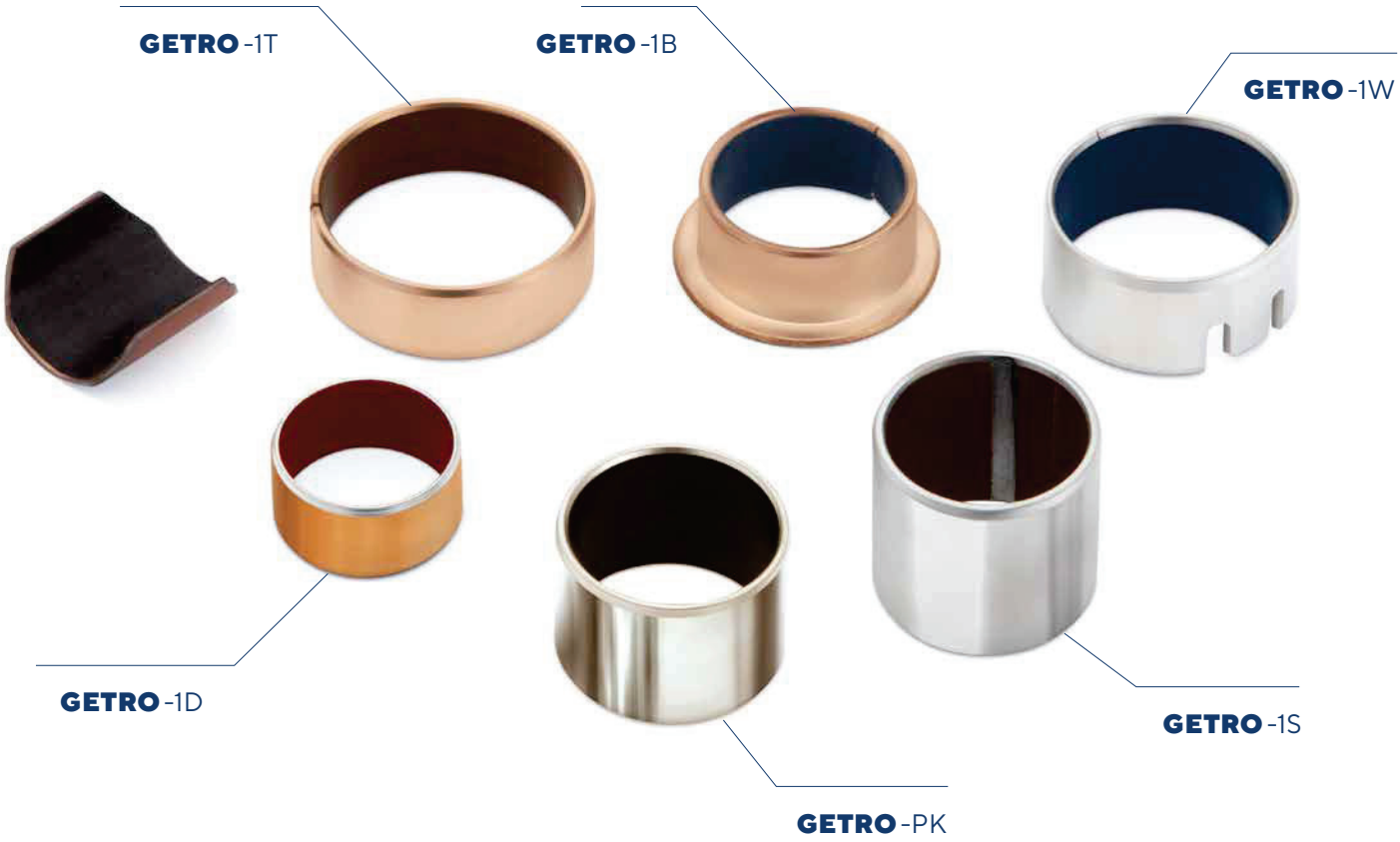
ROLLED DRY SLIDING BUSHINGS (PTFE)



Rolled dry sliding bushings (PTFE) for temperature ranges from -195°C to +280°C

We offer rolled dry bushings (PTFE) in various designs for all industry-specific requirements. These include, for example, rolled dry plain bearings GETRO-1W, which are manufactured from a three-layer composite material. They consist of a steel strip, a sintered porous bronze layer and a PTFE surface sliding layer.

GETRO®
ROLLED SLIDING BUSHINGS

GETRO-1W-ROHS

The GETRO-1W bushings are encapsulated sliding bushings made of a three-layer composite produced from a steel strip, a sintered-on porous bronze layer and a surface sliding layer made of PTFE. This type of bushing has a low friction coefficient and protection against wear and corrosion, and can be used without oil. The low manufacturing costs and top-of-the-range technical foundations mean that these bushings are used in a variety of different kinds of sliding applications, such as in textile manufacturing machinery, hydraulic systems and automotive machinery as well as agricultural and forestry machinery.

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	Limit value (dry)	Limit value (oil)
	GETRO-1W-ROHS	140 N/mm²	-195°C to +280°C	5 m/s	0.04 - 0.20	3.6 N/mm² × m/s	50 N/mm² × m/s

GETRO-1T

The GETRO-1T consists of a specially developed PTFE surface sliding layer and is particularly suited to applications with high PV ratings, such as transmission oil pumps.

This type of bushing is primarily used in hydraulic systems or for boundary lubrication, and in medium or high-pressure transmission oil pumps (p = 16 – 25 Mpa, V = 3,5 – 5 m/s).

The friction coefficient and the wear and shock-resistant properties have undergone additional improvements.

With hydrodynamic lubrication, the PV limit was reached at 120 N/mm² × m/s. These sliding bushings are used in transmission pumps as well as in piston pumps and vane pumps.

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	Limit value (dry)	Limit value (oil)
	GETRO-1T	140 N/mm²	-195°C to +280°C	10 m/s	0.03 - 0.18	4.3 N/mm² × m/s	60 N/mm² × m/s

GETRO-1D-ROHS

The GETRO-1D bushing is particularly suitable for linear or axial movements. This type of bushing is particularly wear-resistant and can retain lubricant well, even if it has a long service life. It also simultaneously protects the mating surfaces from wear and tear.

This type of bearing is generally used as a piston ring in shock absorbers for cars and motor cycles and for various hydraulic cylinders, hydraulic motors and pneumatic components.

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	Limit value (dry)	Limit value (oil)
	GETRO-1D-ROHS	140 N/mm²	-195°C to +280°C	3 m/s	0.04 - 0.20	3.8 N/mm² × m/s	50 N/mm² × m/s

GETRO-1B (TU-B)

The ttv -1B bearings consist of a PTFE layer sintered onto a phosphated bronze strip. These bearings are corrosion-resistant and are suited to high-temperature applications that can be carried out without the use of oil requiring long operating cycles.

This type of bearing is used radially or axially, particularly in the steel and cement industries. The ttv-1B bearings can be used in panels as bridge bearings, as the thick inner surface sliding layer can withstand a load of up to 140 N/mm²

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	Limit value (dry)	Limit value (oil)
	GETRO-1B (TU-B)	140 N/mm²	-195°C to +280°C	5 m/s	0.03 - 0.18	4.3 N/mm² × m/s	50 N/mm² × m/s

GETRO-1S (DI)-ROHS

The GETRO-1S sliding bushings are oil-resistant, acid-resistant, alkali-resistant and saltwater-resistant. They consist of a stainless steel band, a sintered bronze layer, and a PTFE layer. Furthermore, the PTFE surface sliding layer is lead-free, meaning that this type of bush-ing can be used for applications in the food industry, for alkali-flow measuring devices, in pharmaceutical machinery, printing machinery, in chemical engineering and in the shipping industry.

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	Limit value (dry)	Limit value (oil)
	GETRO-1S (DI)- ROHS	140 N/mm²	-195°C to +280°C	2.5 m/s	0.04 - 0.20	3.6 N/mm² × m/s	50 N/mm² × m/s

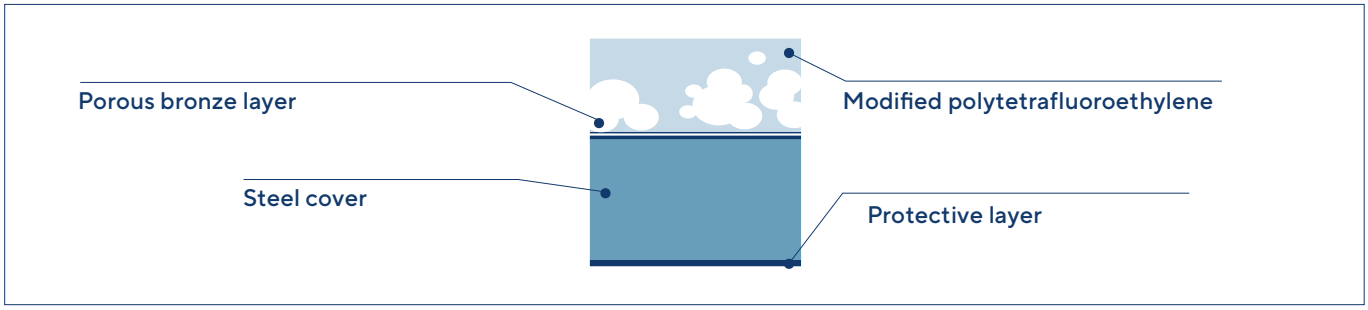
Structure

The self-lubricating sliding bearings in series 1 consist of three different material layers:

- A steel or bronze strip that improves the mechanical resistance
- A porous sintered bronze layer that ensures thermal conduction and rigidity (0.20 to 0.35 mm)
- A surface layer (blend of PTFE and Pb/no Pb; 0.01 to 0.05 mm) that enables good self-lubrication (low levels of wear and lower levels of friction)
- The steel strip is protected by a thin layer of copper or tin to improve corrosion resistance and thermal conduction

Functionality

The structure of the GETRO PTFE sliding bushings successfully combines the mechanical resistance of the steel, the dry gliding of the PTFE and the thermal conduction capacity of the bronze.



Maximum dry load factor	Alternating load	pv	**0.9 N/mm² × m/s**
	Continuous load		**1.8 N/mm² × m/s**
	Limit for short periodw		**3.6 N/mm² × m/s**
Load limit	Static GETRO-1X	P	**250 N/mm²**
	Static for GETRO-1B		**200 N/mm²**
	Slight movements		**140 N/mm²**
	Rotation and Oscillating		**60 N/mm²**
Limit temperature	Dry	v	**2.5 m/s**
	Hydrodynamic operation		**< 10 m/s**
Limit speed	Minimum	m	**0.03**
	Maximum		**0.2**
Coefficient of friction	Minimum	T	**– 195 °C**
	Maximum		**+ 270 °C**
Linear expansion coefficient	GETRO-1X	a st	**14 × 10⁻⁶ / K**
	GETRO-1B	a bz	**18 × 10⁻⁶ / K**
Electricity output coefficient	GETRO-1X	l st	**40 W/m × K**
	GETRO-1B	l bz	**60 W/m × K**

Steel + PTFE

Determining the technical data and preliminary check
The following information is required to select the correct sliding bushing and calculate the service life of the TU sliding bushing.

Designation	Short designation	Unit
Sliding bearing inner diameter	d_1	mm
Washer inner diameter	D_4	mm
Washer outer diameter	D_5	mm
Length of the sliding bearing	L	mm
Load on the sliding bearing	P	N
Speed of rotation	N	t/mm
Angle of oscillation degrees	φ	°
Frequenzy of oscillation	Nosz	cycles/min
Nominal life	LH	hours

For sliding bushings, the load area corresponds to the area of the inner diameter ($d_1 \times L$).

$$P = \frac{N}{d_1 \times L}$$

Sliding speed

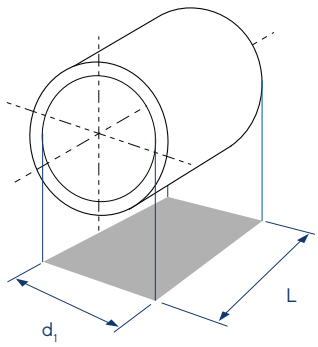
The sliding speed of the sliding bushings depends on the rotational speed and the oscillation angle. It is calculated as follows:

Rotating thrust washer

$$V = \frac{\pi \times D_5 \times N}{60 \times 10^3}$$

Rotating sliding bushing

$$V = \frac{\pi \times d_1 \times N}{60 \times 10^3}$$

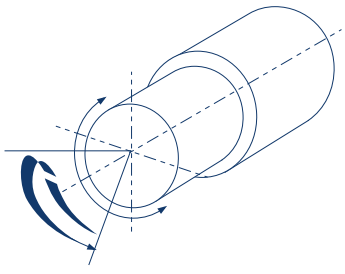


Oscillating thrust washer

$$V = \frac{\pi \times D_5}{60 \times 10^3} \times \frac{2\varphi \times Nosz}{360}$$

Oscillating sliding bushing

$$V = \frac{\pi \times d_1 \times 2\varphi \times Nosz}{60 \times 10^3 \times 360}$$



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Load factor

The load factor results from the specific load and sliding speed. The „pv value“ provides a direct indication of the load level of the sliding bushings.

$$P(N/mm^2) \times v\ (m/s) = pv(N/mm^2 \times m/s)$$

Preliminary checks

The following application limits must be observed and verified using preliminary checks for both new and existing sliding bushing dimensions.

Provided that these limits are not exceeded, initial information will be provided regarding the feasibility of usage, and it will be possible to determine the service life.

$P = 250\ N/mm^2 \times v = 2.5\ m/s$ max.

pv for changing load = max. 0.9
pv for short periods of time = max. 1.8
pv for permanent load = max. 3.6

Calculating the service life

The service life of sliding bushings for application in dry environments is inversely proportional to the pv limit value. However, the following correction factors were implemented in order to achieve a high approximate value:

Ka = constant, dependent on area of application
Fp = load correction factor
Fc = temperature correction factor
Fd = dimension correction factor
Fm = material correction factor
Lh = hours

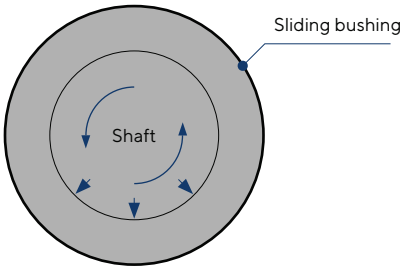
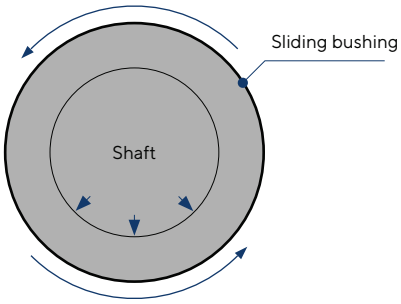
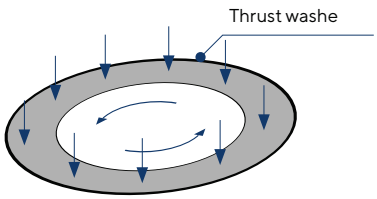
$$Lh = \frac{Ka}{pv^{1.2}} \times Fp \times Fc \times Fd \times Fm$$

Fc = Temperature correction factor							
Characteristics	Heat dissipation	Temperature °C					
		20	60	100	150	200	280
Continuous | Operation in dry environment	Good	1.0	0.8	0.6	0.4	0.2	0.1
Continuous | Operation in dry environment	Poor	0.5	0.4	0.3	0.2	0.1	-
Interrupted operation | Interrupted operation Interval > 10 × operating time	Good	2	1.6	1.2	0.8	0.4	0.2
Permanent placement in water		2.0	1.6	0.8	-	-	-
Temporary placement in water		0.4	0.2	0.1	-	-	-
Permanent placement in lubricant		3.0	2.4	1.8	1.2	0.8	-

Fd = Dimension correction factor				
∅ Shaft diameter (mm)				
≤ 20	20 ≤ 40	40 ≤100	100 ≤ 150	≥150
1	0.9	0.7	0.5	0.4

Fp = Load correction factor			
P = N/mm 2			
≤ 10	≤ 25	≤ 50	≤ 60
1	0.3	0.2	0.1

Fm = material correction factor	
Steel (low carbon content)	1
High-carbon steel	1.5
Non-oxidising	2
Shaped iron	1
Aluminium	0.4
Bronze	0.4
Zinc cadmium	0.2
Nickel	0.2
Chrome	2
Anodic oxidised aluminium	2

Ka = Application correction factor		
Load effective in one direction	Load factor P	Coefficient of fricition
		
400	800	250

Friction

The friction of GETRO sliding bushings depends on the applied load, the sliding speed and the operating temperature. The degree of completion of the mating surface is also a significant factor.

Sliding speed v (m/s)	Load factor PV	Coefficient of fricition
to 0.001	140	0.03
from 0.001 to 0.005	from 140 to 62	from 0.04 to 0.07
from 0.005 to 0.05	from 62 to 11	from 0.07 to 0.1
from 0.05 to 0.5	from 11 to 1	from 0.1 to 0.15
from 0.5 to 2	1	from 0.15 to 0.20

Wear

During the running in phase, part of the PTFE sliding bushing surface is transferred onto the mating surface of the shaft or the bolt. This causes part of the surface roughness to be offset and a uniform sliding film to be formed. Shafts, bolts and other mating surfaces should be manufactured from steel alloys, stainless steel, a chrome layer or anodised aluminium. This increases the service life of the sliding bushings.

Surfaces made of bronze or aluminium, phosphated or nickel-plated, are not suitable for use as mating surfaces for series 1 sliding bushings. In order to optimise the durability, we recommend a maximum roughness of 0.4 RA. Due to the large number of special cases, it is recommended to carry out preliminary practical tests.

GETRO-1B sliding bushings

As the GETRO-1X is fitted on a steel strip, its corrosion resistance is limited. If the external protective layer is damaged, this can lead to corrosion resulting from environmental influences such as humidity, oxygen or alkaline or acidic substances. Using the GETRO-1B sliding bushing can significantly reduce this risk. The GETRO-1B sliding bushing has a bronze strip rather than a steel strip as the base layer. Bronze is very resistant to corrosion, as the structure cannot be corroded by water, oxygen or saline media. ttv supplies all GETRO-1X sliding bushing dimensions also as GETRO-1B sliding bushings.

GETRO-1S sliding bushings

Structure

GETRO-1S sliding bushings are made from stainless steel, type AISI-316 (UNI-NIMO 1712, DIN 1.4401). This steel is used in particular due to its excellent mechanical stability and corrosion resistance. The PTFE treatment makes the working surfaces self-lubricating, thereby allowing use in dry environments. The GETRO-1S sliding bushings are lead-free, which causes a reduction of the total load that can be carried by the sliding bushings. However, these bushings provide very high levels of corrosion resistance with simultaneously high media compatibility.

Properties

These bushings are primarily recommended for static or slow-moving applications. However, with a highly reduced load, they reach a sliding speed of up to 2 m/s.

The load limits that must be observed in the construction phase are 100 N/mm^2 under static conditions and reduce to 4 N/mm^2 at a sliding speed of 0.2 m/s. The data is, however, affected by a variety of factors, such as mating surface processing, axiality, lubricant content, any contamination etc.

The operating temperature for the ttv-1S series is –195 °C to + 270 °C.

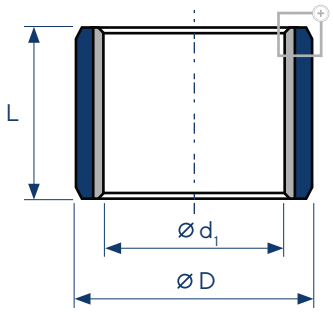
The GETRO-1S sliding bushing is practically impervious to corrosion, and is therefore ideally suited to applications in closed installations in which media (including corrosive fluids) are used and for which maintenance is either impossible or very difficult to carry out due to low accessibility.

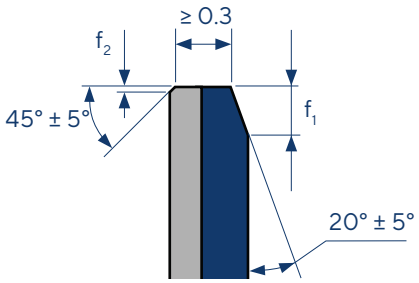
Typical examples of this type of application are valves, electric meters and other production installations. The fundamental properties are the same as those already described for the TU sliding bushings:

- Reduced dimensions
- Simple installation
- Reduced friction coefficient
- No stick-slip effect

GETRO PTFE – Cylindrical standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diameter
L: Length
f_1: Outer chamfer
f_2: Inner chamfer





d_1	D	Shaft Diameter f7	Housing H7	Wall thickness		f_1	f_2	L									
				min	max			6	8	10	12	15	20	25	30	40	50
6	8	6	8	0.980	1.005	0.5	0.3	0606	0608	0610							
8	10	8	10					0806	0808	0810	0812	0815					
10	12	10	12					1006	1008	1010	1012	1015	1020				
12	14	12	14					1206	1208	1210	1212	1215	1220	1225			
13	15	13	15							1310			1320				
14	16	14	16							1410	1412	1415	1420	1425			
15	17	15	17							1510	1512	1515	1520	1525			
16	18	16	18							1610	1612	1615	1620	1625			
17	19	17	19							1710	1712		1720				
18	20	18	20							1810	1812	1815	1820	1825			
20	23	20	23	1.475	1.505	0.8	0.4			2010	2012	2015	2020	2025	2030		
22	25	22	25							2210	2212	2215	2220	2225	2230		
24	27	24	27									2415	2420	2425	2430		
25	28	25	28							2510	2512	2515	2520	2525	2530	2540	2550
28	32	28	32	1.970	2.005	1.0	0.5					2815	2820	2825	2830	2840	
30	34	30	34								3012	3015	3020	3025	3030	3040	
32	36	32	36										3220		3230	3240	
35	39	35	39								3512	3515	3520	3525	3530	3540	3550
38	42	38	42									3815			3830	3840	
40	44	40	44								4012		4020	4025	4030	4040	4050

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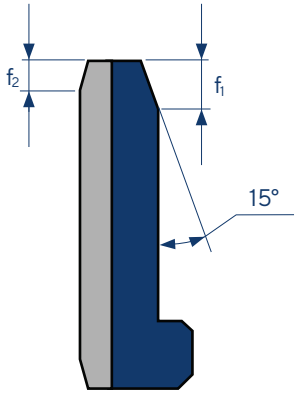
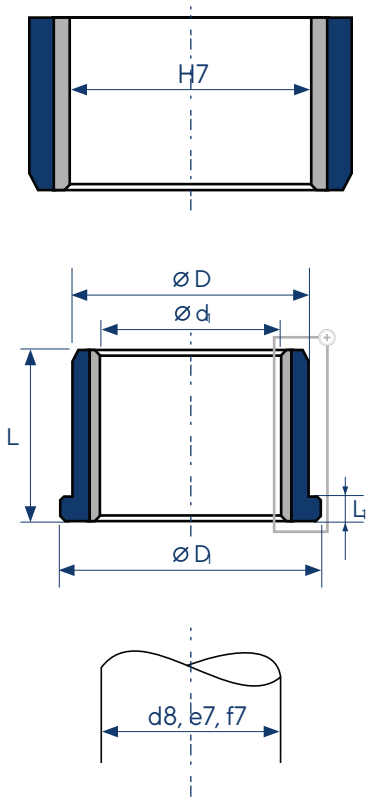
d_1	D	Shaft Dia-meter f7	Housing H7	Wall thickness		f_1	f_2	L								
				min	max			20	25	30	40	50	60	70	80	100
45	50	45	50	2.460	2.505	1.2	0.6	4520	4525	4530	4540	4550				
50	55	50	55					5020		5030	5040	5050	5060			
55	60	55	60							5530	5540	5550	5560			
60	65	60	65							6030	6040	6050	6060	6070		
65	70	65	70							6530	6540	6550	6560	6570		
70	75	70	75								7040	7050	7060	7070	7080	
75	80	75	80							7530	7540	7550	7560	7570	7580	
80	85	80	85	2.440	2.490	1.4	0.7				8040	8050	8060	8070	8080	80100
85	90	85	90								8540		8560		8580	85100
90	95	90	95								9040	9050	9060		9080	90100
95	100	95	100									9550	9560		9580	95100
100	105	100	105									10050	10060		10080	
105	110	105	110										10560		10580	
110	115	110	115										11060		11080	
120	125	120	125	2.415	2.465	1.6	0.8						12060		12080	120100
125	130	125	130										12560			125100
130	135	130	135										13060		13080	130100
140	145	140	145										14060		14080	140100
150	155	150	155									15050	15060		15080	150100
160	165	160	165										16060		16080	160100
180	185	180	185												18080	180100
190	195	190	195												19080	190100
200	205	200	205										20060		20080	200100
220	225	220	225												22080	220100
250	255	250	255												25080	250100
260	265	260	265												26080	260100
280	285	280	285												28080	280100
300	305	300	305												30080	300100

GETRO PTFE – Flanged sliding bushings, standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diameter
L: Length





d_1	D	Shaft Diameter f7	Housing H7	D_1 ± 0.25	L ± 0.25	L1 -0.2	f_1	f_2
6	8	- 0.015 - 0.028	+ 0.015	12	7	1	0.6	0.3
8	10			15	5.5 7.5			
10	12	- 0.018 - 0.021	+ 0.018	18	7 9 12			
12	14			20	7 9 12			
14	16			22	12 17			
15	17			23	9 12			
16	18			24	12 17			

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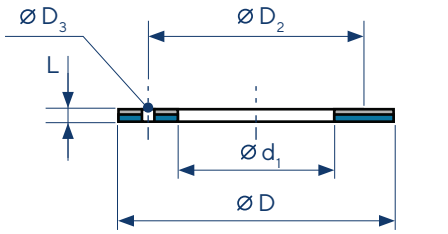
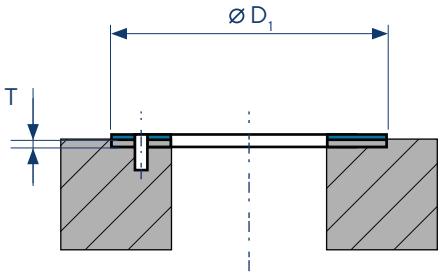
d_1	D	Shaft Diameter f7	Housing H7	D_1 ± 0.25	L ± 0.25	L1 -0.2	f_1	f_2
18	20	- 0.018 - 0.021	+ 0.021	26	12 17 20	1	0.6	0.3
20	23	- 0.020 - 0.041		30	11.5 16.5 21.5	1.5	0.6	0.4
22	25			32	15 20			
25	28			35	11.5 16.5 21.5			
30	34		+ 0.025	42	16 26	2	1.2	
35	39	- 0.025 - 0.050		47	16 26			
40	44			53	26 40			

GETRO PTFE – Thrust washers standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diameter
D_2: Screw hole position
D_3: Screw hole diameter
L: Thickness
T: Installation measurement





Shaft Diameter f7	$d_1^{+0.25}$	$D_{-0.25}$	$D_2^{\pm 0.12}$	$L_{-0.05}$	$D_{3+0.4+0.1}$	$T^{\pm 0.2}$	$D_1^{\pm 0.12}$
8	10	20	15	1.5	1.5	1	20
10	12	24	18				24
12	14	26	20		2		26
14	16	30	23				30
16	18	32	25				32
18	20	36	28		3		36
20	22	38	30				38
22	24	42	33				42
24	26	44	35				44
26	28	48	38		4		48
30	32	54	43				54
36	38	62	50				62
40	42	66	54				66
46	48	74	61	2		1.5	74
50	52	78	65				78
60	62	90	76				90

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