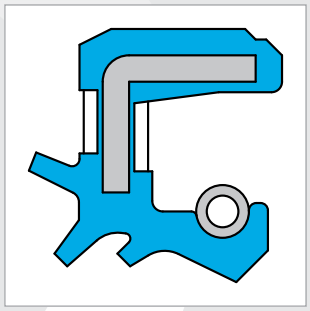


STANDARD SHAFT SEALS
TC9

DESCRIPTION

The TC9 profile is a shaft seal composed of a single metal cage with a rubber coating, a primary sealing lip with an integrated spring and three additional radial and axial anti-pollution lips.

ADVANTAGES

Very good static sealing

Very good thermal expansion compensation

Greater roughness is allowed in the housing

Reduced risk of corrosion

Sealing for low and high viscosity fluids

Modern primary sealing lip with low radial forces

Protection against undesirable air contaminants

APPLICATIONS

All types of rotative applications

Machine tools
Agriculture
Construction
Transmission
Gear boxes
Motors
Pumps

MATERIALS

Rubber

ACM 70 - 75 Shore A

EPDM 70 - 75 Shore A

FKM 70 - 75 Shore A

HNBR 70 - 75 Shore A

NBR 70 - 75 Shore A

Metal cage

Steel - AISI 1010

Spring

Steel - AISI 1070 - 1090

Stainless steel - AISI 316

SEAL DESIGN

Tolerance for the outside diameter of the seal (ØD)

Bore diameter ØD1 (mm)	Apparent metal cage	Rubber coating	Coating with grooves
ØD1 ≤ 50.0	+0.10 / +0.20	+0.15 / +0.30	+0.20 / +0.40
50.0 < ØD1 ≤ 80.0	+0.13 / +0.23	+0.20 / +0.35	+0.25 / +0.45
80.0 < ØD1 ≤ 120.0	+0.15 / +0.25	+0.20 / +0.35	+0.25 / +0.45
120.0 < ØD1 ≤ 180.0	+0.18 / +0.28	+0.25 / +0.45	+0.30 / +0.55
180.0 < ØD1 ≤ 300.0	+0.20 / +0.30	+0.25 / +0.45	+0.30 / +0.55
300.0 < ØD1 ≤ 500.0	+0.23 / +0.35	+0.30 / +0.55	+0.35 / +0.65
500.0 < ØD1 ≤ 630.0	+0.23 / +0.35	+0.35 / +0.65	+0.40 / +0.75

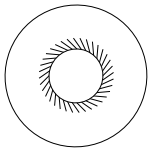
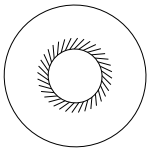
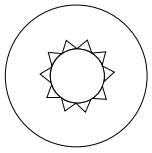
Roundness tolerance

Bore diameter ØD1 (mm)	Apparent metal cage	Rubber coating
ØD1 ≤ 50.0	0.18	0.25
50.0 < ØD1 ≤ 80.0	0.25	0.35
80.0 < ØD1 ≤ 120.0	0.30	0.50
120.0 < ØD1 ≤ 180.0	0.40	0.65
180.0 < ØD1 ≤ 300.0	0.25% of the outside diameter	0.80
300.0 < ØD1 ≤ 500.0	0.25% of the outside diameter	1.00
500.0 < ØD1 ≤ 630.0	-	-

Tolerance for the inside diameter of the seal (Ød)

Free and without constraint, the inside diameter of the sealing lip is always smaller than the diameter of the shaft. The pre-tightening or interference denotes the difference between these two values. Depending on the shaft diameter, the diameter of the sealing lip is generally considered to be less, between 0.8 and 3.5 mm.

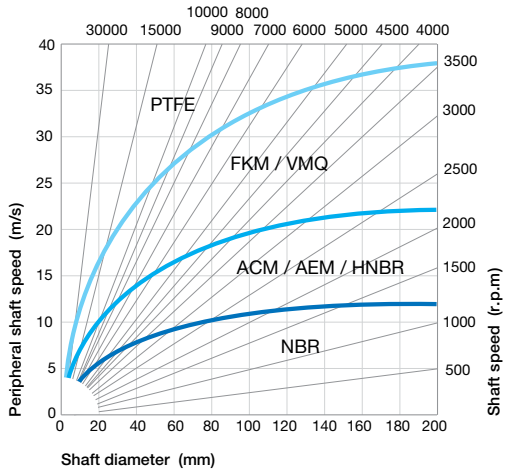
Pumping leads

Clockwise	Anti-clockwise	Bi-directional
		
R	L	H0

Other types of pumping leads can be created according to your specifications. Please contact our experts.

TECHNICAL DATA

Speed



The shaft seals with an additional protective lip are limited to a speed of 8 m/sec.

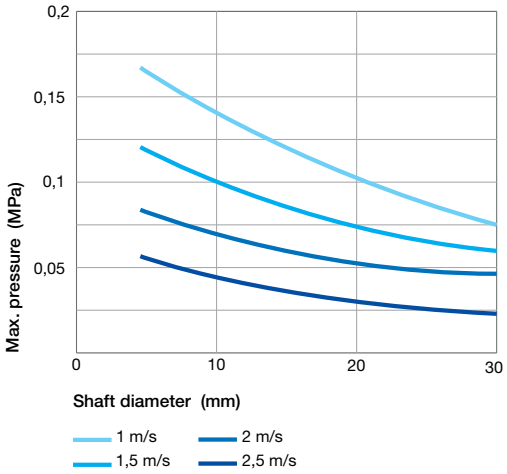
Linear speed calculation:

$$s\ (m/s) = \frac{[\text{shaft } Ø\ (mm)\ \times\ \text{speed (rpm)}\ \times\ \pi]}{60{,}000}$$

Pressure

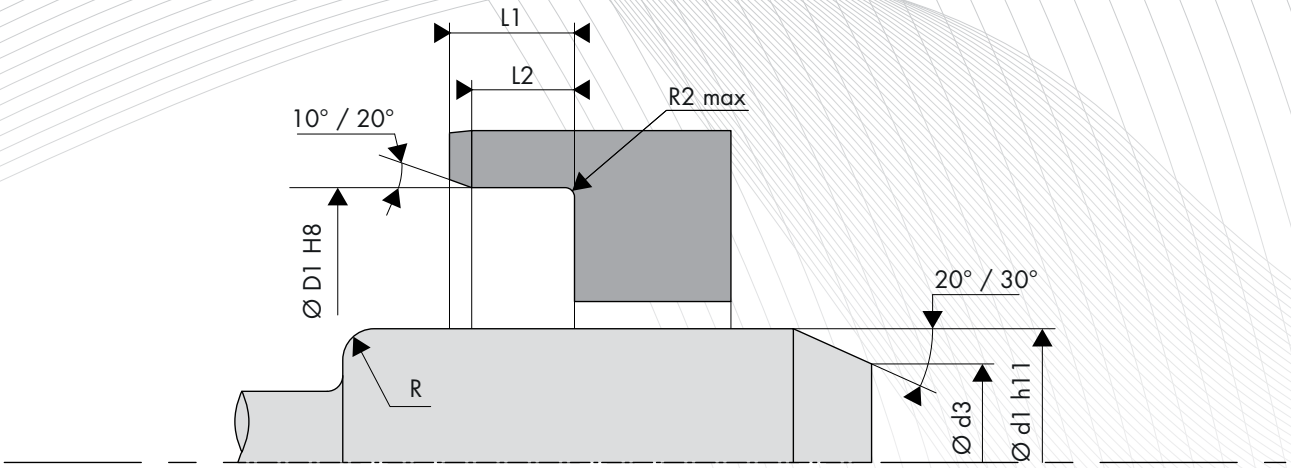
The standard shaft seals are generally used in unpressurised environments, or for pressures between 0.02 and 0.05 MPa maximum.

Higher pressures are acceptable, following testing, for standard NBR or FKM shaft seals used on a shaft of less than 30 mm.



Temperature / Media

Media		Maximum temperature depending on the materials						
		ACM	AEM	EPDM	FKM	HNBR	NBR	VMQ
Mineral oils	Oils for motors	+130°C	+130°C	–	+170°C	+130°C	+100°C	+150°C
	Oils for gearboxes	+120°C	+130°C	–	+150°C	+110°C	+80°C	+130°C
	Oils for hypoid gears	+120°C	+130°C	–	+150°C	+110°C	+80°C	–
	ATF oils	+120°C	+130°C	–	+170°C	+130°C	+100°C	–
	Hydraulic oils	+120°C	+130°C	–	+150°C	+130°C	+90°C	–
	Greases	–	+130°C	–	–	+100°C	+90°C	–
Fire-resistant fluids	HFA group - Emulsion with more than 80% water	–	–	–	–	+70°C	+70°C	+60°C
	HFB group - Opposite solution (water in oil)	–	–	–	–	+70°C	+70°C	+60°C
	HFC group - Polymer aqueous solution	–	–	+60°C	–	+70°C	+70°C	–
	HFD group - Water-free synthetic fluids	–	–	–	+150°C	–	–	–
Other fluids	EL + L heating oil	–	–	–	–	+100°C	+90°C	–
	Air	+150°C	+150°C	+150°C	+200°C	+130°C	+100°C	+200°C
	Water	–	–	+150°C	+100°C	+100°C	+90°C	–
	Water for washing	–	–	+130°C	+100°C	+100°C	+90°C	–
Temperature range	Min.	-25°C	-40°C	-45°C	-20°C	-30°C	-30°C	-60°C
	Max.	+150°C	+150°C	+150°C	+200°C	+150°C	+100°C	+200°C



SHAFT DESIGN

Shaft hardness

Rotation speed	Hardness in HRC
s ≤ 4.0 m/sec	45 HRC
4.0 < s ≤ 10.0 m/s	55 HRC
s > 10.0 m/sec	60 HRC

Surface roughness

Ra *	0.2 to 0.8 µm
Rz	1.0 to 4.0 µm
Rmax	≤6.3 µm

*Ra = 0.1 µm for demanding applications

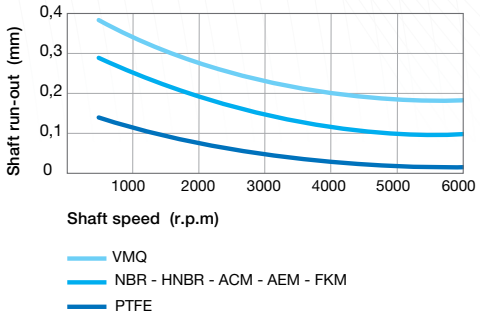
Shaft tolerance

Shaft diameter Ød1 (mm)	Tolerance h11 (mm)
Ød1 ≤ 3.0	-0.060 / 0
3.0 < Ød1 ≤ 6.0	-0.075 / 0
6.0 < Ød1 ≤ 10.0	-0.090 / 0
10.0 < Ød1 ≤ 18.0	-0.110 / 0
18.0 < Ød1 ≤ 30.0	-0.130 / 0
30.0 < Ød1 ≤ 50.0	-0.160 / 0
50.0 < Ød1 ≤ 80.0	-0.190 / 0
80.0 < Ød1 ≤ 120.0	-0.220 / 0
120.0 < Ød1 ≤ 180.0	-0.250 / 0
180.0 < Ød1 ≤ 250.0	-0.290 / 0
250.0 < Ød1 ≤ 315.0	-0.320 / 0
315.0 < Ød1 ≤ 400.0	-0.360 / 0
400.0 < Ød1 ≤ 500.0	-0.400 / 0

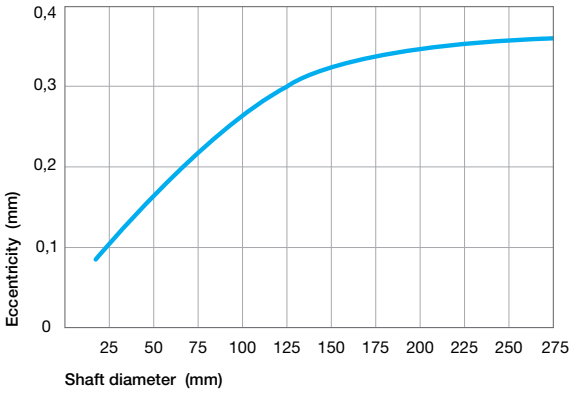
Chamfer and radius

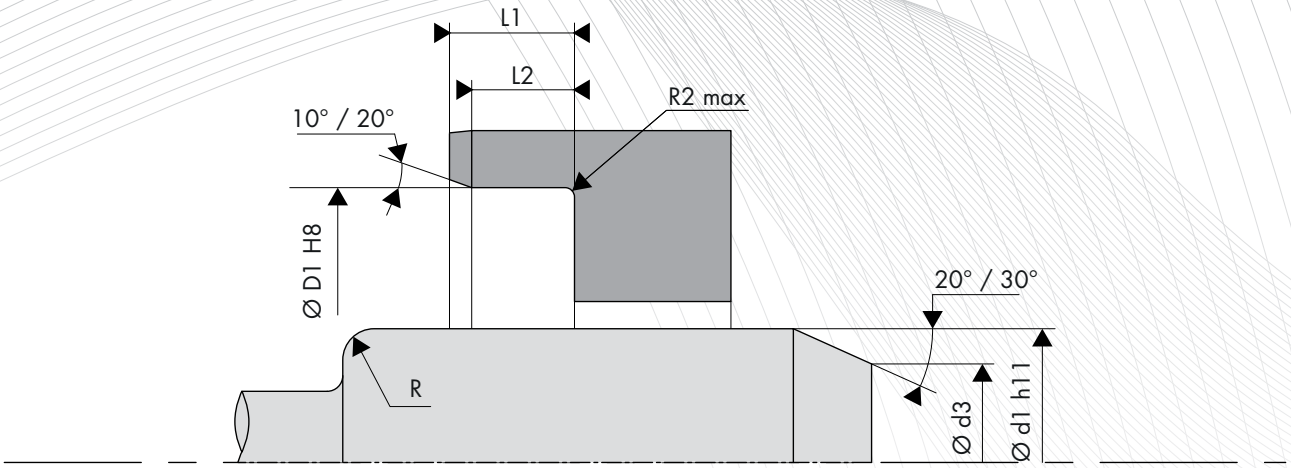
Shaft diameter Ød1 (mm)	Chamfer diameter Ød3 (mm)	Radius R (mm)
Ød1 ≤ 10.0	Ød1 - 1.50	2.00
10.0 < Ød1 ≤ 20.0	Ød1 - 2.00	2.00
20.0 < Ød1 ≤ 30.0	Ød1 - 2.50	3.00
30.0 < Ød1 ≤ 40.0	Ød1 - 3.00	3.00
40.0 < Ød1 ≤ 50.0	Ød1 - 3.50	4.00
50.0 < Ød1 ≤ 70.0	Ød1 - 4.00	4.00
70.0 < Ød1 ≤ 95.0	Ød1 - 4.50	5.00
95.0 < Ød1 ≤ 130.0	Ød1 - 5.50	6.00
130.0 < Ød1 ≤ 240.0	Ød1 - 7.00	8.00
240.0 < Ød1 ≤ 500.0	Ød1 - 11.00	12.00

Shaft run out



Eccentricity





HOUSING DESIGN

Surface roughness

Ra	1.6 to 6.3 µm
Rz	10.0 to 25.0 µm
Rmax	≤25.0 µm

Housing tolerance

Bore diameter ØD1 (mm)	Tolerance H8 (mm)
3.0 < ØD1 ≤ 6.0	0 / +0.018
6.0 < ØD1 ≤ 10.0	0 / +0.022
10.0 < ØD1 ≤ 18.0	0 / +0.027
18.0 < ØD1 ≤ 30.0	0 / +0.033
30.0 < ØD1 ≤ 50.0	0 / +0.039
50.0 < ØD1 ≤ 80.0	0 / +0.046
80.0 < ØD1 ≤ 120.0	0 / +0.054
120.0 < ØD1 ≤ 180.0	0 / +0.063
180.0 < ØD1 ≤ 250.0	0 / +0.072
250.0 < ØD1 ≤ 315.0	0 / +0.081
315.0 < ØD1 ≤ 400.0	0 / +0.089
400.0 < ØD1 ≤ 500.0	0 / +0.097
500.0 < ØD1 ≤ 630.0	0 / +0.110

Housing radius and width

Height H1 (mm)	Width		Radius R2 max (mm)
	L2min (H1 x 0.85)	L1min (H1 x +0.3)	
7.00	5.95	7.30	0.50
8.00	6.80	8.30	
10.00	8.50	10.30	
12.00	10.30	12.30	0.70
15.00	12.75	15.30	
20.00	17.00	20.30	

DIMENSIONS

Part number	Shaft diameter Ød1 h11	Bore diameter ØD1 H8	Seal height H1	Seal height H2
TC9 25 x 62 x 10 x 13	25.00	62.00	10.00	13.00
TC9 28 x 44 x 8 x 11	28.00	44.00	8.00	11.00
TC9 33 x 52 x 7 x 12	33.00	52.00	7.00	12.00
TC9 33 x 52 x 9 x 13.5	33.00	52.00	9.00	13.50
TC9 34 x 52 x 9 x 14	34.00	52.00	9.00	14.00
TC9 37 x 62 x 10 x 17	37.00	62.00	10.00	17.00
TC9 38 x 62 x 9 x 11.5	38.00	62.00	9.00	11.50
TC9 40 x 52 x 7 x 10.5	40.00	52.00	7.00	10.50
TC9 40 x 56 x 9 x 12.5	40.00	56.00	9.00	12.50
TC9 44 x 63 x 8 x 14	44.00	63.00	8.00	14.00
TC9 45 x 65 x 11 x 17	45.00	65.00	11.00	17.00

Part number	Shaft diameter Ød1 h11	Bore diameter ØD1 H8	Seal height H1	Seal height H2
TC9 48 x 84 x 9 x 13.6	48.00	84.00	9.00	13.60
TC9 49 x 75 x 11 x 12	49.00	75.00	11.00	12.00
TC9 49 x 85 x 8 x 9.5	49.00	85.00	8.00	9.50
TC9 50 x 68 x 11.5 x 16	50.00	68.00	11.50	16.00
TC9 50 x 72 x 8 x 11	50.00	72.00	8.00	11.00
TC9 80 x 100 x 10 x 14	80.00	100.00	10.00	14.00
TC9 96 x 124 x 14 x 20.5	96.00	124.00	14.00	20.50
TC9 110 x 140 x 9 x 13	110.00	140.00	9.00	13.00
TC9 120 x 153 x 15 x 18	120.00	153.00	15.00	18.00
TC9 155 x 167 x 8 x 11.5	155.00	167.00	8.00	11.50