

GAMMA Seal





■ Gamma Seal

■ General Description

The GAMMA seal is the result of a large-scale development project covering many years of attempts to combine the capability of conventional mechanical seals to operate at high speeds with the simplicity of the Rotary Shaft Lip Seal. Figure 91 shows the different types, which are characterized by simple design. The basic design consists of two parts, sealing element and metal case. The GAMMA seal is designed to be fixed to the shaft at a pre-determined distance from the sealing surface, which is positioned perpendicularly to the shaft, for example the end wall of a bearing housing. During rotation, the sealing lip rubs against the counter face under a contact pressure calculated to achieve a sealing function. The seal also operates as a deflector ring, and its centrifugal action contributes to good sealing function. Due to the effect of centrifugal force, the sealing lip tends to reduce its contact pressure with increasing speed. As a result, the curve for power loss is very favorable (see Figure 86). At a peripheral speed of around 12 m/s, friction losses begin to diminish and cease completely at about 20 m/s, when the sealing lip has completely lifted free of counter faces. The GAMMA seal then functions as a combined deflector ring and clearance seal.

The GAMMA seal is primarily intended for sealing against foreign matter, liquid splatter, grease.

The foremost features of the GAMMA seal are:

- Very narrow installation width
- Friction diminishes with increasing rotational speed
- Centrifugal action contributes to good sealing
- Lower demands on surface smoothness, surface hardness and tolerances
- Mechanical protection
- Easy to fit

GENERAL DESIGN PARAMETERS

The GAMMA seal permits simple installation design and the requirements on the surface against which the sealing lip works are low. A finish-turned, polished surface with a roughness of 3 - 5 $\mu\text{m Ra}$ is normally adequate. However, the character of the surface is of greater importance than the action surface roughness value. Surface profiles with sharp peaks must be avoided. Injection-molded light-metal alloys can be used in counter faces without further machining. It is necessary to ensure, however, that the part of the mould that produces the counter face is absolutely flawless.

Cold-rolled steel sheet, stainless or zinc plated sheet are excellent materials for counter faces for GAMMA seal. In comparison to other types of seals, the GAMMA seal can better absorb a certain amount of shaft misalignment. It is also relatively insensitive to shaft-to-bore eccentricity and shaft run-out.

Directions of shaft design and fitting are provided in the following sections on GAMMA seal types TBP/RB and TBR/9RB.

GAMMA SEAL TYPE TBP/RB AND TBR/9RB

GAMMA seal type TPB/RB and TBR/9RB consists of an elastic sealing element and a metal case (see Figure 85). The case serves as a holder, support and protection for the sealing element and constitutes a very effective deflector. The components are not bonded to each other, the rubber-sealing element is stretched and held in the case by its elasticity.

Type TBP/RB and TBR/9RB provide a very narrow installation width, which has proved to be very advantageous in certain applications and has permitted this seal to be used in assemblies where other seals could not previously be installed due to lack of space. The seal is press fitted on the shaft, and no other means of fixing is required.

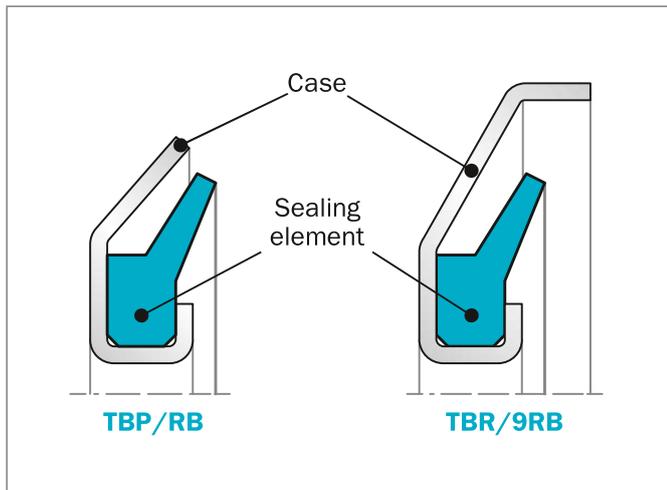


Figure 85: GAMMA seal types

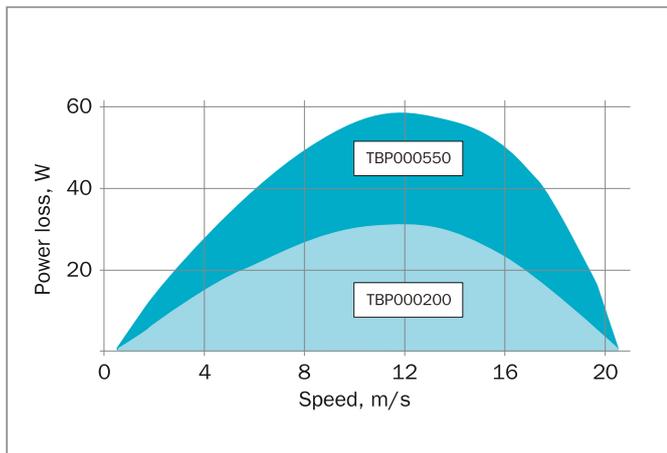


Figure 86: Power loss as a function of peripheral speed (Counterface 1.5 - 2 μm Ra not lubricated seal)

MANUFACTURING MATERIALS

The sealing element is molded and is normally made of Nitrile rubber with a hardness of 75 ± 5 IRHD. Other compounds can be supplied on request. The case is stamped of cold-rolled steel sheet. In order to ensure a good seal and a tight grip on the shaft, the inside diameter is machined to dimensions which ensure a suitable press fit. The tolerances for the inside diameter of the case are given in Table 57. The case is normally zinc plated. The case can also be made out of other materials, such as, stainless steel.

INSTALLATION DESIGN

GAMMA seal type TBP should normally be installed as shown in Figure 88, i.e. with the seal located in the medium which it is to seal against. As shown in Figure 92 the counter face for type TBR against which the sealing lip works should be designed with a groove for the case extension in order to create the clearance seal. For vertical shafts a design in accordance with Figure 87 is preferred, which effectively will reject impurities and liquid splatter. Shaft tolerance ISO h9 provides a suitable press fit. The shaft tolerances normally used for ball and roller bearings, ISO g6 to n6, can also be used. The seal does not require any other axial fixing other than that which is obtained by the press fit between the case and the shaft.

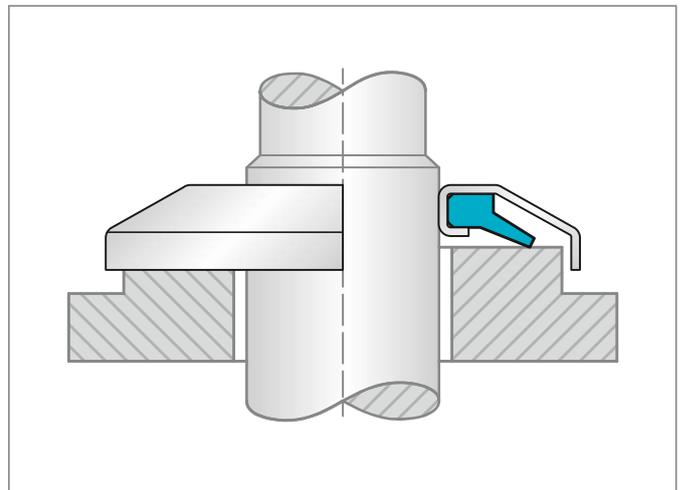


Figure 87: Vertical installation

However, providing a shoulder or a circlip to position the ring may facilitate fitting. The installation dimensions are given in the dimension table.

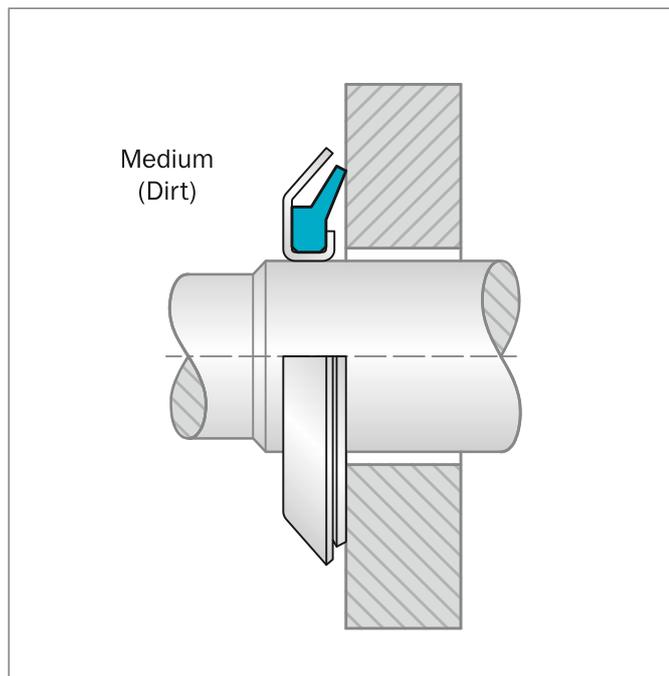


Figure 88: Installation Drawing

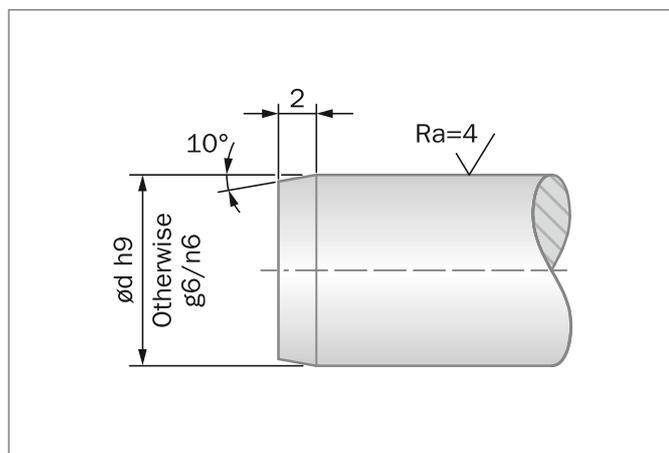


Figure 89: Tolerance of the shaft, surface roughness and chamfer of the shaft

The surface roughness of the shaft should not exceed $4 \mu\text{m}$ Ra. In addition, the shaft should be provided with a chamfer as per Figure 89. Sharp edges or burrs are not permitted. In the case of width b, a variation of $+0.5 \text{ mm}$ is permissible.

Table 57: Lead-in Chamfers

Inside Diameter mm	Chamfer mm	Tolerance mm
0 - 35	2	-0.15 -0.25
36 - 50	2	-0.18 -0.28
51 - 135	2	-0.20 -0.30
136 - 200	2	-0.25 -0.35

FITTING

Prior to being fitted, the sealing member shall be greased, but not between the sealing member and the case. It is important that the seal is fitted with adequate precision. The seal shall be pressed onto the shaft with a uniform and even pressure.

The case must not be tapped directly with the hammer. The seal should therefore be pressed to the right position by means of a suitable assembly tool (see Figure 90, Figure 91 and Figure 92). Since facial fixing beyond the press fit between the seal and the shaft is not provided, the assembly tool should be of a design as shown in Figure 90 and Figure 92 in order to obtain the installation width b as per the dimension tables.

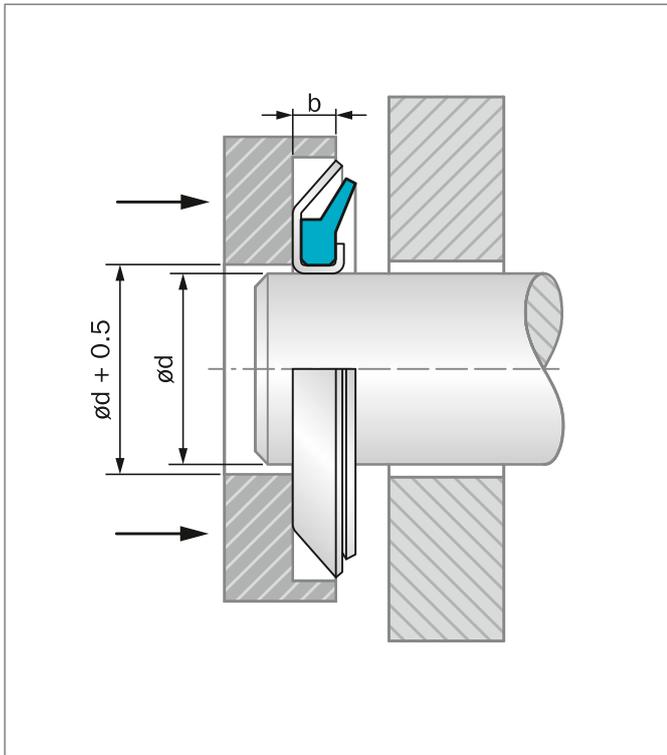


Figure 90: Assembly tool for TBP/RB

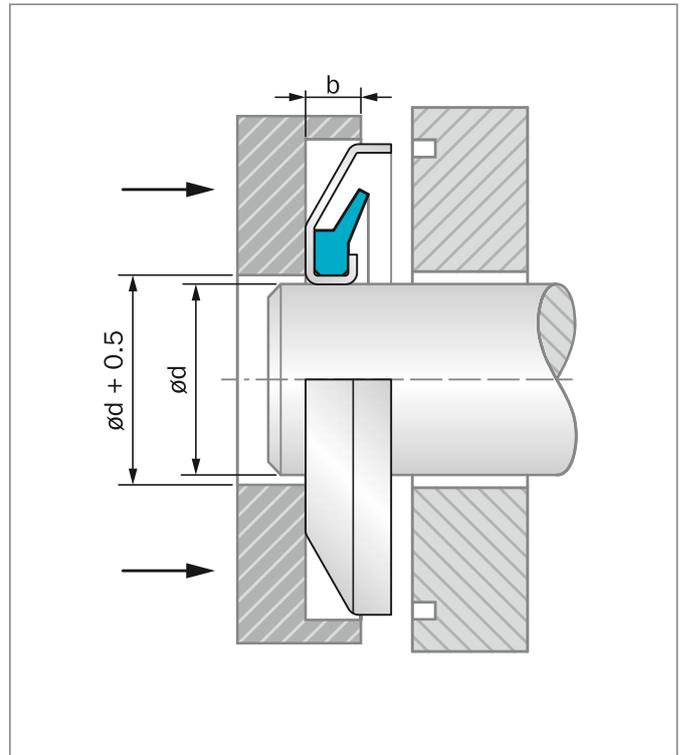


Figure 92: Assembly tool TBR/9RB

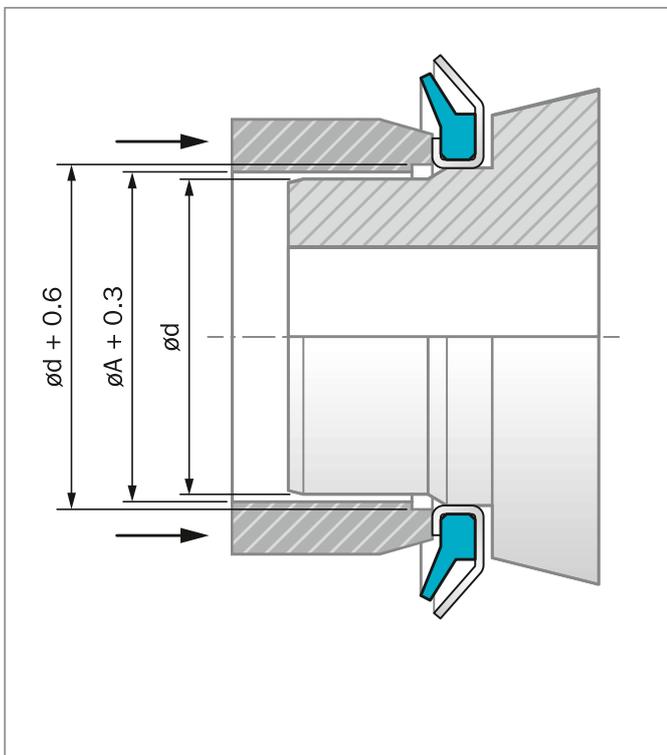


Figure 91: Assembly tool. When positioning the GAMMA seal against a shoulder it is important not to deform the case by pressing with too high load.



■ Type TBP/RB

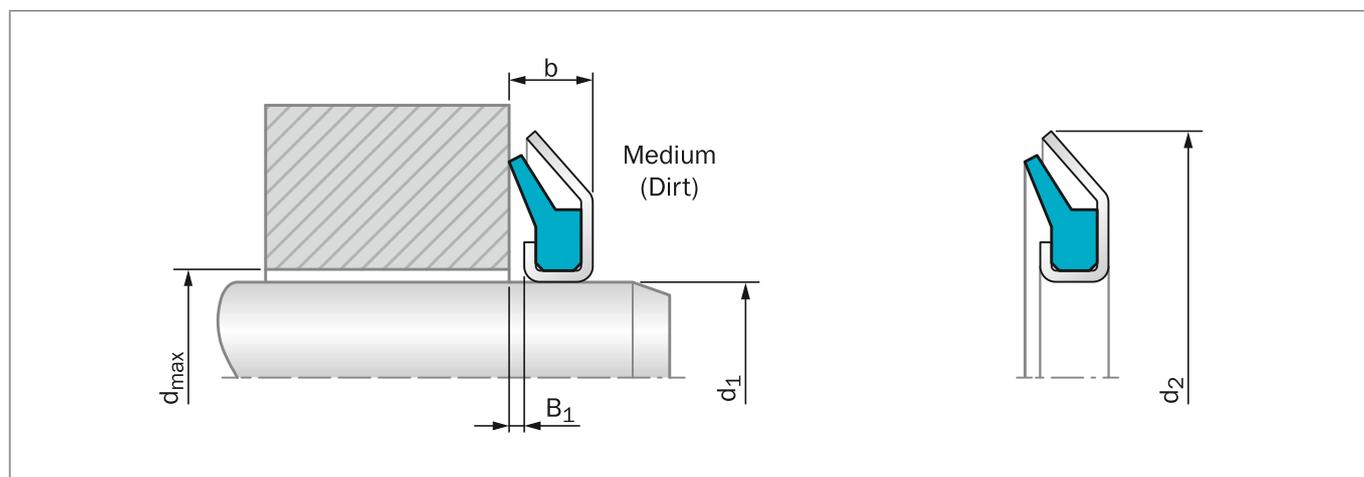


Figure 93: Installation Drawing

GENERAL DESCRIPTION

The design of the most commonly used GAMMA Seal TBP/RB is based on many years of experience in such applications. The total axial force of the sealing lip is given by elastomer pre-stretching together with lip deformation force which depends on the elasticity of the rubber material, geometry of the sealing lip and assembly positioning against the counter-face. The metal shell is protecting the seal from solids and contributes to exclude other pollution media by centrifusion, allowing a good drainage after immersion in liquids.

ADVANTAGES

- Good dynamic sealing
- Very good protection against solid pollution particles
- Modern lip design provides low axial forces (low power loss)
- Small fitting width
- No supplementary retention's needed

APPLICATION EXAMPLES

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors
- Machine tools
- Wheels and heavy-duty axles

OPERATING CONDITIONS

Pressure:	No pressure
Temperature:	-40 °C to +200 °C depending on material
Speed:	Up to 20 m/s
Media:	Mineral and synthetic lubricants (CLP, HLP, APGL etc.)
Housing:	Carbon steel - chromate treated (N7MM) or zinc plated (4N04, 4V04) Stainless and acid-proof steel on request

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask your local Trelleborg Sealing Solutions marketing company for details.

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.



Table 58: Materials

Standard Material*	TSS Material Code	STEFA Material Reference	Standard Metal Shell**
NBR (70 Shore A)	N7MM	-	Carbon steel (chromated)
NBR (75 Shore A)	4N04	1452	Carbon steel (zinc plated)
FKM (75 Shore A)	4V04	5466	Carbon steel (zinc plated)

* Special grades and other materials (HNBR, ACM, VMQ) on request.

** Metal shell can be supplied in different material or treatment on request.

ORDERING EXAMPLE GAMMA SEAL TSS TYPE

TSS type:	BP		
Code:	TBP		
Dimensions:	Shaft diameter	25 mm	
	Housing diameter	40 mm	
	Width	4 mm	
Material:	NBR		
Material Code:	N7MM		

ORDERING EXAMPLE GAMMA SEAL STEFA TYPE

STEFA type:	RB		
Code:	TBP		
Dimensions:	Shaft diameter	25 mm	
	Housing diameter	40 mm	
	Width	4 mm	
Material:	NBR 1452		
Material Code:	4N04		

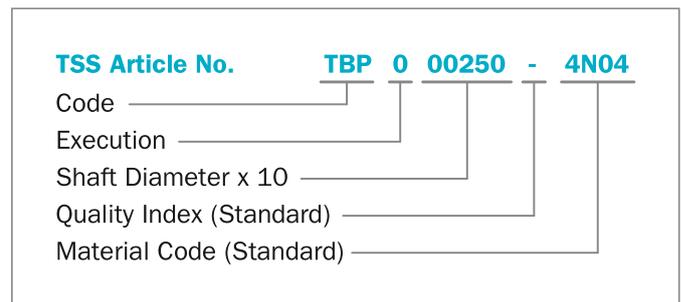
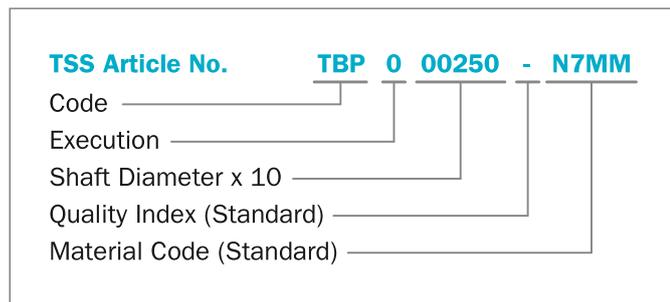


Table 59: Preferred Series / Dimension, TSS Part Numbers

Dimension					TSS Part No.	STEFA	TSS	
d ₁	d ₂	b	B ₁	d _{max}	Type	NBR 4N04	FKM 4V04	NBR N7MM
10	24	3.5	1.0	15	TBP000100	RB10	●	●
12	26	3.5	1.0	17	TBP000120	RB12	●	●
15	30	4	1.0	21	TBP000150	RB15	●	●
16	32	4	1.0	23	TBP000160	RB16	●	●
17	32	4	1.0	23	TBP000170	RB17	●	●
18	33	4	1.0	24	TBP000180	RB18	●	●
20	35	4	1.0	26	TBP000200	RB20	●	●
22	40	4	1.0	28	TBP000220	RB22	●	●
24	40	4	1.0	30	TBP000240	RB24	●	●
25	40	4	1.0	31	TBP000250	RB25	●	●
26	40	4	1.0	32	TBP000260	RB26	●	●
28	43	4	1.0	34	TBP000280	RB28	●	●
30	47	4.5	1.0	37	TBP000300	RB30	●	●



Dimension					TSS Part No.	STEFA			TSS
d ₁	d ₂	b	B ₁	d _{max}		Type	NBR 4N04	FKM 4V04	NBR N7MM
32	49	4.5	1.0	39	TBP000320	RB32	●	●	
35	52	4.5	1.0	42	TBP000350	RB35	●	●	●
40	57	4.5	1.0	47	TBP000400	RB40	●	●	●
45	62	4.5	1.0	52	TBP000450	RB45	●	●	●
48	65	4.5	1.0	55	TBP000480	RB48	●	●	
50	70	5.5	1.0	58	TBP000500	RB50	●	●	●
52	72	5.5	1.0	60	TBP000520	RB52	●	●	
53	73	5.5	1.0	61	TBP000530	RB53	●	●	
55	75	5.5	1.0	63	TBP000550	RB55	●	●	●
58	78	5.5	1.0	66	TBP000580	RB58	●	●	
60	80	5.5	1.0	68	TBP000600	RB60	●	●	●
62	82	5.5	1.0	70	TBP000620	RB62	●	●	
65	85	5.5	1.0	73	TBP000650	RB65	●	●	●
68	88	5.5	1.0	76	TBP000680	RB68	●	●	
70	90	5.5	1.0	78	TBP000700	RB70	●	●	●
72	92	5.5	1.0	80	TBP000720	RB72	●	●	
75	95	5.5	1.0	83	TBP000750	RB75	●	●	●
78	98	5.5	1.0	86	TBP000780	RB78	●	●	
80	100	5.5	1.0	88	TBP000800	RB80	●	●	●
85	105	5.5	1.0	93	TBP000850	RB85	●	●	●
90	110	5.5	1.0	98	TBP000900	RB90	●	●	
95	115	5.5	1.0	103	TBP000950	RB95	●	●	
100	120	5.5	1.0	108	TBP001000	RB100	●	●	●
105	125	5.5	1.0	113	TBP001050	RB105	●	●	
125	148	6.5	1.0	133	TBP001250	RB125	●	●	
135	159	6.5	1.0	145	TBP001350	RB135	●	●	



■ Type TBR/9RB

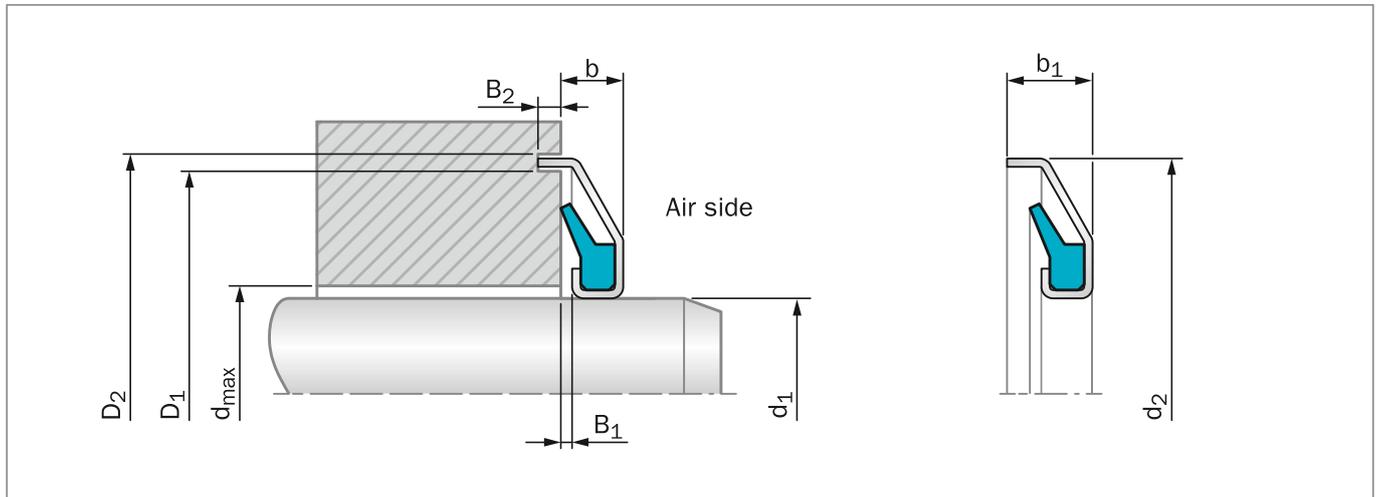


Figure 94: GAMMA seal with labyrinth

GENERAL DESCRIPTION

The design of the GAMMA seal TBR/9RB is based on many years of experience in such applications. The total axial force of the sealing lip is given by elastomer pre-stretching together with lip deformation force which depends on the elasticity of the rubber material, geometry of the sealing lip and assembly positioning against the counterface. The metal shell is protecting the seal from solids and contributes to exclude other pollution media by centrifusion, allowing a good drainage after immersion in liquids. The shape of the metal shell allows a supplementary barrier via the labyrinth in the housing groove which is very effective for heavy-duty applications.

ADVANTAGES

- Good dynamic sealing
- Very good protection against solid pollution particles
- Modern lip design provides low axial forces (low power loss)
- Small fitting width
- No supplementary retention's needed
- Very effective supplementary labyrinth protection

APPLICATION EXAMPLES

- Transmission systems (e.g. gearboxes)
- Pumps
- Electrical motors - mixers
- Machine tools
- Wheels and heavy-duty axles

OPERATING CONDITIONS

Pressure:	No pressure
Temperature:	-40 °C to +200 °C depending on material
Media:	Mineral and synthetic lubricants (CLP, HLP, APGL etc.)
Housing:	Carbon steel - zinc plated Stainless and acid-proof steel on request

Trelleborg Sealing Solutions has carried out several thousands compatibility tests. Please ask your local Trelleborg Sealing Solutions marketing company for details.

IMPORTANT NOTE

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**Table 60: Materials**

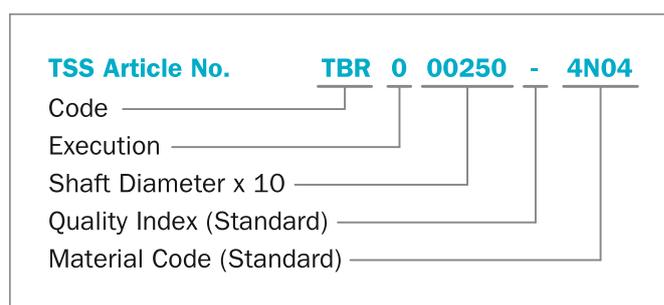
Standard Material*	TSS Material Code	STEFA Material Reference	Standard Metal Shell**
NBR (75 Shore A)	4N04	1452	Carbon steel (zinc plated)
FKM (75 Shore A)	4V04	5466	Carbon steel (zinc plated)

* Special grades and other compounds (HNBR, ACM, VMQ) on request.

** Metal shell can be supplied in different material or treatment on request.

ORDERING EXAMPLE GAMMA SEAL STEFA TYPE

STEFA type:	9RB		
Code:	TBP		
Dimensions:	Shaft diameter	25 mm	
	Housing diameter	42 mm	
	Width	4 mm	
Material:	NBR 1452		
Material Code:	4N04		

**Table 61: Preferred Series / Dimension, TSS Part Numbers**

Dimension									TSS Part No.	TSS		
d ₁	d ₂	b	B ₁	b ₁	B ₂	dmax	D ₁	D ₂		Type	NBR 4N04	FKM 4V04
15	32	4	1.0	6.0	3	21	29	34	TBR000150	9RB15	●	●
17	34	4	1.0	6.0	3	23	31	36	TBR000170	9RB17	●	●
20	37	4	1.0	6.0	3	26	34	39	TBR000200	9RB20	●	●
25	42	4	1.0	6.0	3	31	39	44	TBR000250	9RB25	●	●
30	48	4.5	1.0	6.5	3	37	45	50	TBR000300	9RB30	●	●
35	53	4.5	1.0	6.5	3	42	50	55	TBR000350	9RB35	●	●
40	58	4.5	1.0	6.5	3	47	55	60	TBR000400	9RB40	●	●
45	63	4.5	1.0	6.5	3	52	60	65	TBR000450	9RB45	●	●
55	77	5.5	1.0	7.5	3	63	73.5	79	TBR000550	9RB55	●	●
70	92	5.5	1.0	7.5	3	78	88.5	94	TBR000700	9RB70	●	●
80	102	5.5	1.0	7.5	3	88	98.5	104	TBR000800	9RB80	●	●
85	107	5.5	1.0	7.5	3	93	103.5	109	TBR000850	9RB85	●	●
90	112	5.5	1.0	7.5	3	98	108.5	114	TBR000900	9RB90	●	●
95	117	5.5	1.0	7.5	3	103	113.5	119	TBR000950	9RB95	●	●
100	122	5.5	1.0	7.5	3	108	118.5	124	TBR001000	9RB100	●	●