

Turcon® Roto Variseal®



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■ Turcon® Roto Variseal®

■ General Description

The Turcon® Roto Variseal® is a single-acting seal consisting of a U-shaped seal jacket and a V-shaped corrosion resistant metal spring.

The key characteristic of the Turcon® Roto Variseal® is the flanged heel, which prevents the seal from rotating by clamping in the groove and the short and heavy dynamic lip offering reduced friction, long service life and a good scraping effect even in highly viscous media.

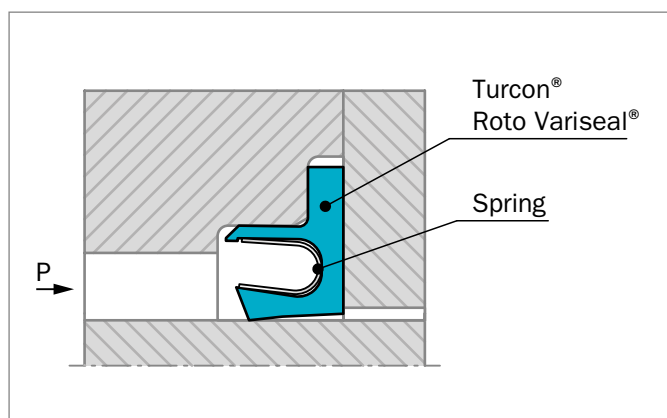


Figure 146: Turcon® Roto Variseal®

At low and zero pressure, the metal spring provides the primary sealing force. As the system pressure increases, the main sealing force is achieved by the system pressure and ensures a tight seal from zero to high pressure.

The possibility of matching suitable materials for the seal and the spring allows use in a wide range of applications going beyond the field of hydraulics, e.g. in the chemical, pharmaceutical and foodstuffs industries.

The Turcon® Roto Variseal® can be sterilized and is available in a special Hi-Clean version where the spring cavity is filled with a Silicone elastomer preventing contaminants from being entrapped in the seal. This design also works well in applications involving mud, slurries or adhesives to keep grit from packing into the seal cavity and inhibiting the spring action.

FEATURES AND BENEFITS

- Suitable for rotary, reciprocating and static applications
- Protects against mechanical torsion
- Low coefficient of friction
- Remains tight in groove even when subject to oscillating or helical movements
- Withstands rapid changes in temperature
- High abrasion resistance
- Excellent resistance to aging
- Good scraping ability
- Can be sterilized
- Available in Hi-Clean version

OPERATING CONDITIONS

Operating Pressure:	For dynamic loads: 20 MPa For static loads: 25 MPa
Speed:	Rotating: Up to 2 m/s
Temperature:	-70 °C to +300 °C For specific applications at lower temperatures, please contact your local Customer Solution Center
Media:	Virtually all fluids, chemicals and gases

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 and temperature.



FRictional FORCE

Indicative values for frictional force are included in Figure 147. Frictional force is given as a function of sliding speed and operating pressure for a shaft diameter of 50 mm at an oil temperature of +60 °C. The operating limits are lower at higher temperatures.

Indicative values for other shaft diameters can be calculated from the formula:

$$P \approx P_{50} \times \left(\frac{d}{50 \text{ mm}} \right) \text{ [W]}$$

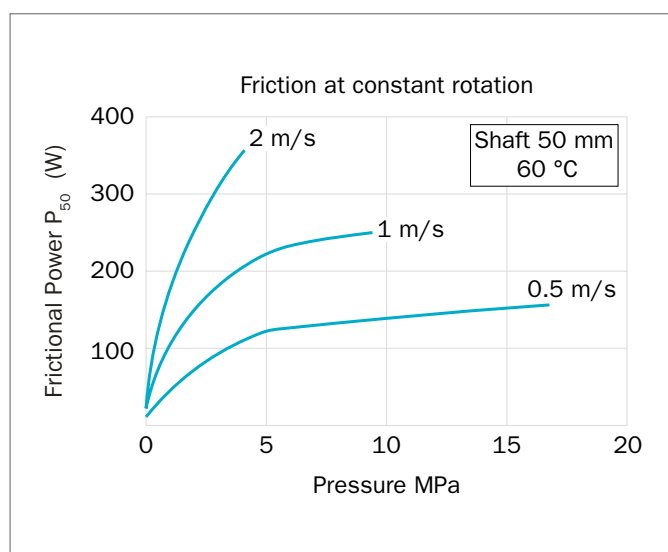


Figure 147: Frictional power for Turcon® Roto Variseal®

The indicative values apply for constant operating conditions. Changes in these, such as pressure fluctuations or direction of rotation can result in significantly higher frictional values.

APPLICATION EXAMPLES

The Turcon® Roto Variseal® is used as a single acting rotary seal in sectors such as:

- Rotary injection units (injection molding machines)
- Rotary distributors
- Pivoting motors in pharmaceutical, industrial, machine tools, foodstuff and chemical industries

APPLICATION LIMITS

The maximum operating limits for temperature, pressure and speed are dependent upon one another and therefore cannot all apply at the same time.

The lubrication properties of the media to be sealed and heat dissipation must also be taken into consideration.

The following PV values can be used as general guidelines:

Poor lubrication up to PV = 2 MPa x m/s

Good lubrication up to PV = 5 MPa x m/s

Very good cooling up to PV = 8 MPa x m/s

These values are lower for diameters < 50 mm (2 inches). Tests of these characteristics are recommended to establish application limits.

MATERIALS

All materials used are physiologically safe. They contain no odor or taste-affecting substances.

The following standard material combination has proved effective for most applications:

Seal ring: Turcon® T40
Spring: Stainless Steel Material No. AISI 301

For use in accordance with the demands of the FDA, suitable materials are available on request.

LEAD-IN CHAMFERS

In order to avoid damage during installation, lead-in chamfers and rounded edges must be provided on the housing and on the rod (Figure 148). If this is not possible for design reasons, a separate installation tool is recommended.

The minimum length of the lead-in chamfer depends on the profile size of the seal and can be seen in Table 98. If concentricity between the parts is not ensured during installation, the lead-in chamfers must be increased correspondingly.

For the surface quality of the lead-in chamfer, the same recommendations apply as given for the sealing surfaces in Table 100.

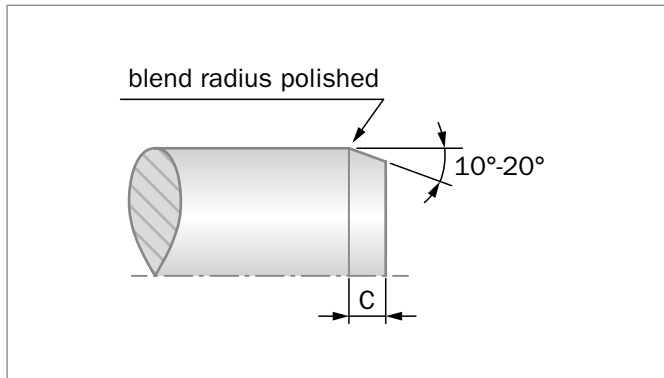


Figure 148: Lead-in chamfer on shaft

Table 98: Lead-in chamfers for Turcon® Roto Variseal®

Series	Lead-in Chamfers Length C min.
TVM1	4.5
TVM2	5.0
TVM3	8.0
TVM4	12.0

MATING SURFACE MATERIALS

Sealing of applications with rotating movements requires very good mating surfaces. A minimum hardness of 55 HRC is recommended to a hardening depth of at least 0.3 mm. Particular attention must be paid to coated surfaces and good heat dissipation through the coating is required.

SHAFT BEARING/RADIAL CLEARANCE FOR BEARING

In general, the sealing elements should not take on any bearing tasks as this will reduce the functioning of the seals. Consequently we recommend to guide the components by means of a roller or slide bearing.

INSTALLATION INSTRUCTIONS

The following points should be observed before installation of the seals:

- Check whether housing or rod has a lead-in chamfer; if not, use an installation sleeve
- Deburr and chamfer or round sharp edges, cover the tips of any screw threads
- Remove machining residues such as chips, dirt and other foreign particles and carefully clean all parts
- If the seals are installed with grease or oil, attention must be paid to the compatibility of the seal materials with these lubricants. Use only grease without solid additives (e.g. molybdenum disulfide or zinc sulfide)
- Do not use installation tools with sharp edges

INSTALLATION OF TURCON® ROTO VARISEAL®

Turcon® Roto Variseal® is installed in split grooves.

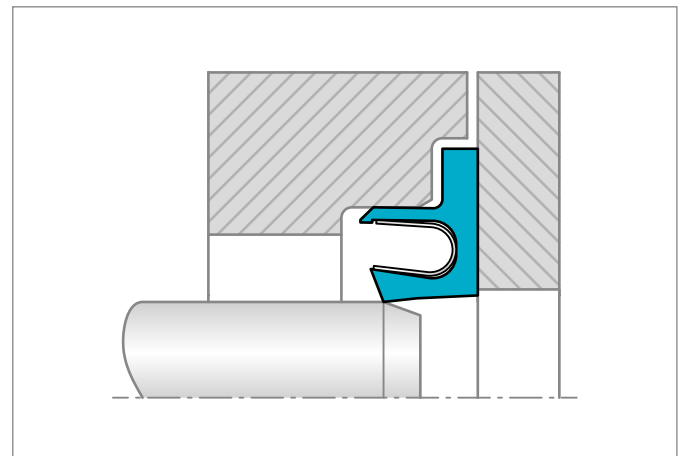


Figure 149: Turcon® Roto Variseal® Installation

Installation should be performed in the following steps in order to ensure a concentric and strain-free fit:

- Place the seal ring into the open groove, taking care that the OD lip doesn't catch on the housing edge
- Fit the cover loosely onto the housing
- Insert the shaft
- Tighten the cover


Table 99: Standard Turcon® Materials for Turcon® Roto Variseal®

Material, Applications, Properties	Code	Spring Material	Code	Operating Temp.* °C	Mating Surface Material	MPa max.
Turcon® T40 For all lubricating and non-lubricating Hydraulic fluids, water hydraulics, soft mating surfaces Carbon fiber filled Color: Gray	T40	Spring material AISI 301	S	-100 to +260	Steel Steel, chrome plated Cast iron Stainless steel Aluminum Bronze Alloys	15
Turcon® T78 For all lubricated and non-lubricated applications, soft mating surfaces Aromatic polymer Color: Tan to dark brown	T78	Spring material AISI 301	S	-100 to +260	Steel Steel, chrome plated Cast iron Stainless steel	5

☐ Highlighted materials are standard.

Trelleborg Sealing Solutions recommends that the following surface finishes are observed:

Table 100: Surface Roughness

Media	Shaft surface ¹⁾	Static groove surface
Cryogenic and low molecular gases Hydrogen, Helium, Freon, Oxygen, Nitrogen	Rz1max = 1.0 µm Rz = 0.63 µm Ra = 0.1 µm	Rz1max = 3.5 µm Rz = 2.2 µm Ra = 0.3 µm
Low viscosity fluids Water, Alcohols, Hydrazine, Gaseous nitrogen, Natural gas, Skydrol, air	Rz1max = 2.5 µm Rz = 1.6 µm Ra = 0.2 µm	Rz1max = 5.0 µm Rz = 3.5 µm Ra = 0.6 µm
High viscosity fluids Hydraulic oils, Crude oil, Gear oil, Sealants, Glue, Milk products	Rz1max = 2.5 µm Rz = 1.6 µm Ra = 0.2 µm	Rz1max = 6.5 µm Rz = 5.0 µm Ra = 0.8 µm

¹⁾ The sealing surface must be free from spiral grooves.

The material contact area (Rmr) should be approx. 50 to 70%, determined at a cut depth c = 0.25 x Rz, relative to a reference line of C_{ref}. 5%.



■ Installation Recommendation

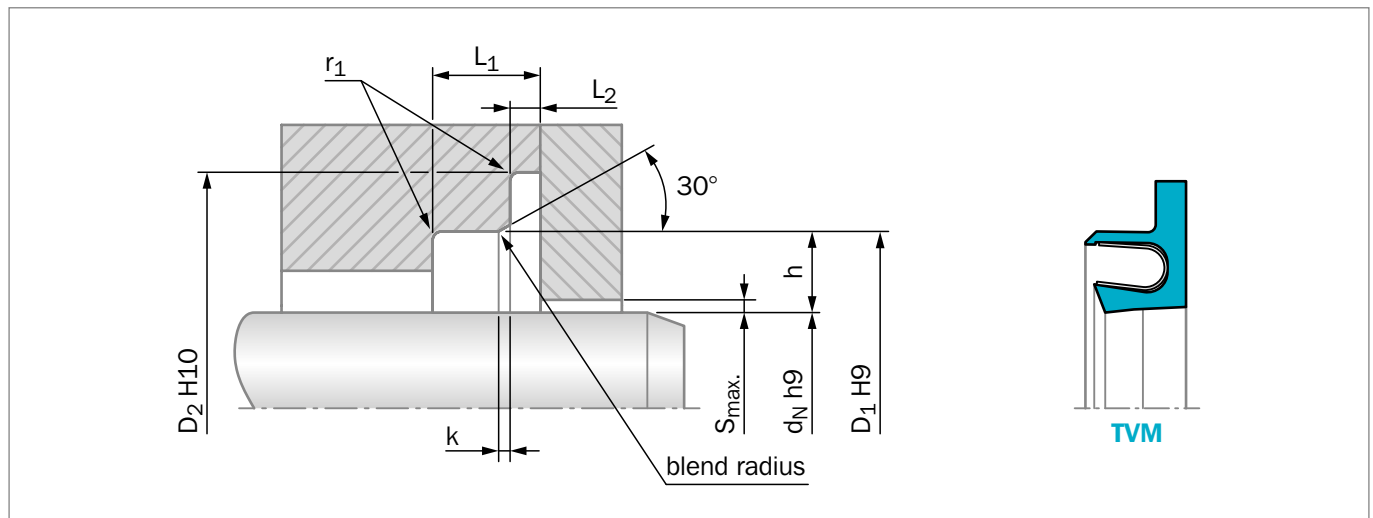


Figure 150: Installation Drawing

Table 101: Installation Dimensions

Series No.	Shaft Diameter d_N h9		D_1	h	D_2	L_1	L_2	k	r_1	Radial Clearance S_{max}		
	Standard Range	Extended Range	Groove Diameter H9	Groove Depth	Flange Diameter H10	Groove Width Min	Flange Groove Width	Lead-in Chamfer	Radius Max	2 MPa	10 MPa	20 MPa
TVM1	5.0 - 19.9	5.0 - 200.0	$d_N + 5.0$	2.50	$d_N + 9.0$	3.6	0.85 +0/-0.10	0.8	0.38	0.25	0.15	0.10
TVM2	20.0 - 39.9	10.0 - 400.0	$d_N + 7.0$	3.50	$d_N + 12.5$	4.8	1.35 +0/-0.15	1.1	0.38	0.35	0.20	0.15
TVM3	40.0 - 399.9	20.0 - 700.0	$d_N + 10.5$	5.25	$d_N + 17.5$	7.1	1.80 +0/-0.20	1.4	0.38	0.50	0.25	0.20
TVM4	400.0 - 999.9	35.0 - 999.9	$d_N + 14.0$	7.00	$d_N + 22.0$	9.5	2.80 +0/-0.20	1.6	0.51	0.60	0.30	0.25



ORDERING EXAMPLE

Turcon® Roto Variseal®

Series:	TVM3 (from Table 101)
Rod diameter:	$d_N = 80.0$ mm
TSS Part No.:	TVM300800 (from Table 102)

Select the material from Table 99. The corresponding code numbers are appended to the TSS Part No. (from Table 102). Together they form the TSS Article No. For all intermediate sizes not shown in Table 101, the TSS Article No. can be determined from the example opposite.

* For diameters $\geq 1,000.0$ mm multiply only by factor 1.
Example: TVM4 for diameter 1,200.0 mm.
TSS Article No.: TVM4X1200 - T40SM.

TSS Article No.	TVM3 0 0800 - T40 S M
Series No.	TVM3
Type (Standard)	0
Rod Diameter x 10*	0800
Quality Index (Standard)	-
Material Code (Seal Ring)	T40
Material Code (Spring)	S
Spring Load (Standard)**	M

** Turcon® Roto Variseal® are available with the spring groove filled with high temperature silicone. The silicone prevents entrapment of biological contaminants in the seal making the seal easier to clean. Select R for HiClean option.

Table 102: Standard Installation Dimensions / TSS Part Number

d_N	D_1	D_2	TSS Part No.	d_N	D_1	D_2	TSS Part No.	d_N	D_1	D_2	TSS Part No.
5.0	10.0	14.0	TVM100050	42.0	52.5	59.5	TVM300420	110.0	120.5	127.5	TVM301100
6.0	11.0	15.0	TVM100060	45.0	55.5	62.5	TVM300450	115.0	125.5	132.5	TVM301150
8.0	13.0	17.0	TVM100080	48.0	58.5	65.5	TVM300480	120.0	130.5	137.5	TVM301200
10.0	15.0	19.0	TVM100100	50.0	60.5	67.5	TVM300500	125.0	135.5	142.5	TVM301250
12.0	17.0	21.0	TVM100120	52.0	62.5	69.5	TVM300520	130.0	140.5	147.5	TVM301300
14.0	19.0	23.0	TVM100140	55.0	65.5	72.5	TVM300550	135.0	145.5	152.5	TVM301350
15.0	20.0	24.0	TVM100150	56.0	66.5	73.5	TVM300560	140.0	150.5	157.5	TVM301400
16.0	21.0	25.0	TVM100160	60.0	70.5	77.5	TVM300600	150.0	160.5	167.5	TVM301500
18.0	23.0	27.0	TVM100180	63.0	73.5	80.5	TVM300630	160.0	170.5	177.5	TVM301600
20.0	27.0	32.5	TVM200200	65.0	75.5	82.5	TVM300650	170.0	180.5	187.5	TVM301700
22.0	29.0	34.5	TVM200220	70.0	80.5	87.5	TVM300700	180.0	190.5	197.5	TVM301800
25.0	32.0	37.5	TVM200250	75.0	85.5	92.5	TVM300750	190.0	200.5	207.5	TVM301900
28.0	35.0	40.5	TVM200280	80.0	90.5	97.5	TVM300800	200.0	210.5	217.5	TVM302000
30.0	37.0	42.5	TVM200300	85.0	95.5	102.5	TVM300850	210.0	220.5	227.5	TVM302100
32.0	39.0	44.5	TVM200320	90.0	100.5	107.5	TVM300900	220.0	230.5	237.5	TVM302200
35.0	42.0	47.5	TVM200350	95.0	105.5	112.5	TVM300950	230.0	240.5	247.5	TVM302300
36.0	43.0	48.5	TVM200360	100.0	110.5	117.5	TVM301000	240.0	250.5	257.5	TVM302400
40.0	50.5	57.5	TVM300400	105.0	115.5	122.5	TVM301050	250.0	260.5	267.5	TVM302500

Other dimensions and all intermediate sizes up to 2,500 mm diameter including inch sizes can be supplied.