23.0	7.0	16.0	2.0	7.8	AICM00180
20.0	28.0	21.0	24.0	7.0	17.5	2.0	7.8	AICM00200
22.0	30.0	23.0	26.0	7.0	19.5	2.0	7.8	AICM00220
25.0	33.0	26.0	29.0	7.0	22.5	2.0	7.8	AICM00250
28.0	36.0	29.0	32.0	7.0	25.5	2.0	7.8	AICM00280
30.0	40.0	31.5	35.0	7.0	27.5	2.0	7.8	AICM00300
32.0	42.0	33.5	37.0	7.0	29.0	2.0	7.8	AICM00320
36.0	46.0	37.5	41.0	7.0	33.0	2.0	7.8	AICM00360
40.0	50.0	41.5	45.0	7.0	37.0	2.0	7.8	AICM00400
50.0	60.0	51.5	55.0	7.0	47.0	2.0	7.8	AICM00500
57.0	74.0	60.0	65.0	12.5	54.0	2.0	11.0	AICM00570

Cushioning Seal - Type AIAS

Cushioning Seal, type AIAS

Description

The cushioning seal type AIAS provides cushioning at the end of the stroke in pneumatic cylinders and is designed for a smaller groove than type AICM.
As can be seen in the dimensions list, this profile for a cushioning seal can substitute a standard O-Ring.
This permits to a reduction in the dimensions of the cylinder head.

Technical data

Operating pressure:	1.6 MPa
Speed:	≤ 1 m/s
Temperature:	from -30 °C to +80 °C
Media:	Dry or lubricated air, mineral oils and greases, non-aggressive gases

Material

The standard material is a polyurethane with a very high wear resistance and good flexibility at low temperatures.

Standard Material	Polyurethane, 90 Shore A, Material No.: WU9E1

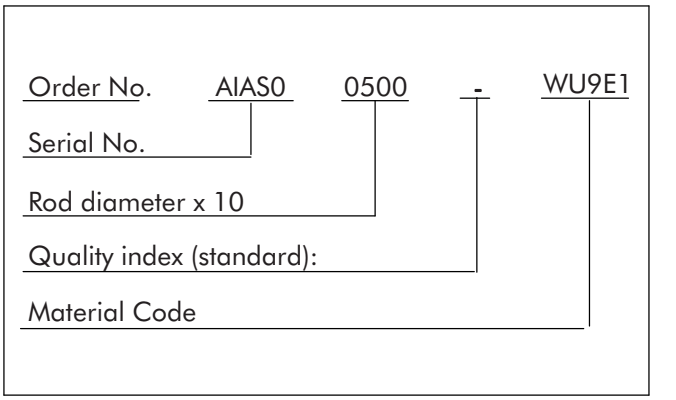
Installation

The installation is simple, we recommend lubricating the seal with grease.

Ordering example

Cushioning seal,
type AIAS

Rod diameter:	d = 50 mm
Groove width:	L = 6 mm
Part No.:	AIAS00500 (Table XIX)
Material No.:	WU9E1 (standard)



Cushioning Seal - Type AIAS

Installation recommendation, type AIAS

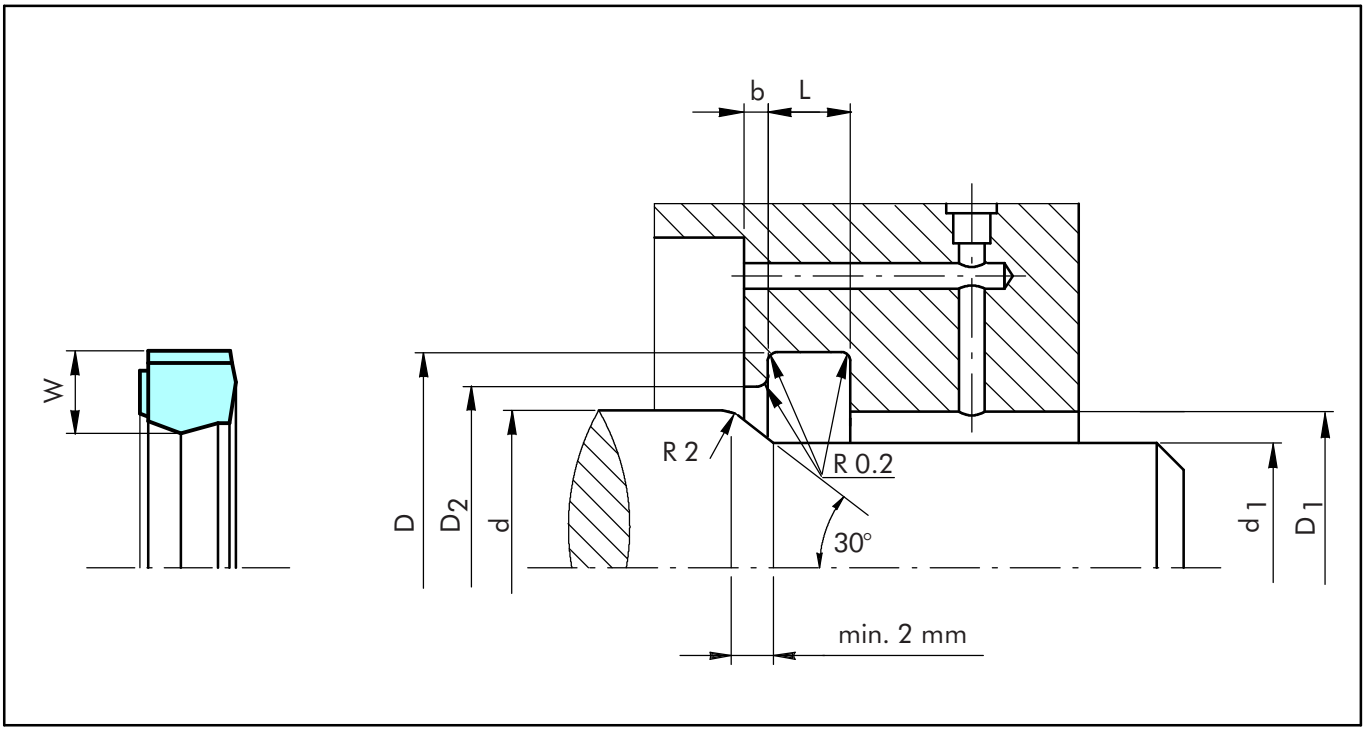


Figure 14 Installation drawing

Table XIX Installation dimensions / Part No.

Rod diameter	Groove dimensions						Ring width	Part No.
d h10	**D** H11	**D_1** H11	**D_2** H11	**L** ±0.1	**d_1** h11	**b** +0.2	**W**	
10.0	18.0	10.5	12.0	4.8	7.0	2.0	4.0	AIAS00100
12.0	20.0	12.5	14.0	4.8	9.0	2.0	4.0	AIAS00120
14.0	22.0	14.5	16.0	4.8	11.0	2.0	4.0	AIAS00140
16.0	24.0	16.5	18.0	4.8	13.0	2.0	4.0	AIAS00160
18.0	26.0	18.5	20.0	4.8	15.0	2.0	4.0	AIAS00180
20.0	28.0	20.5	22.0	4.8	17.0	2.0	4.0	AIAS00200
22.0	30.0	22.5	24.0	4.8	18.0	2.0	4.0	AIAS00220
24.0	32.0	24.5	26.0	4.8	20.0	2.0	4.0	AIAS00240
25.0	33.0	25.5	27.0	4.8	21.0	2.0	4.0	AIAS00250
26.0	36.0	26.5	28.0	6.0	22.0	2.0	5.0	AIAS00260
28.0	38.0	28.6	30.0	6.0	24.0	2.0	5.0	AIAS00280
30.0	40.0	30.6	32.0	6.0	26.0	2.0	5.0	AIAS00300
32.0	42.0	32.6	34.0	6.0	28.0	2.0	5.0	AIAS00320
34.0	44.0	34.6	36.0	6.0	30.0	2.0	5.0	AIAS00340
35.0	45.0	35.6	37.0	6.0	31.0	2.0	5.0	AIAS00350
36.0	46.0	36.6	38.0	6.0	32.0	2.0	5.0	AIAS00360
38.0	48.0	38.6	40.0	6.0	34.0	2.0	5.0	AIAS00380
40.0	50.0	40.6	42.0	6.0	36.0	2.0	5.0	AIAS00400
45.0	55.0	45.6	47.0	6.0	41.0	2.0	5.0	AIAS00450
50.0	60.0	50.6	52.0	6.0	46.0	2.0	5.0	AIAS00500

Wear Ring

Wear ring in modified POM for piston and rod

Description

The wear ring has the twin function of guiding the piston or the rod in a cylinder and of absorbing transversal forces in it.
At the same time, the metal contact between the sliding parts of the cylinder (piston and bore or cylinder rod and cylinder head) must be avoided.
The wear ring in modified POM material has been specifically designed for the use on such pneumatic cylinders.

The ring is available for a wide range of standard dimensions (see tables XXIV and XXVIII, page 36 and 39). Other dimensions are available on request.
The serial No. for wear rings in modified POM are listed in the following table.

Table XX Serial numbers for injection molded wear rings in modified POM

Piston serial No.	Rod serial No.	Groove width L_2	Ring thickness W
GP41	GR41	2.50	1.55
GP43	GR43	4.00	1.55
GP48	GR48	8.20	2.00
GP49	GR49	9.70	2.00
GP51	GR51	10.00	2.00
GP53	GR53	15.00	2.00
GP54	GR54	20.00	2.00
GP55	GR55	25.00	2.00
GP56	GR56	30.00	2.00

All wear guide rings have chamfered edges, in order to avoid undesired edge forces in the corner radii of the grooves.
The choice for the correct size of the ring can be based on the following formula:

$$h = \frac{F \times f}{d \times p}$$

where the meaning of the letters are the following:
p = admissible pressure
F = radial load
f = safety factor
d = average guide diameter
h = guide width

Material

POTBN

This compound in polyacetal was specifically formulated for pneumatic cylinders made in aluminium.

Advantages:

- Good price/performance ratio
- High compressive strength
- Very good sliding effect in dry conditions
- Good resistance to abrasion
- Low stick-slip effect
- Simple installation also in closed grooves
- Long life

Wear Ring

Fields of application

Speed:	Up to 1 m/s, with reciprocating movements.
Temperature:	from -40 °C to +110 °C
Calculation value: Static compressive strength:	max. 36.3 N/mm^2 at room temperature.

The load capacity for dynamic applications most depends on the operating temperature, which, therefore, should not exceed 90 °C.

Wear Ring

Installation recommendation, wear ring for piston

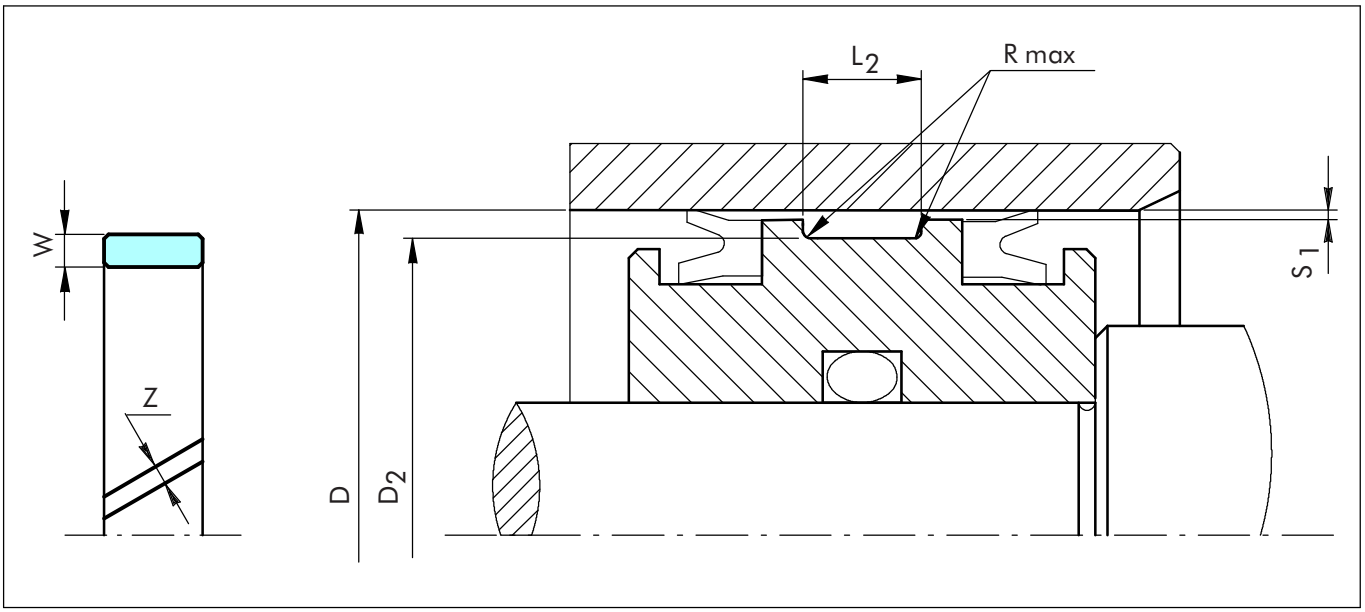


Figure 15 Installation drawing

Table XXI Installation dimensions

Serial No.	Bore diameter[1]	Groove diameter	Groove width	Radial clearance	Ring thickness	Ring gap
	D H9	**D_2** h8	**L_2** +0.2	S_1[2]	W	Z
GP41	8 - 20,0	D -3.10	2,50	0.20 - 0.30	1.55	1 - 3
GP43	10 - 50.0	D -3.10	4.00	0.20 - 0.40	1.55	2 - 4
GP48	20 - 40.0	D -4.00	8.20	0.20 - 0.40	2.00	1 - 3
GP49	16 - 20.0	D -4.00	9.70	0.20 - 0.50	2.00	1 - 3
GP51	45 - 70.0	D -4.00	10.00	0.30 - 0.50	2.00	1 - 3
GP53	75 - 100.0	D -4.00	15.00	0.30 - 0.50	2.00	1 - 3
GP54	105 - 140.0	D -4.00	20.00	0.30 - 0.50	2.00	2 - 4
GP55	150 - 200.0	D -4.00	25.00	0.30 - 0.60	2.00	3 - 5
GP56	220 - 250.0	D -4.00	30.00	0.30 - 0.60	2.00	4 - 6

[1] Recommended diameter ranges [2] Specifications valid only in the area of the wear rings.

Table XXII Recommended radii for groove diam.

D	R max.
8 -250	0.2
>250	0.4

Table XXIII Surface roughness

Parameter	Mating surface µ m	Groove surface µ m
R max.	1.00 - 4.00	< 16.0
R_Z DIN	0.63 - 2.50	< 10.0
R_a	0.10 - 0.40	< 2.5

Wear Ring

Table XXIV Wear ring for piston

Bore diameter	Groove diameter	Groove width	Thickness	Part No.
D H9	**D_2** h8	**L_2** +0.2	**W**	
8.0	4.9	2.5	1.55	GP4100080
10.0	6.9	2.5	1.55	GP4100100
10.0	6.9	4.0	1.55	GP4300100
12.0	8.9	4.0	1.55	GP4300120
14.0	10.9	4.0	1.55	GP4300140
15.0	11.9	4.0	1.55	GP4300150
16.0	12.9	4.0	1.55	GP4300160
16.0	12.0	9.7	2.00	GP4900160
18.0	14.9	4.0	1.55	GP4300180
18.0	14.0	9.7	2.00	GP4900180
20.0	16.9	4.0	1.55	GP4300200
20.0	16.0	8.2	2.00	GP4800200
20.0	16.0	9.7	2.00	GP4900200
22.0	18.0	9.7	2.00	GP4900220
25.0	21.9	4.0	1.55	GP4300250
25.0	21.0	8.2	2.00	GP4800250
30.0	26.0	8.2	2.00	GP4800300
32.0	28.9	4.0	1.55	GP4300320
32.0	28.0	8.2	2.00	GP4800320
35.0	31.0	8.2	2.00	GP4800350
40.0	36.0	8.2	2.00	GP4800400
45.0	41.0	10.0	2.00	GP5100450
50.0	46.0	9.7	2.00	GP4900500
50.0	46.0	10.0	2.00	GP5100500
55.0	51.0	9.7	2.00	GP4900550
55.0	51.0	10.0	2.00	GP5100550
58.0	54.0	10.0	2.00	GP5100580
60.0	56.0	9.7	2.00	GP4900600
60.0	56.0	10.0	2.00	GP5100600
63.0	59.0	10.0	2.00	GP5100630
65.0	61.0	9.7	2.00	GP4900650
65.0	61.0	10.0	2.00	GP5100650
70.0	66.0	10.0	2.00	GP5100700
75.0	71.0	9.7	2.00	GP4900750
75.0	71.0	15.0	2.00	GP5300750
80.0	76.0	9.7	2.00	GP4900800
80.0	76.0	10.0	2.00	GP5100800
80.0	76.0	15.0	2.00	GP5300800
85.0	81.0	9.7	2.00	GP4900850
85.0	81.0	15.0	2.00	GP5300850
90.0	86.0	15.0	2.00	GP5300900
95.0	91.0	15.0	2.00	GP5300950
100.0	96.0	9.7	2.00	GP4901000
100.0	96.0	10.0	2.00	GP5101000
100.0	96.0	15.0	2.00	GP5301000
105.0	101.0	20.0	2.00	GP5401050

Wear Ring

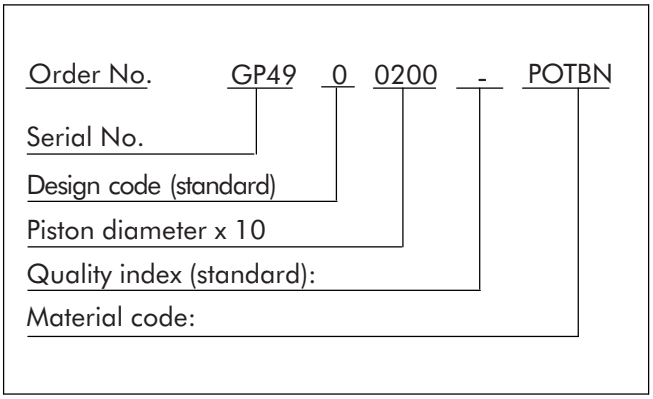
Bore diameter	Groove diameter	Groove width	Thickness	Part No.
D H9	**D_2** h8	**L_2** +0.2	**W**	
110.0	106.0	20.0	2.00	GP5401100
115.0	111.0	20.0	2.00	GP5401150
120.0	116.0	20.0	2.00	GP5401200
125.0	121.0	15.0	2.00	GP5301250
125.0	121.0	20.0	2.00	GP5401250
130.0	126.0	20.0	2.00	GP5401300
135.0	131.0	20.0	2.00	GP5401350
140.0	136.0	20.0	2.00	GP5401400
150.0	146.0	25.0	2.00	GP5501500
160.0	156.0	15.0	2.00	GP5301600
180.0	176.0	25.0	2.00	GP5501800
200.0	196.0	20.0	2.00	GP5402000
200.0	196.0	25.0	2.00	GP5502000
220.0	216.0	30.0	2.00	GP5602200
250.0	246.0	20.0	2.00	GP5402500
250.0	246.0	30.0	2.00	GP5602500

Ordering example

Wear ring for piston, diameter D = 20.00 mm
Series GP49 from Table XXI, page 34
Groove width: 9.70 mm, ring thickness: 2.00 mm

Material: POTBN

Order No.: GP4900200 (from Table XXIV, page 35)



For all intermediate dimensions not listed in table XXIV, the order No. can be formed from the example.

Wear Ring

Installation recommendation, wear ring for rod

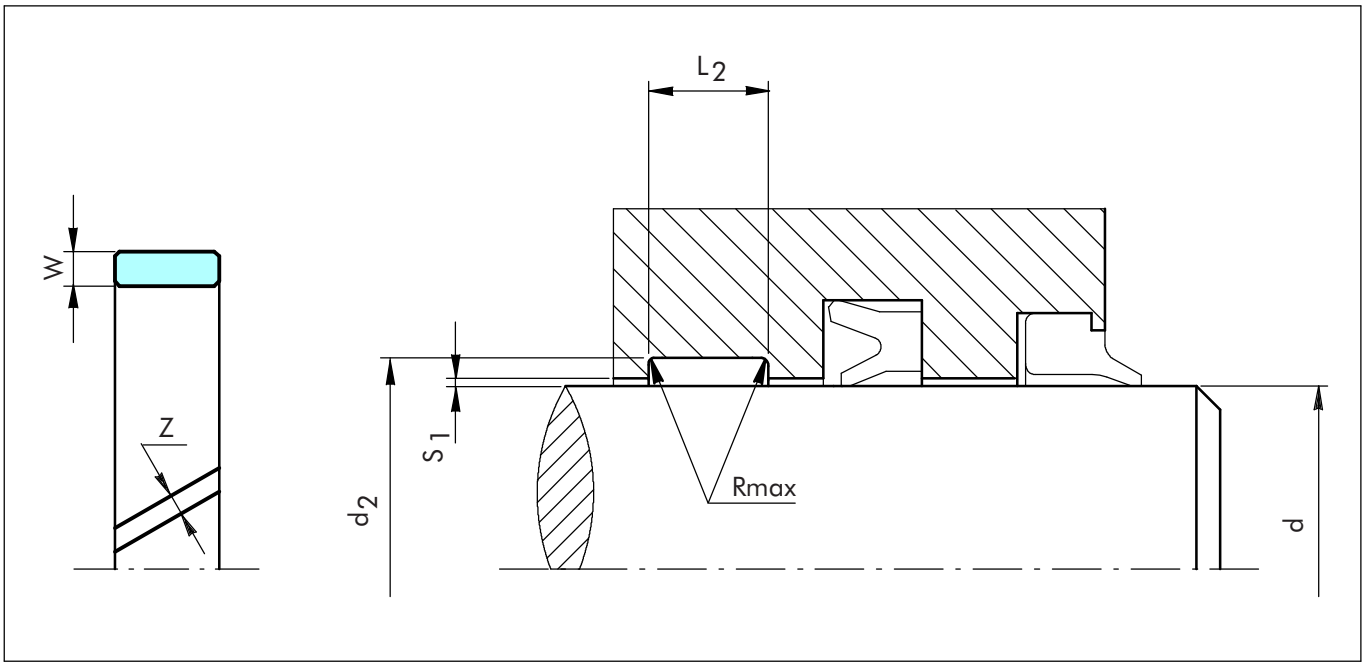


Figure 16 Installation drawing

Table XXV Installation dimensions

Serial No.	Rod diameter[1]	Groove diameter	Groove width	Radial clearance	Ring thickness	Ring gap
	d f8/h9	**d_2** H8	**L_2** +0.2	**S_1**[2]	**W**	**Z**
GR41	8 - 20.0	d +3.10	2.50	0.20 - 0.30	1.55	1 - 3
GR43	10 - 50.0	d +3.10	4.00	0.20 - 0.40	1.55	2 - 4
GR49	16 - 20.0	d +4.00	9.70	0.20 - 0.50	2.00	1 - 3

[1] Recommended diameter ranges

[2] Specifications valid only in the area of the wear rings

Table XXVI Recommended radii for groove diam.

D	R max.
8 -250	0.2
>250	0.4

Table XXVII Surface roughness

Parameter	Mating surface µ m	Groove surface µ m
R max.	1.00 - 4.00	< 16.0
RZ DIN	0.63 - 2.50	< 10.0
Ra	0.10 - 0.40	< 2.5

Wear Ring

Table XXVIII Wear ring for rod

Rod diameter	Groove diameter	Groove width	thickness	Part No.
d f8/h9	**d2** H8	**L2** +0.2	**W**	
8.0	11.1	2.5	1.55	GR4100080
10.0	13.1	2.5	1.55	GR4100100
10.0	13.1	4.0	1.55	GR4300100
12.0	15.1	4.0	1.55	GR4300120
12.0	16.0	9.7	2.00	GR4900120
14.0	17.1	4.0	1.55	GR4300140
14.0	18.0	9.7	2.00	GR4900140
15.0	18.1	4.0	1.55	GR4300150
16.0	19.1	4.0	1.55	GR4300160
16.0	20.0	9.7	2.00	GR4900160
18.0	21.1	4.0	1.55	GR4300180
18.0	22.0	9.7	2.00	GR4900180
20.0	23.1	4.0	1.55	GR4300200
22.0	25.1	4.0	1.55	GR4300220
25.0	28.1	4.0	1.55	GR4300250
28.0	31.1	4.0	1.55	GR4300280
30.0	33.1	4.0	1.55	GR4300300
32.0	35.1	4.0	1.55	GR4300320
35.0	38.1	4.0	1.55	GR4300350
35.0	39.0	9.7	2.00	GR4900350
36.0	39.1	4.0	1.55	GR4300360
40.0	43.1	4.0	1.55	GR4300400
40.0	44.0	9.7	2.00	GR4900400
45.0	49.0	9.7	2.00	GR4900450
46.0	60.0	9.7	2.00	GR4900460
50.0	53.1	4.0	1.55	GR4300500
50.0	54.0	9.7	2.00	GR4900500
55.0	59.0	9.7	2.00	GR4900550
60.0	64.0	9.7	2.00	GR4900600

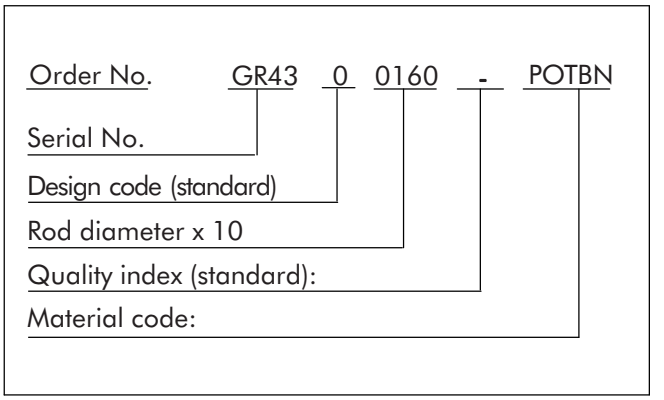
Wear Ring

Ordering example

Wear ring for rod, diameter d = 16.00 mm
Series GR43 from Table XXV, page 37
Groove width: 4.00 mm, ring thickness: 1.55 mm

Material: POTBN

Order No.: GR4300160 (from Table XXVIII, page 38)



For all intermediate dimensions not listed in table XXVIII, the order No. can be formed from the example.