

Turcon® Double Delta®



Double-acting

Rubber-energized plastic-faced seal

For O-Ring Grooves

Material:

Turcon®, Zurcon® and Elastomer



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Turcon® Double Delta®



Description

Turcon® Double Delta® is a rubber energized plastic faced seal, designed to expand and significantly improve the service parameters of O-Rings. Double Delta® can be installed in existing O-Ring grooves.

Double Delta® combines the flexibility and responsiveness of O-Rings with the wear and friction characteristics of the Turcon® materials in dynamic applications.

The double-acting performance of the seal follows from the symmetrical cross section which allows the seal to respond to pressure in both directions - Figure 128.

Initial contact pressure is provided by radial compression of the O-Ring. When the system pressure is increased the O-Ring transforms this into additional contact pressure, the contact pressure of the seal is thereby automatically adjusted so sealing is ensured under all service conditions.

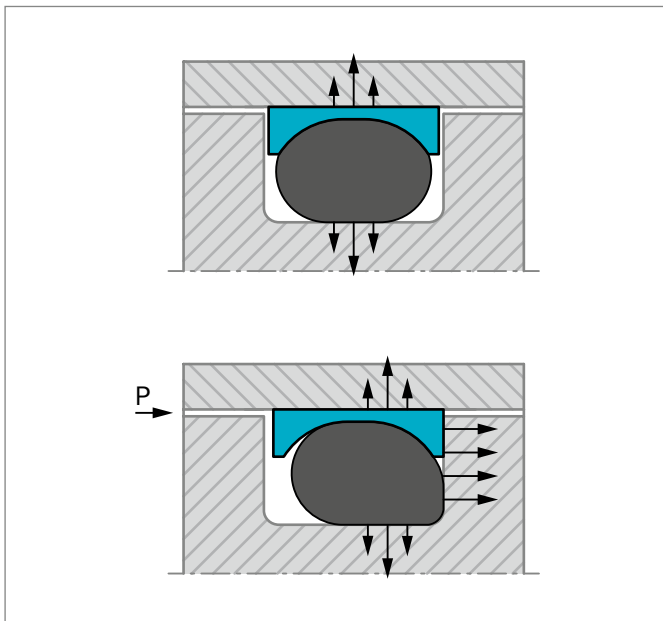


Figure 128: Turcon® Double Delta® without and with pressure

ADVANTAGES

- Compact groove dimensions and simple installation
- Low friction without stick-slip
- Resistance against wear and extrusion
- Piston seals available for all diameters from 5 to 999.9 mm

- Standard cross section cover AS 568A and important metric O-Rings, other cross sections available on request.
- Fits also groove dimensions per ISO 6194 and AS 4716

APPLICATION EXAMPLES

Turcon® Double Delta® is used as double acting piston seal for hydraulic and pneumatic cylinders in applications such as:

- Machine tools
- Handling devices
- Valves
- Chemical process equipment

It is particular recommended for light duty and small diameter applications.

OPERATING CONDITIONS

Pressure:	Up to 35 MPa
Velocity:	Up to 15 m/s
Temperature:	-45 °C to +200 °C* (according to O-Ring material)
Media:	Mineral oil-based hydraulic fluids, flame retardant hydraulic fluids, environmentally friendly hydraulic fluids (bio-oils), phosphate ester, water and others, depending on temperature, seal and O-Ring material compatibility see Table 116
Clearance:	The maximum permissible radial clearance S_{max} is shown in Table 117, as a function of the operating pressure and functional diameter

IMPORTANT NOTE

The above data are maximum values and cannot be used at the same time, e.g. the maximum operating speed depends on material type, pressure, temperature and gap value. Temperature range also depends on media.

* In the case of unpressurized piston applications in temperatures below 0 °C please contact your local Customer Solution Center for more information!



NOTCH

Turcon® Double Delta® is as standard supplied without radial notches, as the thin radial section of the seal gives good response to pressure variations.

For diameters from 8 mm notches on both sides are optional. These ensure direct pressurizing of the seal under all operating conditions.

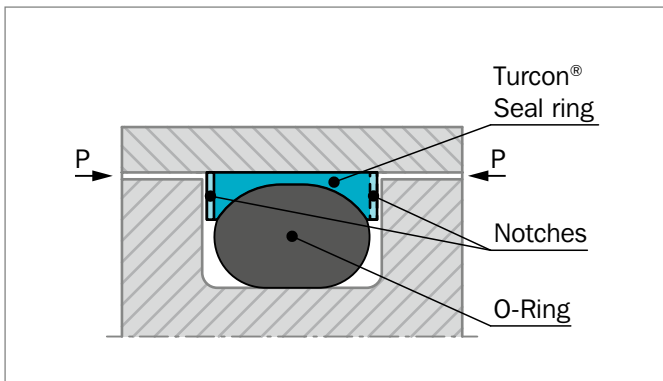


Figure 129: Turcon® Double Delta® with notches

INSTALLATION INSTRUCTIONS

Double Delta® is installed according to information on page 247 to 249.

RECOMMENDED MATERIALS

The following material combinations have proven effective for hydraulic applications:

Turcon® Double Delta® in Turcon® M12

All round material for light to medium hydraulic applications with linear or helical movements in mineral oils, flame retardant hydraulic fluids, phosphate ester, bio-oils or fluids having low lubricating properties:

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

Set code: M12N, M12V or M12E

Turcon® Double Delta® in Turcon® T46

For medium to heavy applications with linear movements in mineral oils and other media with good lubrication:

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

Set code: T46N or T46V

For specific applications, all Turcon® materials are available. Other material combinations are listed in Table 116.

**Table 116: Turcon® and Zurcon® Materials for Double Delta®**

Material, Applications, Properties	Code	O-Ring Material Shore A	Code	O-Ring Operating Temp.* °C	Mating Surface Material	MPa max. Dyna- mic
Turcon® M12 First material choice for seals in linear motion Overall improved properties For new constructions and updating For all commonly applied hydraulic fluids including fluids with low lubrication performance Lowest friction and best sliding properties Lowest wear on seals Improved absorption of abrasive contaminants Low wear or abrasion of counter surface BAM tested Mineral fiber and Additives filled Color: Dark gray	M12	NBR 70	N	-30 to +100	Steel	35
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Cast iron	
		FKM 70	V	-10 to +20	Stainless steel Titanium	
Turcon® T05 For lubricating fluids Also for gas service Very low friction Very good sliding and sealing properties Color: Turquoise	T05	NBR 70	N	-30 to +100	Steel	20
		NBR 70 Low temp.	T	-45 to +80	Steel hardened	
		FKM 70	V	-10 to +200		
Turcon® T24 For lubricating and non-lubricating hydraulic fluids Good sealing function Moderate extrusion resistance Carbon filled Color: Black	T24	NBR 70	N	-30 to +100	Steel	20
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Cast iron	
		FKM 70	V	-10 to +200	Stainless steel	
		EPDM 70	E**	-45 to +145	Aluminum	
Turcon® T46 For lubricated hydraulics in linear motion High compressive strength High extrusion resistance Very good sliding and wear properties BAM tested Bronze filled Color: Light to dark brown, which may have variations in shading	T46	NBR 70	N	-30 to +100	Steel hardened	35
		NBR 70 Low temp.	T	-45 to +80	Cast iron	
		FKM 70	V	-10 to +200		
Zurcon® Z80 For lubricating and non-lubricating fluids Water based fluids, air and gases Dry air pneumatics High abrasion and extrusion resistance For service in abrasive conditions and media with particles Good chemical resistance Limited temperature capability (-60 to +80 °C) UHMWPE (Ultra High Molecular Weight PE) Color: White to off-white	Z80	NBR 70	N	-30 to (+100)	Steel	30
		NBR 70 Low temp.	T	-45 to +80	Steel hardened Stainless steel	
		EPDM 70	E**	-10 to (+145)	Aluminum Ceramic coating	

* The O-Ring Operation Temperature is only valid in mineral hydraulic oil (except EPDM).

** Material not suitable for mineral oils.

BAM: Tested by "Bundesanstalt Materialprüfung, Germany".

 Highlighted materials are recommended.



■ Installation Recommendation

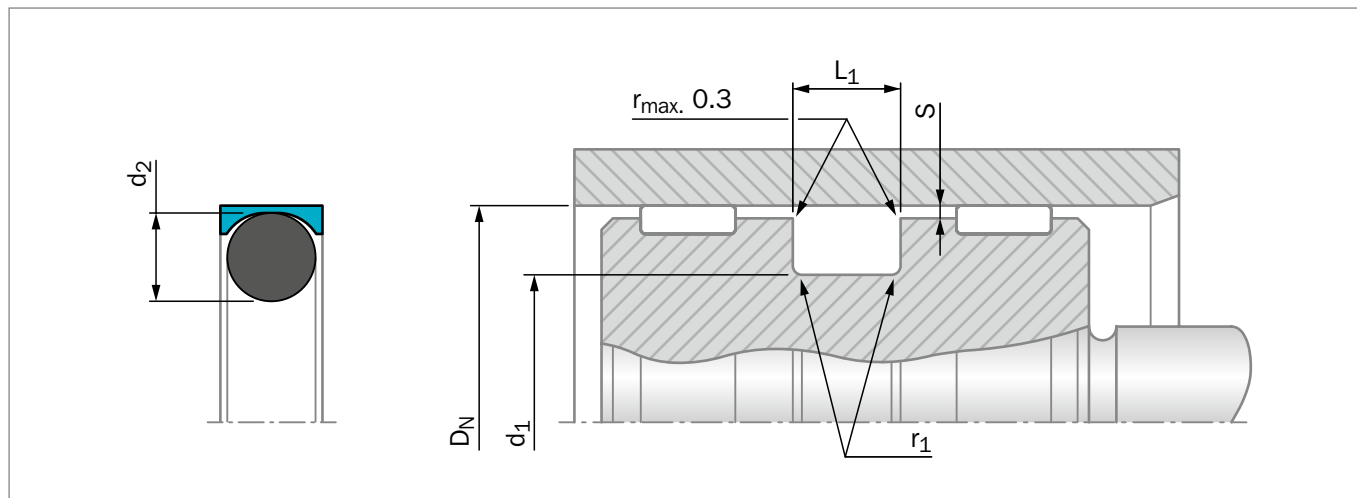


Figure 130: Installation Drawing

Table 117: Installation Dimensions

Series No.	Bore Diameter D_N H9		Groove Diameter	Groove Width	Radius	Radial Clearance S_{max}^*				O-Ring Cross Section
	Standard Application	Available Range	d_1 h9	L_1 +0.2	r_1 max	2 MPa	10 MPa	20 MPa	35 MPa	d_2
PDD0	5 - 13.9	5 - 139.9	$D_N - 2.9$	2.4	0.4	0.10	0.10	0.08	0.05	1.78
PDD1	14 - 24.9	8 - 259.9	$D_N - 4.5$	3.6	0.4	0.15	0.15	0.10	0.07	2.62
PDD2	25 - 45.9	12 - 469.9	$D_N - 6.2$	4.8	0.6	0.25	0.20	0.15	0.08	3.53
PDD3	46 - 124.9	20 - 669.9	$D_N - 9.4$	7.1	0.8	0.35	0.25	0.20	0.10	5.33
PDD4	125 - 669.9	80 - 999.9	$D_N - 12.2$	9.5	0.8	0.50	0.30	0.25	0.15	7.00
PDD5	670 - 999.9	125 - 999.9	$D_N - 15.0$	10.0	1.0	0.60	0.40	0.30	0.20	8.40

* Slydring® / Wear Rings are not applicable at very small radial clearances please consult the Slydring® section in this catalog.

ORDERING EXAMPLE

Double Delta® complete with O-Ring, standard application:

Series: PDD3 from Table 117

Bore Diameter: $D_N = 80.0$ mm

TSS Part No.: PDD300800 from Table 118

Select the material from Table 116. The corresponding code numbers are appended to the Part No. Together these form the TSS Article Number. The TSS Article Number for all intermediate sizes can be determined by following the example:

TSS Article No. **PDD3** **0** **0800** **-** **M12** **N**

TSS Series No. _____

Type (Standard)** _____

Bore Diameter x 10 _____

Quality Index (Standard) _____

Material Code (Seal Ring) _____

Material Code (O-Ring) _____

** "N" for seals with notches. Available for diameters $D_N \geq 8.0$ mm.

For seals for other groove widths/dimensions please refer to Table 119 and Table 120



Table 118: Installation Dimensions / TSS Part No.

Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions	Bore Dia.	Groove Dia.	Groove Width	TSS Part No.	O-Ring Dimensions
D _N H9	d ₁ h9	L ₁ +0.2			D _N H9	d ₁ h9	L ₁ +0.2		
6.0	3.1	2.4	PDD000060	2.57 x 1.78	110.0	100.6	7.1	PDD301100	97.79 x 5.33
8.0	5.1	2.4	PDD000080	4.47 x 1.78	115.0	105.6	7.1	PDD301150	104.14 x 5.33
9.0	6.1	2.4	PDD000090	5.60 x 1.80	120.0	110.6	7.1	PDD301200	107.32 x 5.33
10.0	7.1	2.4	PDD000100	6.70 x 1.80	125.0	112.8	9.5	PDD401250	113.67 x 7.00
11.0	8.1	2.4	PDD000110	7.65 x 1.78	130.0	117.8	9.5	PDD401300	116.84 x 7.00
12.0	9.1	2.4	PDD000120	8.75 x 1.80	135.0	122.8	9.5	PDD401350	120.02 x 7.00
12.7	9.8	2.4	PDD000127	9.25 x 1.78	140.0	127.8	9.5	PDD401400	126.37 x 7.00
14.0	9.5	3.6	PDD100140	9.19 x 2.62	150.0	137.8	9.5	PDD401500	135.89 x 7.00
15.0	10.5	3.6	PDD100150	9.19 x 2.62	160.0	147.8	9.5	PDD401600	145.42 x 7.00
16.0	11.5	3.6	PDD100160	10.77 x 2.62	170.0	157.8	9.5	PDD401700	151.77 x 7.00
18.0	13.5	3.6	PDD100180	12.37 x 2.62	180.0	167.8	9.5	PDD401800	164.47 x 7.00
20.0	15.5	3.6	PDD100200	14.50 x 2.65	190.0	177.8	9.5	PDD401900	177.17 x 7.00
22.0	17.5	3.6	PDD100220	17.12 x 2.62	200.0	187.8	9.5	PDD402000	183.52 x 7.00
24.0	19.5	3.6	PDD100240	18.72 x 2.62	210.0	197.8	9.5	PDD402100	196.22 x 7.00
25.0	18.8	4.8	PDD200250	17.04 x 3.53	220.0	207.8	9.5	PDD402200	202.57 x 7.00
25.4	19.2	4.8	PDD200254	18.66 x 3.53	230.0	217.8	9.5	PDD402300	215.27 x 7.00
27.0	20.8	4.8	PDD200270	20.22 x 3.53	240.0	227.8	9.5	PDD402400	227.97 x 7.00
28.0	21.8	4.8	PDD200280	20.22 x 3.53	250.0	237.8	9.5	PDD402500	227.97 x 7.00
30.0	23.8	4.8	PDD200300	23.40 x 3.53	280.0	267.8	9.5	PDD402800	266.07 x 7.00
32.0	25.8	4.8	PDD200320	25.00 x 3.53	300.0	287.8	9.5	PDD403000	278.77 x 7.00
35.0	28.8	4.8	PDD200350	28.17 x 3.53	320.0	307.8	9.5	PDD403200	304.17 x 7.00
40.0	33.8	4.8	PDD200400	32.92 x 3.53	350.0	337.8	9.5	PDD403500	329.57 x 7.00
42.0	35.8	4.8	PDD200420	34.52 x 3.53	400.0	387.8	9.5	PDD404000	380.37 x 7.00
45.0	38.8	4.8	PDD200450	37.69 x 3.53	420.0	407.8	9.5	PDD404200	405.26 x 7.00
48.0	38.6	7.1	PDD300480	37.47 x 5.33	450.0	437.8	9.5	PDD404500	430.66 x 7.00
50.0	40.6	7.1	PDD300500	37.47 x 5.33	480.0	467.8	9.5	PDD404800	456.06 x 7.00
50.8	41.4	7.1	PDD300508	40.64 x 5.33	500.0	487.8	9.5	PDD405000	481.38 x 7.00
52.0	42.6	7.1	PDD300520	40.64 x 5.33	600.0	587.8	9.5	PDD406000	582.68 x 7.00
55.0	45.6	7.1	PDD300550	43.82 x 5.33	650.0	637.8	9.5	PDD406500	633.48 x 7.00
56.0	46.6	7.1	PDD300560	43.82 x 5.33	The bore diameters in bold type comply with the recommendations of ISO 3320. TSS Part No. for other dimensions and all intermediate dimensions up to 999.9 mm diameter including imperial (inch) dimensions can be supplied. Larger dimensions up to 2,700 mm available upon request.				
60.0	50.6	7.1	PDD300600	50.17 x 5.33					
63.0	53.6	7.1	PDD300630	53.34 x 5.33					
65.0	55.6	7.1	PDD300650	53.34 x 5.33					
70.0	60.6	7.1	PDD300700	59.69 x 5.33					
75.0	65.6	7.1	PDD300750	62.87 x 5.33					
80.0	70.6	7.1	PDD300800	69.22 x 5.33					
85.0	75.6	7.1	PDD300850	72.39 x 5.33					
90.0	80.6	7.1	PDD300900	78.74 x 5.33					
95.0	85.6	7.1	PDD300950	81.92 x 5.33					
100.0	90.6	7.1	PDD301000	88.27 x 5.33					



Turcon® Double Delta® for one Back-up Ring grooves

Double Delta® is available for designs where grooves for O-Ring with one Back-up Ring are used according to Table 119.

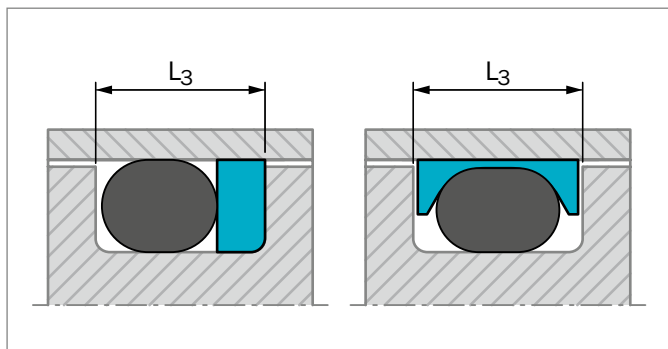


Figure 131: Groove width

ORDERING EXAMPLE

Double Delta® complete with O-Ring, standard application:

Bore Diameter:	$D_N = 80 \text{ mm}$
Groove Diameter:	70.6 mm
Groove Width:	8.5 mm
TSS Article No.:	PDA300800-M12N

Table 119: Seals for one Back-up Ring groove

Series No.	Groove Width	Execution Mark 5th digit		O-Ring Cross Section
	L_3	Without Notch	With Notch*	d_2
PDA0	3.80	0	N	1.78
PDA1	4.65	0	N	2.62
PDA2	5.70	0	N	3.53
PDA3	8.50	0	N	5.33
PDA4	11.20	0	N	7.00
PDA5	12.50	0	N	8.40

* Available for diameters from 8 mm

TSS Article No. **PDA3** **0** **0800** **-** **M12** **N**

TSS Series No.** ————

Type (Standard)*** ————

Bore Diameter x 10 ————

Quality Index (Standard) ————

Material Code (Seal Ring)**** ————

Material Code (O-Ring)***** ————

** From Table 119 or Table 120

*** N for seals with notches, available from diameter 8.0 mm

**** From Table 116

***** From Table 116

Turcon® Double Delta® for metric O-Rings

Double Delta® is available for installation in grooves for metric O-Rings as listed in Table 120.

Table 120: Piston Seals for Metric O-Ring Grooves

O-Ring Cross Section d_2	Groove Diameter d_1 h9	Groove Width L_1 +0.2	Series No.	Execution Mark 5th digit		Available Range
				Standard	Notch*	
2.0	$D_N - 3.3$	2.7	PD2A	0	N	6 - 100.0
2.4	$D_N - 4.1$	3.2	PD2E	0	N	8 - 160.0
2.5	$D_N - 4.3$	3.3	PD2F	0	N	8 - 160.0
3.0	$D_N - 5.2$	4.0	PD3A	0	N	12 - 200.0
4.0	$D_N - 7.0$	5.2	PD4A	0	N	16 - 300.0
5.0	$D_N - 8.8$	6.6	PD5A	0	N	20 - 400.0
5.7	$D_N - 10.0$	7.2	PD5H	0	N	20 - 669.9

* Available for diameters from 8 mm