SEALING
BUSHING

Complete catalogue

BUSHING TECHNOLOGY

ttv-gmbh.de

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BUSHING TECHNOLOGY FOR THE HIGHEST DEMANDS

ttv bushing technology is used in a wide range of applications in drive technology, mechanical engineering and commercial vehicle construction as well as in the road construction and agricultural industries. Whether in wind turbines or power tools, our plain bearings ensure the reliability and functionality of your machines. As a manufacturer from Germany, we rely on high technical standards and state-of-the-art production processes. In addition to a large range of plain bearings from stock, we are increasingly focussing on customer-specific solutions.

As a manufacturer of bushings, we know: Wherever heavy loads need to move with low friction, resilient, high-quality bushings are needed. We are increasingly meeting these ever-increasing requirements with customised products developed by our Engineering Solutions department.

All ttv products naturally fulfil the technical and economic requirements of leading industrial companies. Individual features are optimally realised by us and secure your application with maximum reliability.

YOU CAN RELY ON OVER 40 YEARS OF EXPERIENCE

Specialising in the production and manufacture of high-quality plain bearings, slide rails and special parts since 1983.

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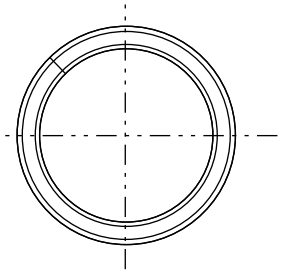
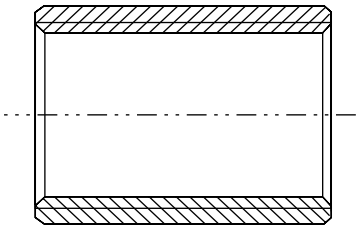
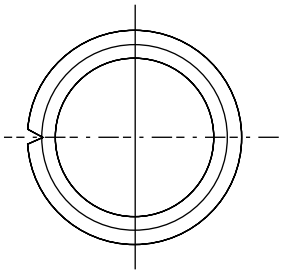
1. ROLLED STANDARD PROFILE

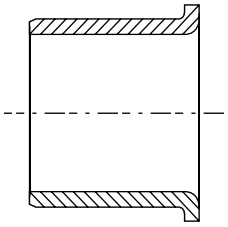
Cylindrical sliding bearings



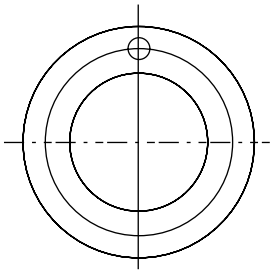


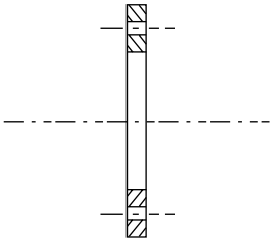
Flanged bushings



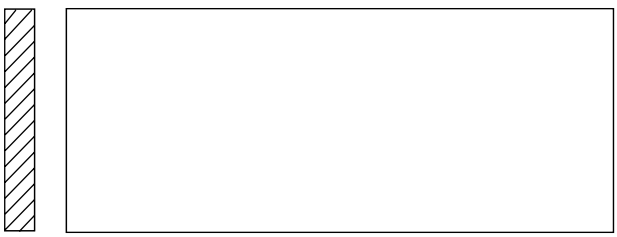


Thrust washers





Strip sections

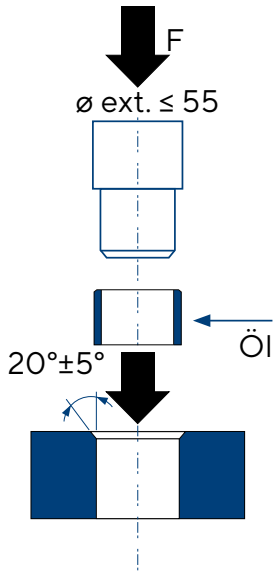


2. INSTALLATION

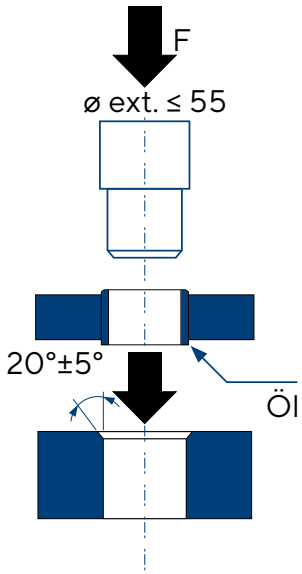
Sliding bearings are installed by being pressed into a machined housing “H7“.

Please note the following:

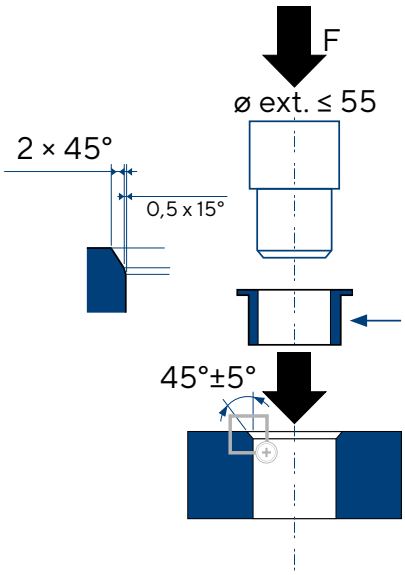
- Create an insertion bevel at an angle, and clean and deburr the parts to be assembled
- Lubricate the outer surface of the sliding bearing prior to installation
- Check the axiality between the installation space and the centring axis of the sliding bearing
- If two sliding bearings are required, these must be aligned
- Use a counter mandrel with suitable dimensions



Linear, axial mandrel alignment, sliding bearing and bore



Lubricate outer surface



Observe insertion chamfer

The installation is carried out using hydraulic presses or mechanical machinery.
The maximum resistance (F) is shown in the following tables:

Strip thickness			
1 mm: F = 300 N × L	1.5 mm: F = 500 N × L	2 mm: F = 700 N × L	2.5 mm: F = 900 N × L

For sliding bearings with a diameter < 55 mm, it is recommended to use an installation ring with a diameter of 0.3 – 0.4 mm

3. INSPECTIONS AND CHECKS

The method used to check the strip thickness consists of checking the inner and outer diameter dimensions. The diameters must not be measured again before pressing in the sliding bearing, as this causes inaccurate measurements. The ISO 3547 standard (replacement for DIN 1494) describes the applicable method of measuring the diameter.

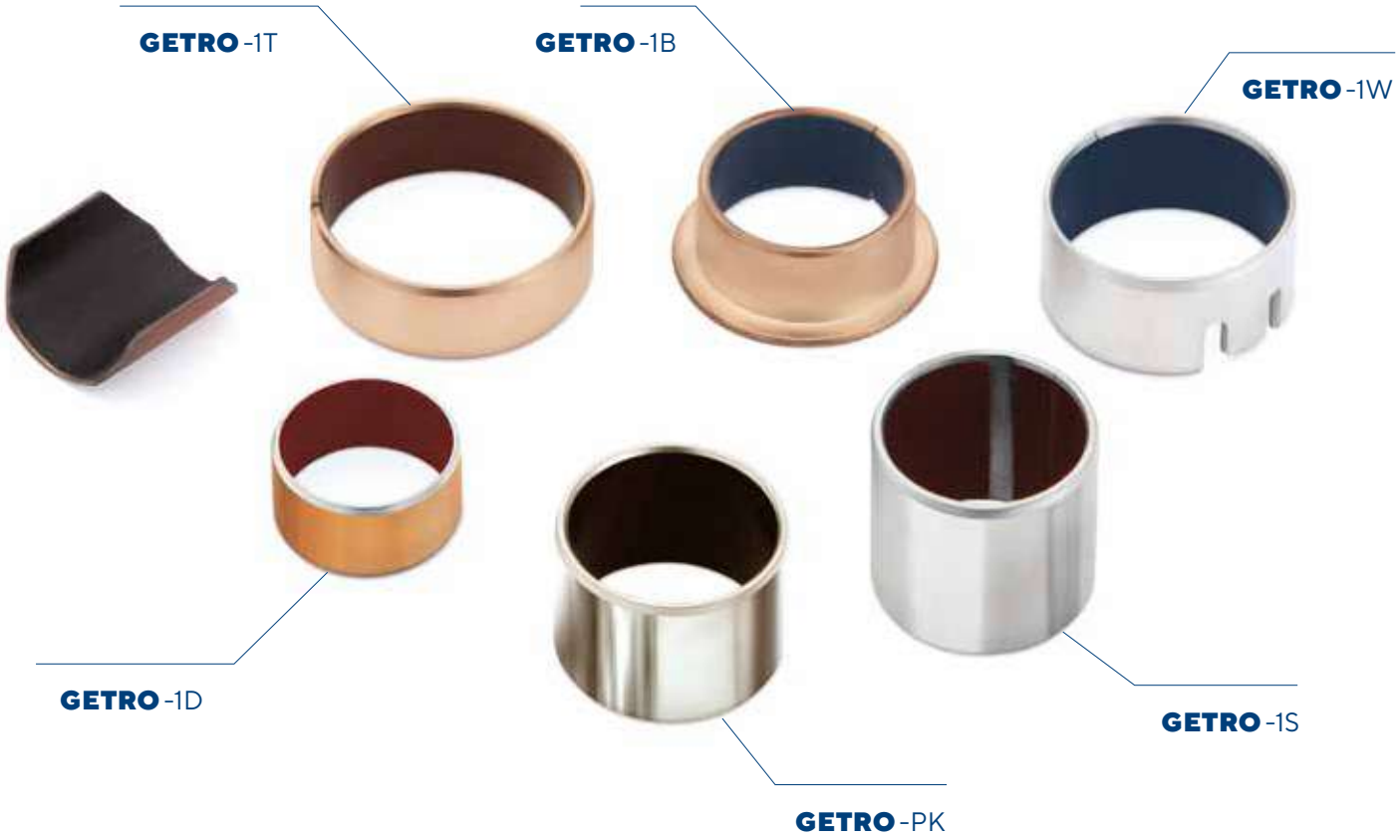
External diameter, test A

The testing equipment must comply with the ISO 3547 standard. The device consists of two halves, into which the sliding bearing is inserted and then clamped in place. During the tests, the two halves are pressurised and checked to see how far the sliding bearing yields. If the deviation „Z" is confirmed to be within a certain range, then the external diameter can be classed as correct.

Inner diameter, test C

The sliding bearing is pressed into an appropriate bore with a diameter tolerance as per "H7". Once it has been pressed in, the inner diameter can be checked using suitable measuring tools.

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

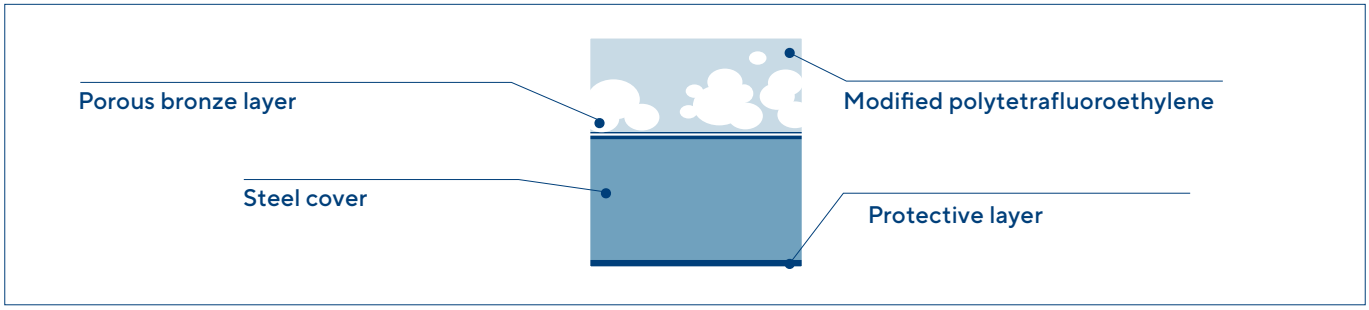
Structure

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	φϕ	°
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

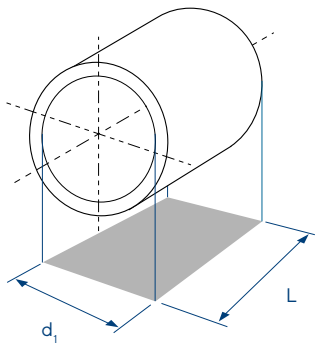
The sliding speed of the sliding bushings depends on the rotational speed and the oscillation angle. It is calculated as follows:

Rotating thrust washer

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

Rotating sliding bushing

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

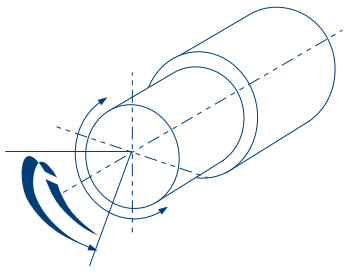


Oscillating thrust washer

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

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

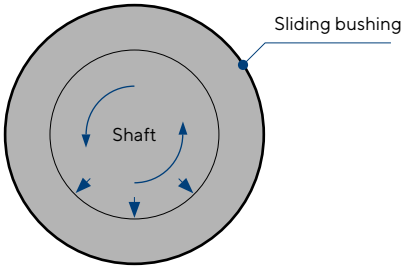
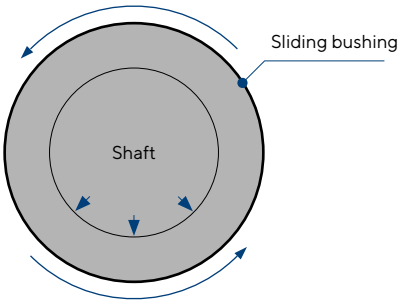
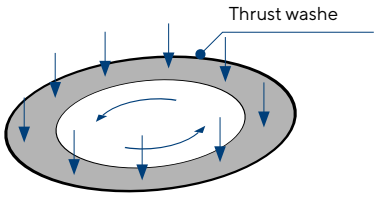
$$Lh = \frac{Ka}{pv^{1.2}} \times Fp \times Fc \times Fd \times Fm$$

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				
Ø 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/mm² under static conditions and reduce to 4 N/mm² 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.

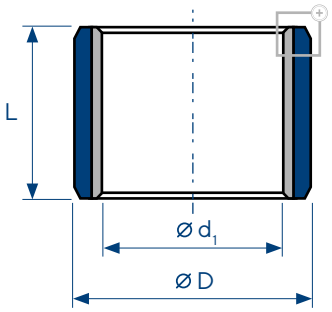
The GETRO-1S sliding bushing is practically impervious to corrosion, and is therefore ideally suited to applications in closed installations in which media (including corrosive fluids) are used and for which maintenance is either impossible or very difficult to carry out due to low accessibility.

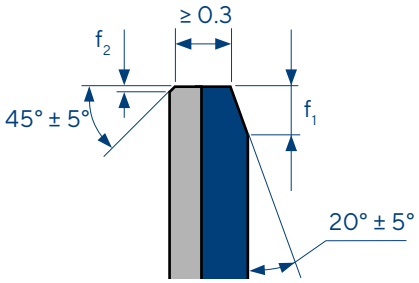
Typical examples of this type of application are valves, electric meters and other production installations. The fundamental properties are the same as those already described for the TU sliding bushings:

- 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			
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14	16	14	16							1410	1412	1415	1420	1425			
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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		
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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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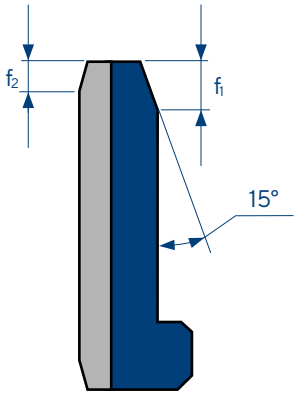
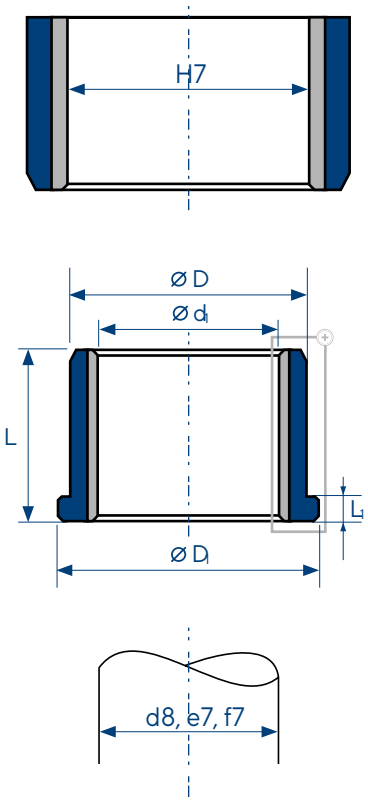
d_1	D	Shaft Dia-meter f7	Housing H7	Wall thickness		f_1	f_2	L								
				min	max			20	25	30	40	50	60	70	80	100
45	50	45	50	2.460	2.505	1.2	0.6	4520	4525	4530	4540	4550				
50	55	50	55					5020		5030	5040	5050	5060			
55	60	55	60							5530	5540	5550	5560			
60	65	60	65							6030	6040	6050	6060	6070		
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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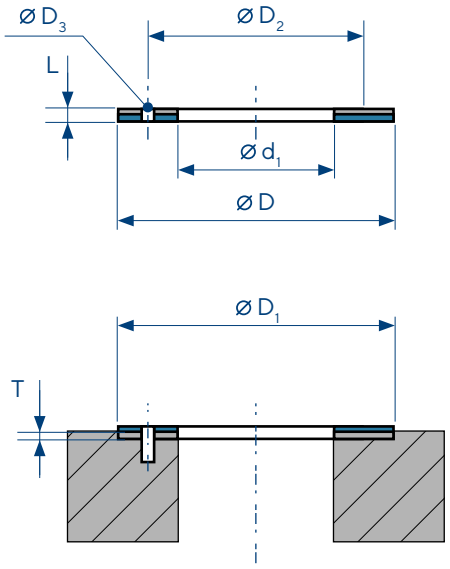
d_1	D	Shaft Diameter f7	Housing H7	$D_1 \pm 0.25$	L ± 0.25	L1 -0.2	f_1	f_2
18	20	- 0.018 - 0.021	+ 0.021	26	12 17 20	1	0.6	0.3
20	23	- 0.020 - 0.041		30	11.5 16.5 21.5	1.5	0.6	0.4
22	25			32	15 20			
25	28			35	11.5 16.5 21.5			
30	34		+ 0.025	42	16 26	2	1.2	
35	39	- 0.025 - 0.050		47	16 26			
40	44			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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GETRO – ROLLED DRY SLIDING BUSHINGS (POM/ARAMID)

Rolled dry sliding bushing POM/Aramid with performance-enhancing additional layers.

We offer sliding bushings from the rolled dry plain bushings POM category in five different designs. Rolled dry sliding bushings of the GETRO-2Y type are lead-free, like all bush-ings from ttv, and have been further improved on the basis of the GETRO-2X type.

The GETRO-3NY type is equipped with a special nylon layer that is sintered onto a steel or bronze band. The GETRO-2X type rolled dry sliding bushing, on the other hand, are based on a composite material consisting of 3 layers for particularly low speeds and heavy loads.

GETRO®
ROLLED SLIDING BUSHINGS

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GETRO-2Y (TX)–ROHS (POM)

The GETRO-2Y sliding bushings are constitute an improvement on the GETRO-2X bushings. They are used in sectors where lead must not be used, such as in textile machinery and vehicle steering systems, medium-speed applications or pplications with medium loads and medium levels of grease lubrication. They consist of a steel band, sintered bronze, and a POM layer.

Profile	Design	PV-limit (lubricated + dry)	Resilience	Temperature range	Sliding speed limit	Friction coefficient
	GETRO - 2Y (TX)–ROHS (POM)	22 N/mm² × m/s	70 N/mm²	-40°C to +130°C	2.5 m/s	0.05 - 0.25

GETRO-3NY (POM)

With immediate effect, we offer the developed sliding bushing material GETRO-3Y (TX) as an improvement of our well-known POM material. A special nylon layer, sintered on a steel or bronze band is characterized by the following advantages towards the characteristics of the POM material: wear-resistant, heat-resistant (no problem to use until max. 160 C°), extended lifetime.

Profile	Design	PV-limit (lubricated + dry)	Resilience	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-3NY POM)	30 N/mm² × m/s	80 N/mm²	-80°C to +160°C	2.5 m/s	0.05 - 0.20

GETRO-2X (POM)

The GETRO-2X sliding bushings are based on a 3-layer composite: The composite comprises a steel substrate, a sintered bronze intermediate layer and a modified POM surface sliding layer. These bushings are particularly suited to applications with low speeds and heavy loads. The GETRO-2X sliding bearings are generally used in the automotive chassis sector, in forging, metallurgical and mining machinery and in power plants and rolling mills, among other areas.

Profile	Design	PV-limit (lubricated + dry)	Resilience	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-2X (POM)	22 N/mm² × m/s	70 N/mm²	-40°C to +130°C	2.5 m/s	0.05 - 0.25

GETRO-2S-ROHS (POM)

The GETRO-2S sliding bushings can be used with very little or even no lubricant under mixed friction, and are characterised by their low levels of friction, good corrosion protection and long service lives. These sliding bushings can be used with oscillating movements under severe environmental impacts, such as corrosion. The applications for these bushings are winches and bulldozers but also printing and dyeing machinery in the textile industry.

Profile	Design	PV-limit (lubricated + dry)	Resilience	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-2S-ROHS (POM)	22 N/mm² × m/s	70 N/mm²	-40°C to +130°C	5 m/s	0.04 - 0.20

GETRO-PK (POM)

GETRO-PK is an advanced type of rolled dry sliding bushing. The innovative bushing, which consists of sheet steel, a copper powder coating and modified PEEK material, is highly polymeric, temperature-resistant, wear-resistant and corrosion-resistant. The advantage is that these rolled dry plain bearings exhibit better properties in water and with little oil.

The wear-resistant PEEK layer of the GETRO-PK rolled dry sliding bushing is over 0.1 mm thick, which significantly extends their service life compared to other materials. These rolled dry sliding bushings are widely used in high-quality shock absorbers, tanks, machine tools and rotating and lifting parts in military applications.

Profile	Design	Resilience	Temperature range	Sliding speed limit	Friction coefficient	PV-limit (dry)	PV-limit (oil)
	GETRO-PK (POM)	100 N/mm²	-195°C to +280°C	2.5 m/s	0.04 - 0.20	3.0 N/mm² × m/s	40 N/mm² × m/s

GETRO-BF (Aramid)

The GETRO-BF bearing use the PTFE fibres fabric and aramid fiber overlayed on metal backing. The fabric has very high load capacity and high acuracy. The bushing has superior performance under low speed and heavy friction condition.

Widely used in heavy equipment like construction machinery, agriculture machinery.

Profile	Bezeichnung	PV-limit (lubricated + dry)	Resilience	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-BF (Aramid)	3.6 N/mm² × m/s	140 N/mm²	-195°C to +260°C	5 m/s	0.04 - 0.20

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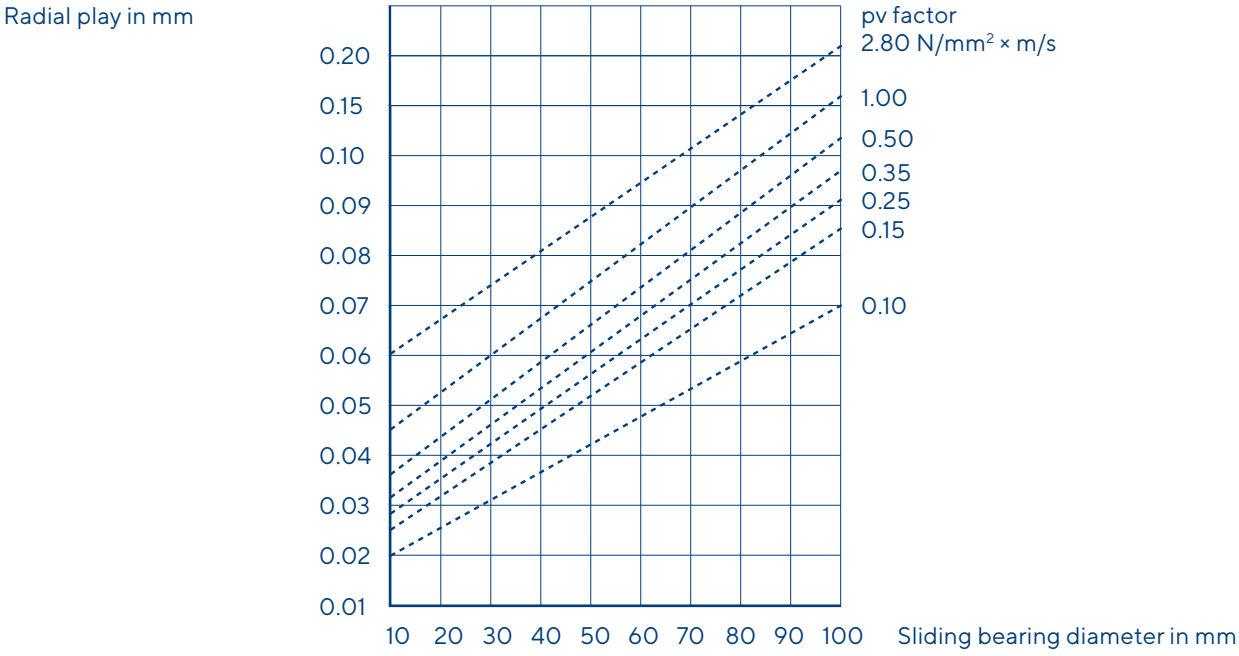
Structure

Wrapped dry sliding bushings GETRO POM also have a multi-layered composition. A porous bronze layer is sintered onto a steel or bronze strip. The function of this layer is to connect the carrier and the sliding layer. It also ensures that the necessary heat removal can occur. The polymeric surface is fitted with lubrication pockets so that the lubricant can be absorbed and gradually dispensed:

Dimension factor

When using prefabricated sliding bushings, the correct play between the shaft and the sliding bushing must be guaranteed. In general, the play in the bearing depends on the load factor (pv) and the temperature. The table shows the play in relation to the diameter, depending on the pv. By increasing the diameter clearance by 0.01 mm per 20°C temperature increase, the temperature is sufficiently factored in.



Performance

The load capacity of the wrapped dry sliding bushings is expressed by the load factor „pv“ (N/mm2 × m/s).

„p“ stands for the specific bushing pressure and „v“ for the speed.

The maximum value for the specific load that can be achieved under static conditions is 140 N/mm^2. The sliding bushings surface is calculated from the inner diameter and the length as „d1 × L“.

Under dynamic conditions, the value for the specific load reduces to 70 N/mm^2. The diagram below shows the limit curve pv with lubricated application and a constant temperature of 20 °C.

Higher temperatures cause a reduction of the load factor by 20% at 50 °C, by 50% at 70 °C and by 80% at 100 °C.

The performance of the wrapped dry sliding bushings is improved by the use of oil, and can reach a pv factor of 8 (N/mm2 × m/s).

Wear coefficient

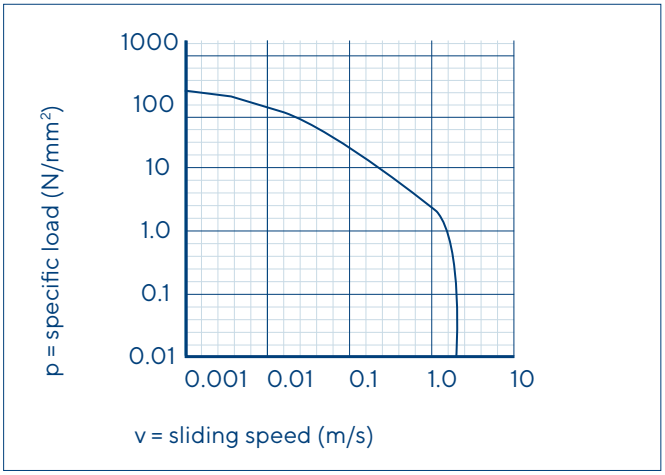
The wear coefficient of the wrapped dry sliding bushings in lubricated applications is hard to calculate in advance, as several other factors have to be considered in addition to the load factor, such as temperature, surface quality, alignment, lubricant contamination etc.

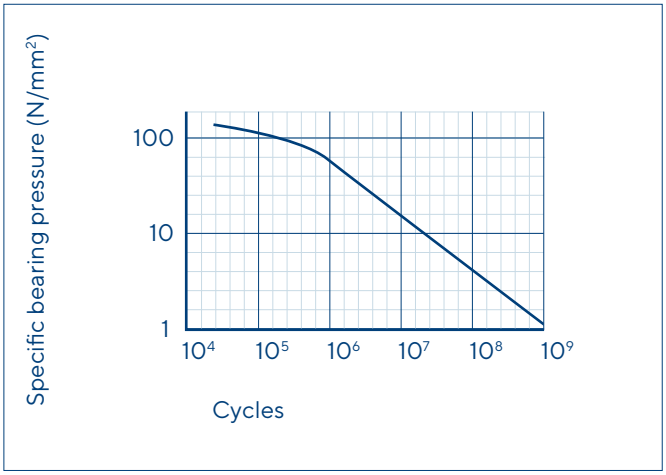
The diagram shows the number of working cycles based on a specific load under ideal functional conditions.

The service life is also affected by the way in which the load is applied. With a uniform specific load, the service life increases, in particular in applications with a rotating load. In contrast, the service life decreases by approx. 30% in loads in one direction.

The degree of wear in wrapped dry sliding bushings is articularly low with a specific load of 10 to 20 N/mm^2. The degree of wear remains low even with loads of up to 120 N/mm^2, provided that the lubricant is well distributed. On the other hand, the degree of wear increases enormously as soon as the lubricant dries out. The bearing must be oiled before wear occurs.

In general, the degree of wear should not exceed 0.0025 mm between two lubrication applications. If the degree of wear exceeds 0.15 mm, then the bearing has usually reached the end of its service life.





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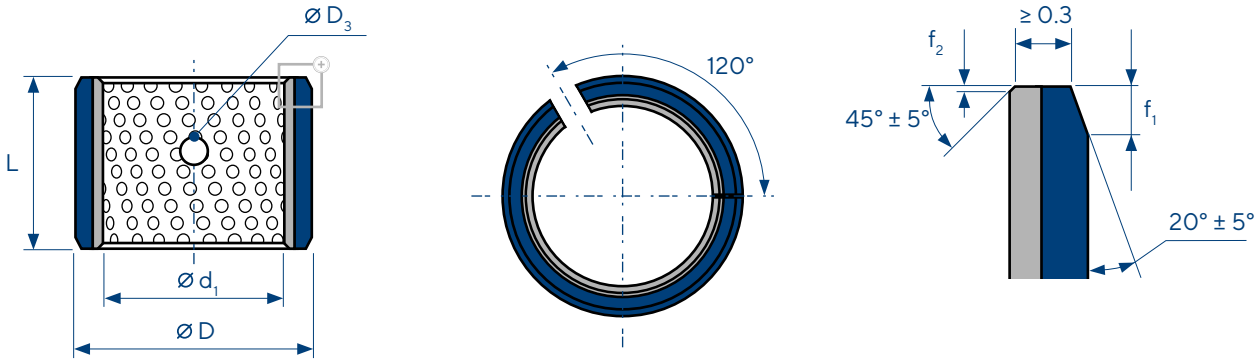
GETRO POM – Cylindrical standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diameter
D_3: Hole diameter
f_1: Outer chamfer
f_2: Inner chamfer
L: Length



d_1	D	Shaft Diameter f7	Housing H7	Wall thickness		D_3	f_1	f_2	L +0									
				min	max				10	15	20	25	30	35	40	45	50	60
10	12	$10_{-0.022}$	$12^{+0.018}$	0.955	0.980	4	0.6	0.3	1010	1015	1020							
12	14	$12_{-0.027}$	$14^{+0.018}$						1210	1215	1220							
14	16	$14_{-0.027}$	$16^{+0.018}$							1415	1420							
15	17	$15_{-0.027}$	$17^{+0.018}$							1515	1520	1525						
16	18	$16_{-0.027}$	$18^{+0.018}$							1615	1620	1625						
18	20	$18_{-0.027}$	$20^{+0.021}$							1815	1820	1825						
20	23	$20_{-0.033}$	$23^{+0.021}$	1.445	1.475		0.6	0.4		2015	2020	2025	2030					
22	25	$22_{-0.033}$	$25^{+0.021}$							2215		2225						
25	28	$25_{-0.033}$	$28^{+0.021}$			6				2515	2520	2525	2530					
28	32	$28_{-0.033}$	$32^{+0.025}$	1.935	1.970		1.2	0.4			2820		2830					
30	34	$30_{-0.033}$	$34^{+0.025}$								3020	3025	3030	3035	3040			
35	39	$35_{-0.039}$	$39^{+0.025}$								3520		3530	3535	3540			
40	44	$40_{-0.039}$	$44^{+0.025}$			8					4020		4030	4035	4040		4050	
45	50	$45_{-0.039}$	$50^{+0.025}$	2.415	2.460		1.8	0.6			4520		4530		4540	4545	4550	
50	55	$50_{-0.039}$	$55^{+0.030}$										5030		5040		5050	5060
55	60	$55_{-0.046}$	$60^{+0.030}$										5530		5540		5550	5560
60	65	$60_{-0.046}$	$65^{+0.030}$										6030		6040		6050	
65	70	$65_{-0.046}$	$70^{+0.030}$						6540		6560							
70	75	$70_{-0.046}$	$75^{+0.030}$						7040	7050		7080						
75	80	$75_{-0.046}$	$80^{+0.030}$						7540		7560	7580						

d_1	D	Shaft Diameter f7	Housing H7	Wall thickness min	Wall thickness max	D_3	f_1	f_2	$L_{-0.40}$ 40	50	60	80	90	95	100	110	120
80	85	$80_{-0.046}$	$85^{+0.035}$	2.385	2.450	9.5	1.8	1.8	8040		8060	8080					
85	90	$85_{-0.054}$	$90^{+0.035}$						8540		8560	8580					
90	95	$90_{-0.054}$	$95^{+0.035}$						9040		9060	9080	9090				
100	105	$100_{-0.054}$	$105^{+0.035}$							10050		10080		10095			
105	110	$105_{-0.054}$	$110^{+0.035}$								10560	10580		10595		105110	
110	115	$110_{-0.054}$	$115^{+0.035}$								11060	11080		11095		110110	
120	125	$120_{-0.054}$	$125^{+0.040}$					0.6			12060	12080				120110	
125	130	$125_{-0.063}$	$130^{+0.040}$								12560					125110	
130	135	$130_{-0.063}$	$135^{+0.040}$							13050	13060	13080			130100		
140	145	$140_{-0.063}$	$145^{+0.040}$							14050	14060	14080			140100		
150	155	$150_{-0.063}$	$155^{+0.040}$							15050	15060	15080			150100		
160	165	$160_{-0.063}$	$165^{+0.040}$							16050	16060	16080			160100		
170	175	$170_{-0.063}$	$175^{+0.040}$							17050		17080			170100		
180	185	$180_{-0.063}$	$185^{+0.046}$							18050	18060	18080			180100		
190	195	$190_{-0.072}$	$195^{+0.046}$							19050	19060	19080			190100		190120
200	205	$200_{-0.072}$	$205^{+0.046}$							20050	20060	20080			200100		200120
220	225	$220_{-0.072}$	$225^{+0.046}$							22050	22060	22080			220100		220120
240	245	$240_{-0.072}$	$245^{+0.046}$							24050	24060	24080			240100		240120
250	255	$250_{-0.072}$	$255^{+0.052}$							25050	25060	25080			250100		250120
260	265	$260_{-0.081}$	$265^{+0.052}$							26050	26060	26080			260100		260120
280	285	$280_{-0.081}$	$285^{+0.052}$							28050	28060	28080			280100		280120
300	305	$300_{-0.081}$	$305^{+0.052}$							30050	30060	30080			300100		300120

GETRO – ROLLES SLIDING BUSHING (CUSN8)

GETRO - Rolled sliding bushing (CuSn8) for high load capacity and service life.

We offer two versions in the CuSn8 rolled bushings product group. These GETRO-090 bushings are rolled from a bronze strip with a high specific density. Depending on customer requirements, diamond-shaped or spherical lubrication grooves are incorporated into the inner surface.

The GETRO-092 variant is made of bronze. These rolled bushings correspond to the GETRO-090 type, but are equipped with evenly distributed lubrication holes.
The lubricant is applied to the holes during assembly.
As a result, these rolled plain bearings are characterised by their good lubricant storage capacity and easy assembly.

GETRO®
ROLLED SLIDING BUSHINGS

GETRO-090 (DZA)

The GETRO-090 sliding bushings are rolled from a bronze strip with a high specific density. There are diamond-shaped or round lubricant indentation on the inner surface, incorporated as per the client's requirements.

This type of bushings is characterised by their high levels of load capacity and long service lives. They take the place of the traditional bronze bushings, but are more economical and more compact. They are suitable for use in lifting vehicles and construction machinery, cars, tractors, trucks, machine tools and in the engine construction industry.

Profile	Design	Base material	Hardness	Temperature range	Resilience	Sliding speed limit
	GETRO-090 (DZA)	CuSn8P0.3 / CuSn6.5P0.1	HB90 HB120	-80°C to +200°C	75 N/mm²	2.5 m/s

GETRO-092 (DZT)

The GETRO-092 bronze sliding bushings are equivalent to the GETRO-090 bushings, but with evenly distributed lubrication holes. The lubricant is dispensed into the holes during assembly. The GETRO-092 sliding bushings are characterised by their good lubricant capacity and simple assembly.

This type of sliding bushing is used with medium-sized loads and low speeds, such as in transport rollers, winding equipment, anchor winches and aligning machinery.

Profile	Design	Base material	Hardness	Temperature range	Resilience	Sliding speed limit
	GETRO-092 (DZT)	CuSn8P0.3 / CuSn6.5P0.1	HB90 HB120	-100°C to +200°C	60 N/mm²	2.5 m/s

Properties

In addition to having high levels of corrosion resistance, this metal alloy is particularly suitable for use in connection with steel components. The lubrication of the sliding surface is guaranteed thanks to the integrated pockets, recesses and fluting. This insures a uniform film of lubricant between the sliding bushing and the shaft.

This series includes cylindrical sliding bushings and a number of other items made of bronze panels of 1, 1.5, 2 and 2.5 mm in thickness. The products contain all of the most common sliding components, such as thrust washers and customised panels.

Compared to solid bronze sliding bearings, these sliding bearings have the following benefits:

- High load capacity
- Chemical resistance to aggressive media
- High thermal conduction capacity
- Simple installation and maintenance
- Good availability of standard dimensions
- Economical production of special items
- Low space requirements

Sliding bushing construction

The lubrication pockets or holes help to reduce the contact surface and therefore also the friction:

- Round pockets = 21%
- Diamond-shaped pockets = 24%
- Holes = 15%

The round pockets guarantee an excellent distribution of the lubricant and make it possible to use oil. In this case, regular lubrication is required.

The construction factors for these sliding bearings are determined based on the impacting load, the sliding speed, the lubrication frequency, the hardness grade and the mating surface processing. The following mechanical properties must also be taken into account.

Mechanical properties to be taken into account			
Breaking load		Rm	470 N/mm²
Elastic limit		$Rp_{0.2}$	250 N/mm²
Expansion		A_{10}	40 %
Hardness		HB	90 – 120
Roughness		Ra	2 µm
Thermal conduction capacity		λ	58 W/m × K
Linear expansion coefficient		α	2 × 10 $^{-5}$ C^{-1}
Maximum working load statisch	static (speed up to 0.01 m/s) dynamic (speed up to 2 m/s	p	120 N/mm² 40 N/mm²

Installation

The standard GETRO-090 and 092 sliding bushings are suitable for installation in housings with “H7” tolerances. However, an “H9” tolerance occurs at the inner diameter following installation. This depends on the properties of the bore.

If the inner diameter reaches the “H9” tolerance, then a shaft must be selected as per the tolerance fields “e” or “f”. If shafts with the tolerance field “h” are used, it is advisable to increase the diameter of the housing from “H7” to “F7”.

The GETRO-092 range consists of sliding bushings made entirely of bronze (CuSn8). These products are derived from the ttv - 090 sliding bearings. The only difference is the fact that the arched sections in the sliding surface have been replaced by holes with a greater lubricant intake capacity

Clearance	Lubricant		Specific load		Movement		
	Grease	Oil	High	Low	Fast	Oscillating	Slow
Reduced		·	·			·	·
Extended	·			·	·		

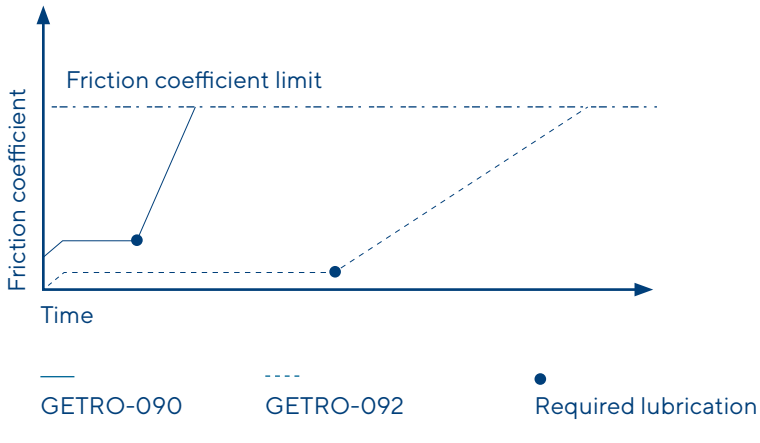
Properties

GETRO-092 sliding bushings can take lubrication with all types of greases or mixes. This enables longer lubrication intervals. Unlike the solid bronze sliding bushings, the GETRO-092 sliding bushings have all advantages of the GETRO090 sliding bushings, which are summarised as follows:

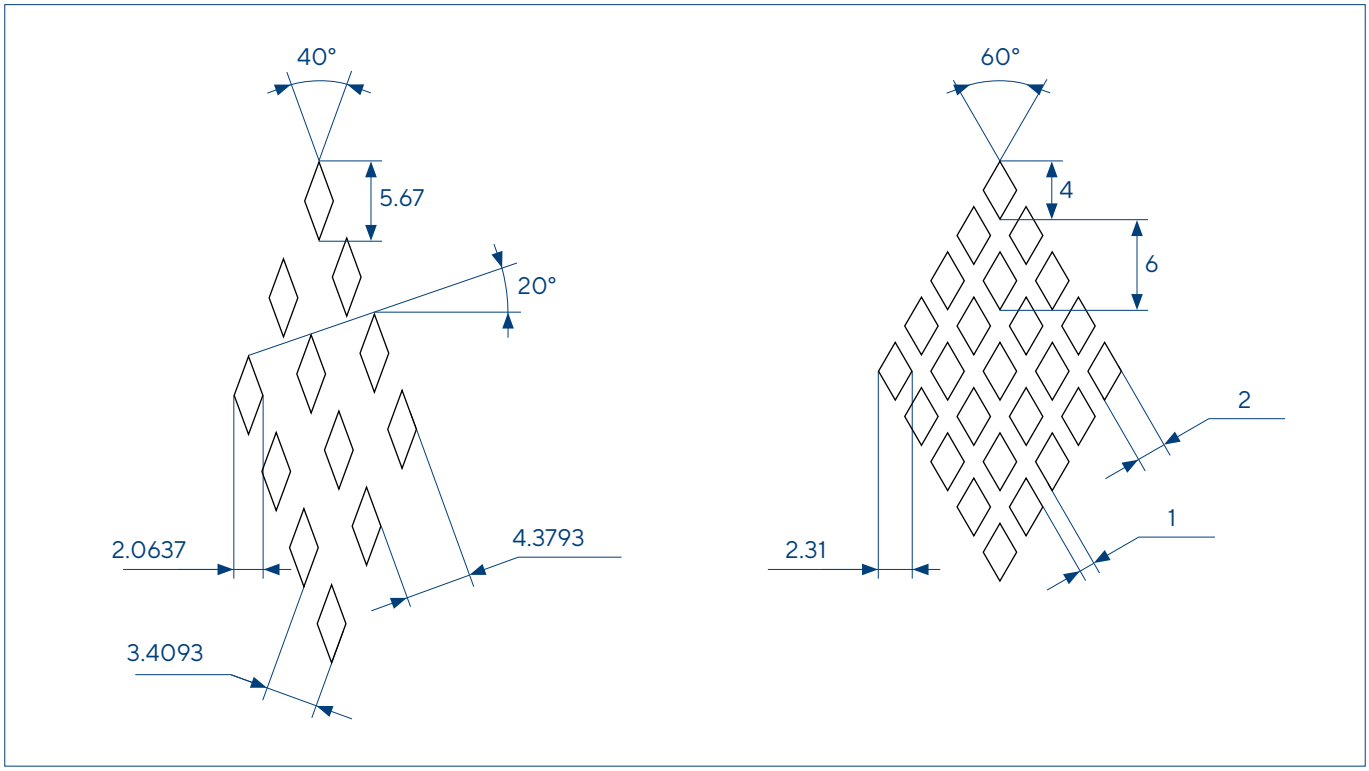
- High load capacity
- Minimal space requirement
- Very good resistance to chemical corrosive agents
- Very good thermal conduction capacity
- Simple installation and maintenance

The surface of theGETRO-092 sliding bearings must be reduced by 15%, taking into account the holes.
The GETRO-092 series is available as cylindrical sliding bearings, flanged sliding bearings, thrust bearing washers and customised panels. Compared to the GETRO-090 range, the GETRO-092 sliding bearings allow longer re-lubrication intervals, which can be seen from the diagram below.

With regards to the dimension development and all other defined properties of these sliding bearings, the same rules as for the GETRO-090 apply in terms of lubrication and play.



Oil indentation



Type	Thickness	Oil Depth
GETRO-090	1 mm	0.3 – 0.4 mm
	1.5 mm	0.4 – 0.5 mm
	2 mm	0.5 – 0.6 mm
	2.5 mm	0.6 – 0.7 mm

GETRO – ROLLED SLIDING BUSHING WITH SOLID LUBRICANT

Rolled sliding bushing with solid lubricant

We offer rolled sliding bushing with solid lubricant in three variants. Rolled sliding bushings with solid lubricant of type GETRO-08G are based on alloys of steel, lead and bronze and are coated with a specially developed solid lubricant. The GETRO-09G type are rolled sliding bushings with solid lubricant that are based on bronze and can be rolled out to very thin wall thicknesses. The GETRO-TF-2 types are self-lubricating and suitable for high temperatures.

GETRO®
ROLLED SLIDING BUSHINGS

GETRO-08G

The GETRO-08G sliding bushings have a steel-lead-bronze alloy base featuring a specially developed solid lubricant.

Due to their high levels of stability and resilience and the helical arrangement of the diamond-shaped indents of the embedded solid lubricant, these bushings have an extremely good lubrication effect at high temperatures and excellent wear-resistance.

Approximately 25% of the bushing surface is lubricated. These sliding bushings are used in automotive or vehicle gearboxes and clutches, as well as generators, cranes and other items of machinery in the metalworking industry.

Profile	Design	Base material	Load Capacity	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-08G	CuSn10Pb10 + Gr.	65 N/mm²	-100°C to +260°C	4 m/s	0.06 - 0.20

GETRO-09G

The GETRO-09G bushings are sliding bushings on a bronze base containing solid lubricant. Thanks to the good stretching properties of bronze, these sliding bushings can be rolled to have very thin walled thicknesses.

Due to the solid lubricant, these bushings are used without any lubricant in gear shafts and similar applications. They are also particularly well-suited for use between clutch discs and the drivetrain.

Profile	Design	Base material	Load Capacity	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-09G - ROHS	CuSn6.5P0.1 + Gr.	65 N/mm²	-100°C to +260°C	4 m/s	0.06 - 0.20

GETRO-TF-2

The GETRO-TF-2 bushings are self-lubricating sliding bushings for use at high temperatures. Compared to the GETRO-TF-1 series, the sliding bushings from this series are considerably less prone to rust and are better suited for use at high temperatures. They are popular in train tracks, automotive moulding etc. They are popular in train tracks, automotive moulding etc.

Profile	Design	Base material	Load Capacity	Temperature range	Sliding speed limit	Friction coefficient
	GETRO-TF-2	CuFeNiSn + Gr.	73.5 N/mm²	+600°C		0.03 - 0.18

GETRO – BI-METAL SLIDING BUSHINGS

GETRO Bi-metal sliding bushings made from solid bronze, cast iron and steel.

We offer bi-metal sliding bushings in variants made of steel with sintered copper, with steel strip or with additional sliding layers. This enables us to meet the different requirements of various industries for sliding bushings with specific product solutions.

The best example is the GETRO-800 type made of steel with sintered CuPb10Sn10 or CuSn6Zn6Pb3 as the surface sliding layer. These bi-metal sliding bushings can be used in balancing suspensions for heavy commercial vehicles, bulldozer wheels, car chassis, etc.

GETRO®
ROLLED SLIDING BUSHINGS

GETRO-800

The construction of the bi-metal sliding bushings GETRO-800 is based on steel with sintered CuPb10Sn10 or CuSn6Zn6Pb3 as surface sliding layer.

These GETRO-800 type products have the best characteristics within the bi-metal Plain bushings. They can be used in balancing suspensions of heavy commercial vehicles, wheels of bulldozers, car chassis, etc. sliding bushings ttv-800 are best suited for the medium speed range and for applications with high impact and shock forces.

Profile	Design	Surface material	Load capacity	Resistance alloy range	Temperature limit
	GETRO-800	CuSn10Pb10 / CuSn6Zn6Pb3	65 N/mm²	HB70 HB100	+260°C

GETRO-720

The product variant GETRO-720 is a bi-metal sliding bushing with steel strip and sintered CuPb24Sn4 as surface sliding layer.

Due to high performance characteristics, long service life with low material fatigue and enormous load capacity, these bi-metal sliding bushings are particularly suitable for medium speeds and loads. sliding bushings GETRO-720 are therefore often used in the construction and agricultural machinery industry.

Profile	Design	Surface material	Load capacity	Resistance alloy range	Temperature limit
	GETRO-720	CuPb24Sn4	38 N/mm²	HB45 HB70	+170°C

GETRO-700

Bi-metal sliding bushings GETRO-700 are equipped with steel strip and sintered CuPb30 as surface sliding layer.

These bi-metal sliding bushings have good anti-blocking protection. Due to their high lead content, the sliding bushings GETRO-700 can bind more dirt particles and foreign matter and thus prevent seizure.

Profil	Design	Surface material	Load capacity	Resistance alloy range	Temperature limit
	GETRO-700	CuPb30	25 N/mm²	HB30 HB45	+170°C

GETRO-20

Sliding bushings GETRO-20 are based on tin and aluminium and are equipped with a steel strip and a surface sliding layer of AlSn20Cu.

These Sliding bushings are characterised by long service life, low material fatigue, high load capacity and low susceptibility to corrosion. Plain bushings GETRO-20 are therefore used in combinations of high speeds with low loads, such as in combustion engines, air compressors and cooling machines.

Profile	Design	Surface material	Load capacity	Resistance alloy range	Temperature limit
	GETRO-20	AlSn20Cu	30 N/mm²	HB30 HB40	+150°C

GETRO-TF-1

The GETRO-TF-1 bi-metal sliding bushings are a further development of the GETRO-800 type, made of a black-lead alloy.

As a result, these bi-metal Plain bushings have improved friction properties. Shaft protection can be achieved without the use of oil, as black lead dissolves when used without oil under high temperatures. Predominantly, these bi-metal Plain bushings are used in guides of lifting equipment, lifts and similar applications.

Profile	Design	Surface material	Load capacity	Friction coefficient	Temperature limit
	GETRO-TF-1	CuSnPb + C	150 N/mm²	0.05 - 0.18	+300°C

Structure

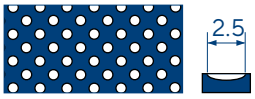
The bi-metal sliding bushings constitute a complete product range. These sliding bearings are characterised by a low-carbon steel carrier strip onto which a layer of sintered bronze is attached by means of a thermal process. The lubricated surface of the bronze layer forms the mating surface of the sliding bushing. These sliding bushings can be lubricated using oil or grease, making them ideally suited to applications with low space requirements, high mechanical stress and low friction values.

The standard thickness of the strips, which is used to obtain the typical bi-metal surface by embossing and roll-molding, is 1/1.5/2 and 2.5 mm. The sintered bronze layer (CuSnPb 10) is best suited to steel couplings. The thickness of the bronze layer is 0.20 to 0.35 mm. If a special carrier strip is used, the thickness can be increased to 0.4 mm or higher.

Important

There are three different profile types for GETRO sliding bushings:
K = Bronze surface with round pockets
R = Bronze surface with diamond-shaped pockets
N = Bronze surface with no pockets, standard bronze thickness

The surfaces of the bi-metal sliding bearings are as follows:



K
Round pockets

R
Diamond-shaped pockets

N
Oil groove

K und R

are used in the event of non-constant lubrication. The pockets act as a reservoir for the lubricant, which is gradually released.

N

requires constant lubrication. Grooves and furrows in the bronze layer can be produced on request, and enable better lubricant distribution.

The standard range of bi-metal sliding bearings contains cylindrical sliding bearings, flanged sliding bearings, thrust bearing washers and panels. The bi-metal sliding bearings offer a wide range of benefits:

- Simple installation and maintenance
- Suitable for use with high loads
- Reduced space requirement
- High thermal conductivity
- Option to manufacture customised parts
- Can be used at a wide range of temperature

Sliding surface

Bi-metal sliding bushings must always be lubricated. The use of grease is recommended for applications with irregular lubrication. The use of oil is preferable in the event of regular or continuous lubrication, the choice of lubricant affects the choice of sliding bushing - grease lubrication calls for the use of K whereas oil lubrication calls for sliding bearings in the R series. As a result, the lubrication plays a very important role in terms of the efficiency of the sliding bushing.

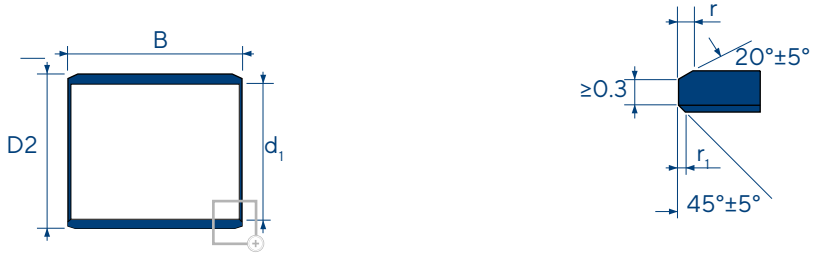
The pockets and the design reduce the contact surface area and therefore the load capacity of the bi-metal sliding bearing. Maximum performance can be achieved by using N sliding bushings that are either completely smooth or that have only very few grooves. These sliding bushings have the best pv factor in hydrodynamic applications.

Lubrication pockets reduce the contact surface area and therefore the friction:

K = round cells: 21%
R = diamond-shaped cells: 24%
N = oil groove: the reduction must be calculated on a case-by-case basis

Bi-metal sliding bushings with round pockets ensure optimal lubricant distribution and can be greased or oiled. However, lubrication must in both cases be applied more often than when using R.

Chamfering bi-metal sliding bearings



Construction tip

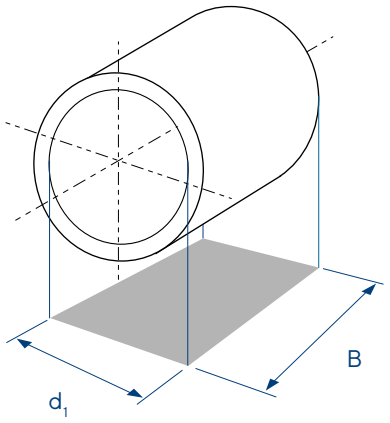
In order to decide on the dimensions of a bi-metal sliding bearing, it is necessary to determine the load, the sliding speed, the type and frequency of lubrication, as well as the hardness, stability and roughness of the mating surface.

Mechanical properties to be taken into account			
Breaking load		Rm	350 N/mm²
Elastic limit		$Rp_{0.2}$	240 N/mm²
Expansion		A_{10}	35 %
Hardness	Steel side Bronze side	HB	100 80
Roughness	Steel side Bronze side	Ra	2 µm 0.6 – 2 µm
Thermal conduction capacity		λ	46 W/m × K
Linear expansion coefficient		α 13 × 10 $^{-6}$	1.3 × 10 $^{-5}$ K^{-1}
Permissible load	static (speed up to 0.01 m/s) dynamic (speed up to 2 m/s)	p	120 N/mm² 40 N/mm²

The carrier surface is the calculated surface d1 × L (diameter × length). The pocket or groove area must be deducted.

Specific bearing pressure p $\frac{F}{d_1 \times L}$ N/mm²

Sliding Speed v $\frac{\pi \times d_1 \times n}{60 \times 10\ 3}$ m/s



F = Total load in Newton
d_1 = Inner diameter in mm
L= Length in mm
n = Rotation per minute

Installation

The bi-metal standard sliding bushings are intended for installation into a housing with “H7” tolerances. Once fitted, the inner diameter adopts an “H9” tolerance. Nevertheless, this tolerance may vary depending on the condition of the housing. Taking into account the lubricant, the following must be noted for the play between the sliding bushing and the shaft:

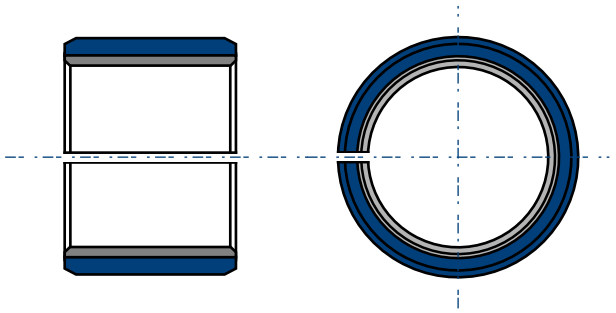
If an inner diameter with an “H9” tolerance is reached, shafts with tolerance fields “e” or “f” must be selected.

In the event that a “h” shaft tolerance is required, it is advisable to increase the housing tolerances for the sliding bearing from “H7” to “F7” in order to increase the inner diameter of the sliding bearing, thereby avoiding the risk of a seize-up.

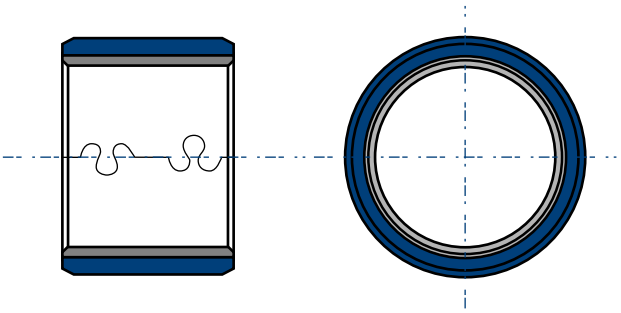
Play	Lubricant		Specific load		Movement		
	Grease	Oil	High	Low	Fast	Oscillating	Slow
Reducing		·	·			·	·
Extended	·			·	·		

Cylindrical standard dimensions
GETRO bimetal series

Straight Joint



Inter Locking Joint



The designing of oil indentations					
Bush O.D	from to				
	14 ~ 22	22 ~ 44	40 ~ 50	50 ~ 100	100 ~ 180
Lubricating Hole	3	3	3	6	7

Thickness of the bimetal series and their tolerances								
Nominal Thickness	1	1.5	2	2.5	3	3.5	4	5
Steel backing	0.6	1	1.4	1.9	2.3	2.8	3.2	4
Bronze layer	0.4	0.5	0.6	0.6	0.7	0.7	0.8	1
Manufactured standard wall thickness	$1_{-0.025}$	$1.5_{-0.03}$	$2_{-0.035}$	$2.5_{-0.04}$	$3_{-0.045}$	$3.5_{-0.05}$	$4_{-0.055}$	$5_{-0.06}$
Producible wall thickness	$1^{+0.25}_{+0.15}$	$1.5^{+0.25}_{+0.15}$	$2^{+0.25}_{+0.15}$	$2.5^{+0.25}_{+0.15}$	$3^{+0.25}_{+0.15}$	$3.5^{+0.25}_{+0.15}$	$4^{+0.25}_{-0.055}$	$5^{+0.25}_{-0.06}$

Composition of the alloy									
Chemical elements	Cu	Pb	Sn	Zn	P	Fe	Ni	Sb	Andere
GETRO-800	Rest	9.0 ~ 11.0	9.0 ~ 11.0	0.5	0.1	0.7	0.5	0.2	0.5
GETRO-720	Rest	21.0 ~ 27.0	3.0 ~ 4.5	0.5	0.1	0.7	0.5	0.2	0.5

Physical Characteristics								
	Load capacity (static)	Load capacity (dynamic)	Tensile strength	Sliding speed limit	Friction coef. (Oil)	PV Limit N/mm² × m/s		„Sapphire" Fatigue Clasee Mpa
						dry	oil	
GETRO-800	150	65	150	5	0.06 ~ 0.14	2.8	10	125
GETRO-720	130	38	150	10	0.06 ~ 0.16	2.8	10	115

LUMET - TURNED SOLID SLIDING BUSHINGS

LUMET - Turned solid plain bearings made of solid brass with turned-in oil grooves.

Bushings from the turned solid sliding bushing product range are made of solid brass with turned-in oil grooves. Due to their greater load-bearing capacity, longer service life and higher base hardness, these bushings are mainly used at low speeds.

This includes, for example, applications in gearboxes, booms or gripper arms.

LUMET®
BRONZE sliding bushings

LUMET-1U

LUMET-1U machined solid sliding bushings are made of solid brass with machined oil grooves. Due to their higher load capacity, good corrosion resistance, longer service life and higher basic hardness, machined solid sliding bushings are mainly used at low speeds. The LUMET-1U sliding bushings are currently used primarily in gearboxes, jibs or gripper arms.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U	CuZn24Al6/ CuZn25Al6Mn4Fe3	8	>210	>12	>450	>750

LUMET-1U SH1

LUMET 1U-SH1 is a CuSn5Pb5Zn5 alloy offering excellent running-in and emergency running properties as well as high wear and corrosion resistance. It is suitable for medium loads at low to medium sliding speeds and is often used in general mechanical engineering for sliding bushings under medium pressures.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U SH1	CuSn5Pb5Zn5	8.9	>70	>15	>90	>200

LUMET-1U SH2

LUMET 1U-SH2 is an aluminium bronze CuAl10Ni5Fe5 with very high strength, excellent fatigue and corrosion resistance, and good thermal conductivity. It is ideal for highly loaded plain bearings and is preferred for use in pumps, shipbuilding, and offshore and marine applications.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U SH2	CuAl10Ni5Fe5	7.8	>150	>10	>260	>600

LUMET-1U SH3

LUMET 1U-SH3 is a tin bronze CuSn12 that offers a balanced combination of strength and toughness. It offers good wear and corrosion resistance as well as reliable emergency running properties and is suitable for static and alternating loads, for example in hydraulic, mechanical engineering and agricultural applications.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U SH3	CuSn12	8.9	>95	>8	>150	>260

LUMET-1U SH4

This is a tin-lead bronze CuSn10Pb10 with pronounced emergency running properties and very good sliding behaviour even with insufficient lubrication. The alloy shows a low tendency to seize or cold weld, has high damping properties and is particularly suitable for shock-loaded bearings, oscillating movements and applications in construction and conveyor machines.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U SH4	CuSn10Pb10	8.9	>75	>8	>100	>210

LUMET-1U SH5

LUMET 1U-SH5 is a high-strength aluminium-manganese bronze CuZn25Al6Fe3Mn4 that impresses with its exceptional strength and hardness, even under extreme loads. It offers excellent corrosion resistance, even in seawater, as well as high resistance to cavitation and erosion. Areas of application include heavy-duty bearings, propeller bushings and heavily stressed offshore components.

Profile	Design	Base material	Density	Hardness HB	Elongation %	Yield point N/mm²	Tensile strength N/mm²
	LUMET-1U SH5	CuZn25Al-6Fe3Mn4	8	>250	>8	>450	>800

SOLID LUBICANT SLIDING BUSHINGS

LUMET - Solid lubicant sliding bushings made from solid bronze, cast iron and steel.

In the solid lubricant sliding bushing product category, we offer products made from three different materials. LUMET solid lubricant sliding bushings are made from solid bronze with a permanently integrated graphite lubricant, while LUMET-4 solid lubricant sliding bushings are made from HT250 cast iron.

LUMET-5 sliding bushings are made of GCr15 steel, are characterised by high compressive strength and are particularly suitable for use in lifting and conveyor machinery.

LUMET®
BRONZE sliding bushings

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LUMET

LUMET solid lubricant sliding bushings are made of solid bronze with pre-integrated solid graphite lubricant. Their load limit is considerably higher than standard sliding bushings, where lubrication is dependent upon there being a film of oil. It is suitable for heavy-duty operation and corrosive environments as well as hard-to-reach lubrication points, for example in die casting, mining, shipbuilding, turbo generators, and injection molding machines.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET	CuZn24Al6/ CuZn25Al 6Fe3Mn4	100	8	>210	>12	+300°C	>450	>750	15 m/min

LUMET-SH1

LUMET-SH1 is based on the CuSn5Pb5Zn5 alloy and combines good wear resistance with reliable emergency running properties and high corrosion resistance. The material is suitable for medium loads up to 400 °C and enables dry sliding operation up to approx. 10 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-SH1	CuSn5Pb5Zn5	60	8.9	>70	>15	+400°C	>90	>200	10 m/min

LUMET-SH2

Made from CuAl10Ni5Fe5 aluminium bronze, LUMET-SH2 offers high strength, excellent fatigue resistance and very good chemical resistance. The alloy is a versatile all-rounder for high loads up to 400 °C and sliding speeds up to approx. 20 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-SH2	CuAl10Ni5Fe5	50	7.8	>150	>10	+400°C	>260	>600	20 m/min

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LUMET-SH3

Based on the high-alloy tin bronze CuSn12, LUMET-SH3 has good toughness, high wear resistance and reliable emergency running properties even with limited lubrication. The alloy is suitable for alternating loads up to 400 °C and sliding speeds up to approx. 10 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-SH3	CuSn12	70	8.9	>95	>8	+400°C	>150	>260	10 m/min

LUMET-SH5

Made from CuZn25Al5Mn4Fe3 aluminium-manganese bronze, LUMET-SH5 offers very high strength, hardness and outstanding corrosion resistance. The material can withstand temperatures of up to +150 °C and speeds of around 15 m/min and is particularly suitable for high point loads at moderate speeds.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-SH5	CuZn25Al 5Mn4Fe3	120	8	>250	>8	+150°C	>450	>800	15 m/min

LUMET-HHP

LUMET-HHP bushings are based on high-performance zinc bronze CuZn32Al5Ni3. Thanks to their high mechanical strength and hardness, LUMET-HHP plain bearings are suitable for harsh operating conditions up to +150 °C, offering high load-bearing capacity and sliding speeds of up to 15 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-HHP	CuZn32Al5Ni3	150	8	>280	>0.3	+150°C	>450	>540	15 m/min

LUMET-4

LUMET-4 solid lubricant sliding bushings have a HT250 cast iron base. These sliding bushings are used when a cost-effective solution is required and when the mechanical requirements are not to high, e.g. in guide rods for moulding tools, cast-iron plates for plastic injection moulding machinery.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-4	HT250	60		HB180 HB230		+400°C			15 m/min

LUMET-5

LUMET-5 solid lubricant sliding bushings are reinforced-material products from the LUMET series and have a GCr15 steel base.

These sliding bushings have high levels of compression resistance and are particularly suitable for use in guides for lifting machinery and winding equipment. They are also used in winches and cranes. They should not be used in water or in acidic or alkaline conditions.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-5	100 Cr6	250		HRC58 HRC60		+350°C			6 m/min

LUMET®
BRONZE sliding bushings

Structure

The lubricator, which is based on aintenance-free solid lubricant or graphite, is embedded into the steel or bronze of the sliding bearing. The lubricator makes it possible, and easier, to work in dry environments.

LUMET sliding bearings are more resistant at higher temperatures compared to other types of sliding bearings.

Technical information

The application conditions must be observed without fail when selecting the solid lubricant.

Application conditions			
Maximum specific load		P	100 N/mm²
Maximum speed		v	0.5 m/s
Maximum sliding bearing load		pv	1.65 N/mm² × m/s
Temperature	**PTFE/graphit + MoS_2 With lubricant**	T	- 40 to + 300 °C - 40 to + 150 °C
Friction coefficient		m	0.16

Movement

LUMET sliding bushings are suitable for applications with heavy loads and low speeds. They mainly operate laterally.

Application

Underwater sliding bearings, e.g. floodgates, foundries, steel work, tool operations, the printing and mining industries, building construction and civil engineering.

Possible lubricants

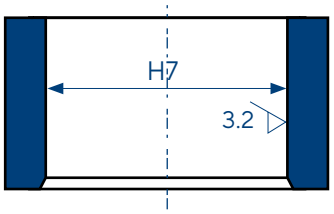
- Graphite
- Graphit + MoS_2
- PTFE

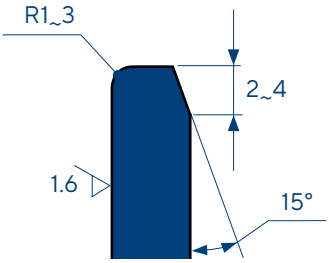
LUMET sliding bearing range

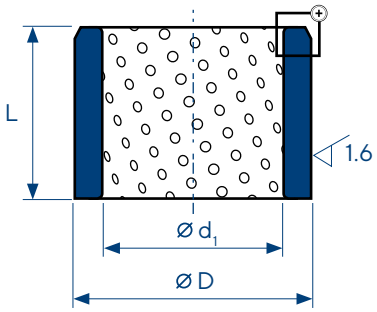
The product range includes cylindrical sliding bushings, flanged sliding bearings, thrust bearing washers and panels. For specific enquiries, please contact our technical team.

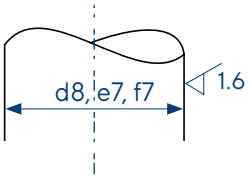
LUMET – Solid lubricant sliding bushings – Cylindrical standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diameter
D_3: Hole diameter
L: Length









d_1	d_1 F7	D	D m6	L -0.30											
				8	15	20	25	30	35	40	45	50	60	70	80
8	+0.028 +0.013	12	+0.018 +0.007	081208	081210	081212	081215								
10		14		101408	101410	101412	101415		101420						
12	+0.034 +0.008	18			121810	121812	121815	121816	121820	121825	121830				
13		19	+0.021 +0.008		131910		131915	131916							
14		20			142010	142012	142015		142020	142025	142030				
15		21			152110	152112	152115	152116	152120	152125	152130				
16		22			162210	162212	162215	162216	162220	162225	162230	162235	162240		
18		24				182412	182415	182416	182420	182425	182430	182435	182440		
20	+0.041 +0.020	28			202810	202812	202815	202816	202820	202825	202830	202835	202840	202850	
22		32	+0.025 +0.009			223212	223215		223220	223225					
25		33				253312	253315	253316	253320	253325	253330	253335	253340	253350	253360
30		38				303812	303815		303820	303825	303830	303835	303840	303850	303860
35	+0.050 +0.025	45							354520	354525	354530	354535	354540	354550	354560
40		50							405020	405025	405030	405035	405040	405050	405060
45		55	+0.030 +0.011								455530	455535	455540	455550	455560
50		60									506030	506035	506040	506050	506060

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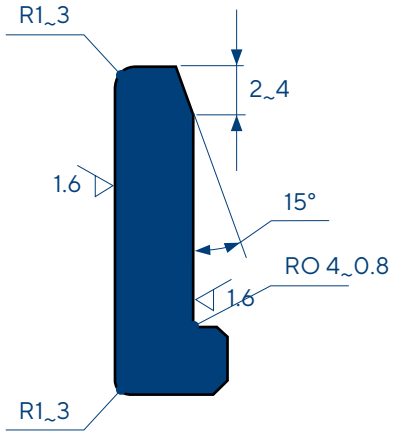
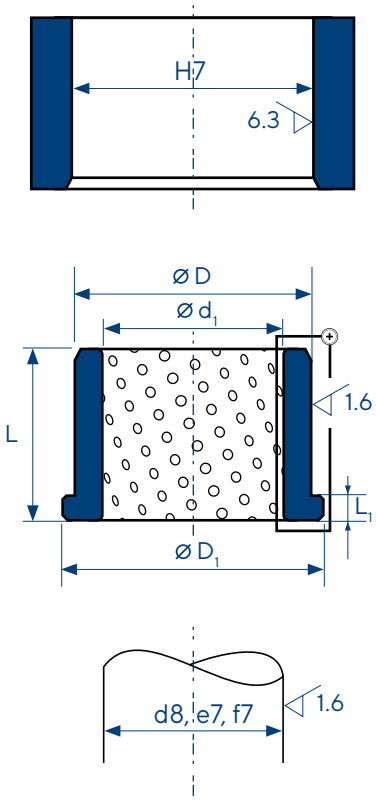
LUMET – Solid lubricant sliding bushings – Flanged sliding bearings, standard dimensions

d_1: Nominal inner diameter
D: Nominal outer diamet
D_3: Hole diameter
L: Length





d_1	d_1 E7	D	D r6	F	$L_1^{-0.10}$	L $^{-0.30}$									
						15	20	25	30	35	40	50	60	80	100
10	+0.040 +0.025	14	+0.034 +0.023	22	2	1015	1020								
12	+0.050 +0.032	18		25	3	1215	1220								
13		19	+0.041 +0.028	26		1315	1320								
14		20		27		1413	1420								
15		21		28		1515	1520	1525	1530						
16		22		29		1615	1620	1625	1630						
20	+0.061 +0.040	30		40	5	2015	2020	2025	2030		2040				
25		35	+0.050 +0.034	45		2515	2520	2525	2530		2540				
30		40		50			3020	3025	3030	3035	3040	3050			
31.5	+0.075 +0.050	40		50			3120			3135					
35		45		60			3520		3530		3540	3550			
40		50		65			4020		4030		4040	4050			
45		55	+0.060 +0.041	70					4530		4540	4550	4560		
50		60		75					5030		5040	5050	5060		
55	+0.090 +0.060	65		80							5540		5560		
60		75	+0.062 +0.043	90	7.5						6040	6050		6080	

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LUMET – Solid lubicant sliding bushings – Flanged sliding bearings, standard dimensions

d_1	d_1 E7	D	D r6	F	$L_1^{-0.10}$	$L^{-0.30}$									
						15	20	25	30	35	40	50	60	80	100
63	+0.090 +0.060	75	+0.062 +0.043	85	7.5									6367	
70		85	+0.073 +0.051	105								7050		7080	
75		90		110									7560		
80		100		120	10								8060	8080	80100
90	+0.107 +0.072	110	+0.076 +0.054	130									9060	9080	
100		120		150										10080	100100
120		140	+0.088 +0.063	170										12080	120100

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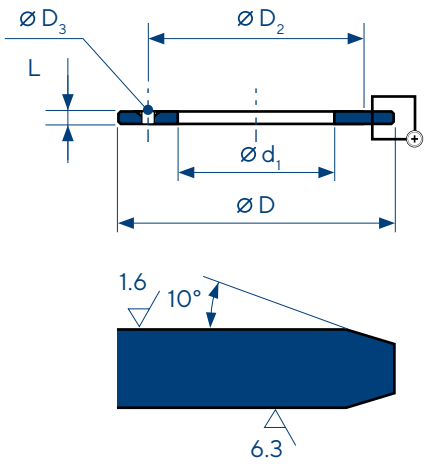
LUMET – Solid lubicant sliding bushings – Thrust washers, standard dimensions

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



Shaft Diameter f7	d	D	Bolt			
			D_2	Quality	Size	D_3
10	10.2	30				
12	12.2	40	28	2	M3	3.5
13	13.2					
14	14.2					
15	15.2	50	35			
16	16.2					
18	18.2					
20	20.2				M5	6
25	25.2	55	40			
30	30.2	60	45			
35	35.2	70	50			
40	40.2	80	60		M6	7
45	45.2	90	67.5			
50	50.2	100	75			
55	55.2	110	85			
60	60.2	120	90		M8	9
65	65.2	125	95			
70	70.2	130	100			
75	75.2	140	110			
80	80.2	150	120			
90	90.2	170	140		M10	11
100	100.2	190	160			
120	120.2	200	175			

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LUMET - SOLID LUBRICANT SLIDING STRIPS AND SLIDING PLATES

LUMET - Solid lubricant sliding strips/sliding plates made of solid bronze

The customised LUMET solid lubricant sliding strips or sliding plates are made of solid bronze with a permanently integrated graphite lubricant and are therefore characterised by their low maintenance requirements. They are designed for high loads (temperatures up to 400°C) at low friction speeds. Products from this series are used in particular in the offshore sector and in connection with food or textile machinery.

We would be happy to analyse your requirements in detail in order to offer you the best possible solution for your individual case. You can rely on over 40 years of experience, specialising in the production and manufacture of high-quality slide rails, slide plates and slide bearings.

LUMET®
BRONZE sliding bushings

LUMET-GL

LUMET is a solid bronze slide plate with integrated graphite lubricant that enables automatic and energy-efficient lubrication and offers significantly higher load limits than oil-regulated elements. It is suitable for heavy-duty operation and corrosive environments as well as hard-to-reach lubrication points, for example in die casting, mining, shipbuilding, turbo generators and injection moulding machines.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GL	CuZn24Al6/ CuZn25Al 6Fe3Mn4	100	8	>210	>12	+300°C	>450	>750	15 m/min

LUMET-GLSH1

LUMET-GLSH1 is based on the CuSn5Pb5Zn5 alloy and combines good wear resistance with reliable emergency running properties and high corrosion resistance. The material of the slide plate is suitable for medium loads up to 400 °C and enables dry sliding operation up to approx. 10 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GLSH1	CuSn5Pb5Zn5	60	8.9	>70	>15	+400°C	>90	>200	10 m/min

LUMET-GLSH2

Made from CuAl10Ni5Fe5 aluminium bronze, the LUMET-GLSH2 offers high strength, outstanding fatigue resistance and very good chemical resistance. The alloy of this sliding strip is a versatile all-rounder for high loads up to 400 °C and sliding speeds up to approx. 20 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GLSH2	CuAl10Ni5Fe5	50	7.8	>150	>10	+400°C	>260	>600	20 m/min

LUMET-GLSH3

Based on the high-alloy tin bronze CuSn12, the LUMET-GLSH3 offers good toughness, high wear resistance and reliable emergency running properties even with limited lubrication. The alloy of this is suitable for alternating loads up to 400 °C and sliding speeds up to approx. 10 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GLSH3	CuSn12	70	8.9	>95	>8	+400°C	>150	>260	10 m/min

LUMET-GLSH5

Made from CuZn25Al5Mn4Fe3 aluminium-manganese bronze, LUMET-GLSH5 offers very high strength, hardness and outstanding corrosion resistance. The material can withstand temperatures of up to +150 °C and speeds of around 15 m/min and is particularly suitable for high point loads at moderate speeds.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GLSH5	CuZn25Al 5Mn4Fe3	120	8	>250	>8	+150°C	>450	>800	15 m/min

LUMET-GLHHP

LUMET-GLHHP are based on high-performance zinc bronze CuZn32Al5Ni3. Thanks to their high mechanical strength and hardness, LUMET-HHP are suitable for harsh operating conditions up to +150 °C, offering high load-bearing capacity and sliding speeds of up to 15 m/min.

Profile	Design	Base material	Dynamic load N/mm²	Density	Hard-ness HB	Elongation %	Temperature limit	Yield point N/mm²	Tensile strength N/mm²	Max. speed (dry)
	LUMET-GLHHP	CuZn32Al 5Ni3	150	8	>280	>0.3	+150°C	>450	>540	15 m/min

Material structure

The material of the LUMET sliding strips and sliding plates is characterised by high strength and excellent load-bearing capacity - even under alternating or shock loads.
The embedded solid lubricants form a uniform friction film on the bearing surface during commissioning and transfer this to the mating material on first contact

.

This is particularly important under dry running conditions:
A running-in film is formed at the beginning, which smoothes the friction partners and transfers the solid lubricant specifically into the microstructure of the mating surface.
This reduces stick-slip effects, micro-vibrations and plastic deformation - the typical causes of friction and wear in unlubricated metal pairings.

In contrast to conventional lubricants, which are displaced from the contact area under pressure, the solid lubricant film in LUMET sliding strips and sliding plates remains stable in the friction zone. The lubricant is continuously released from the plugs and evenly distributed due to the micro-movements during operation.

The result:
- Constantly low frictional resistance
- Minimised wear even under high loads
  and a significantly longer service life of the bearing point

Material properties

LUMET materials have been developed for demanding applications and impress with the following properties:
- Maintenance-free operation with a long service life
- High load capacity - under both static and dynamic loads
- Constantly low coefficient of friction - without stick-slip effects, even in start-stop operation
- Resistant to dirt, corrosion, impacts and edge loads
- The cast copper alloy has a shock-absorbing effect and protects neighbouring components
- Generous temperature range - for applications in extremely cold or hot environments.
- Suitable for linear, rotating and oscillating movements
- Long service life and service life

SIBRO - SINTERED BEARINGS

SIBRO - sintered bearings for maintenance-free operation

SIBRO sintered bearings offer automatic lubrication over their entire service life thanks to their oil-impregnated structure. They are the perfect choice for applications where high speed and medium loads are required. Ideal for drive technology, paper and textile machines and agricultural machinery - SIBRO ensures smooth operation without maintenance.

SIBRO®
OIL-SOAKED SINTERED BEARINGS

SIBRO-FU-1 Sintered bronze

The SIBRO-FU-1 sliding bushings made from sintered bronze powder are pressed to shape and sintered under a high pressure and temperature. The oil is simultaneously dispensed into the tiny pores on the metal.

The SIBRO-FU-1 sliding bushings can be used in dry conditions for applications with medium speeds and low loads over a long period of time without requiring any maintenance. Sintered bronze sliding bushings are economical options, and are available in an almost unlimited variety of dimensions. They are popular in electrical and electronic machinery, chemical engineering machinery, cars and office equipment.

Profile	Design	Base material	Load capacity	Temperature range	Friction coefficient
	SIBRO-FU-1 Sintered bronze	CuSn6Zn6Pb3 / CuSn10	35 N/mm²	-80°C to +160°C	0.12 - 0.18

SIBRO-FU-2 Sintereisen

The SIBRO-FU-2 sintered iron sliding bushings protect the shafts by means of the embedded oil. At low loads, these bearings have the same sliding and frictional properties as the sintered bronze sliding bushings. The absorbed oil in the sintered iron sliding bushings helps prevent seize-ups.

These bushings are commonly used in textile machinery, power tools and shock absorbers for cars and motor bikes. They can also be used statically as guide bushings or retaining bushings.

Profile	Design	Base material	Load capacity	Temperature range	Friction coefficient
	SIBRO-FU-2 Sintered iron	Fe	45 N/mm²	-80°C to +160°C	0.15 - 0.20

SIBRO-FU-3 Sinterbronzestahl

The SIBRO-FU-3 sintered bronze steel sliding bushings have the same benefits as the SIBRO-FU-1 and SIBRO-FU-2 bushings.

The proportions of iron and bronze can be configured by the client according to different requirements.

Profile	Design	Base material	Load capacity	Temperature range	Friction coefficient
	SIBRO-FU-3 Sintered bronze steel	Fe + Cu + C	45 N/mm²	-80°C to +160°C	0.12 - 0.20

SIBRO®
OIL-SOAKED SINTERED BEARINGS

Function

Self-lubricating sintered bearings are impregnated with approx. 25 volume percentage oil. This quantity of oil is sufficient for the entire service life. As a result of the capillary effect, elastic deformation and thermal expansion, a film of oil forms between the bearing and the shaft during operation. The temperature inside the bearing increases over operating time. The thermal expansion of the oil is greater than that of the bearing metal, and forces oil into the bearing gap. With increased circumferential speed, the lubrication becomes hydrodynamic.

Production

Sintered components are produced by the following steps:

- Mixing metal powder in the required composition
- Compressing mixture to form a solid element
- Sintering at a temperature appropriate to the composition
- Calibrating and re-calibrating where necessary in order to maintain the required tolerances

Properties

Sintered plain bearings are among the most proven products of powder metallurgy and have been a fixture in a wide range of technical applications for decades. Their performance is largely based on two key properties: the high dimensional accuracy in production and the characteristic pore structure of the material. Both are decisive for the self-lubricating effect - and therefore for reliable, low-maintenance use in numerous plain bearing applications.

The key properties of sintered bearings are as follows:

- Very high dimensional accuracy
- Quiet running
- High reliability
- Low maintenance costs
- No oil leaks
- No additional lubrication required

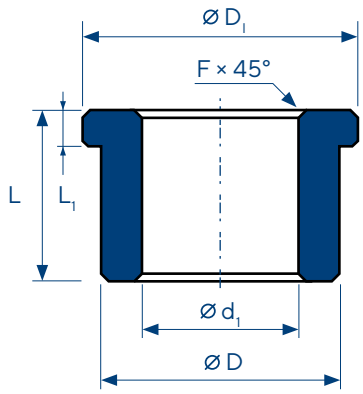
Functionality

One key factor is crucial for low-friction and wear-free movement within a plain bearing: reliable separation of the moving surfaces using a suitable lubricant. Only when the lubricant is in the right place at the right time and forms a stable lubricating film can the bearing realise its full potential.

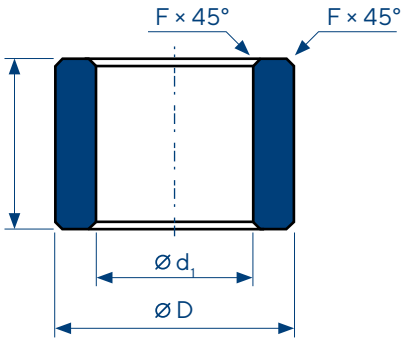
The structure of the material plays a decisive role in sintered plain bearings in particular. Thanks to their open-pored microstructure, these bearings have a pore volume of around 15-25 % of the total volume. These pores serve as storage chambers for liquid or solid lubricants, which are released independently onto the sliding surfaces - exactly when they are needed.

The lubricant stored in the pores is transported into the so-called bearing gap by the movement of the shaft. There - due to the slight eccentricity between the shaft and bearing - a wedge-shaped lubrication zone is formed. This geometry leads to a hydrodynamic effect: the lubricating film builds up automatically, without any external feed. The movement of the shaft is sufficient to distribute the lubricant continuously.

The result: a maintenance-free, durable and reliable bearing with excellent emergency running properties - ideal for demanding applications in industry, mechanical engineering or automation.

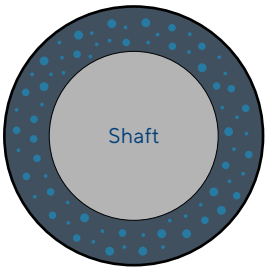


d_1 = Inner diameter
D = Outer diameter
L = Length
L_1 = Flange thickness
D_1 = Flange diameter



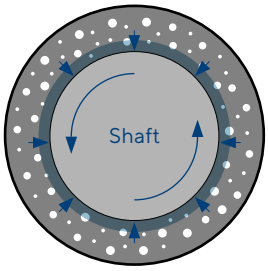
Capillary pores

1 - Standstill
The bearings' pores, which make up 25% of the volume of the bearings, are impregnated to the point of saturation with an oil withhigh lubricity.



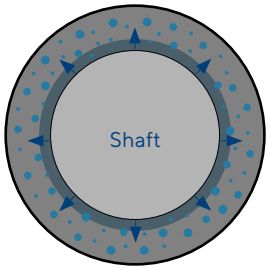
Film of oil

2 - Operation
The suction effect of the rotating shaft and the wedge of oil form a hydrodynamic film, i.e. an oil buffer.



Sucked back oil

3 - Hold/Stop
Provided that the shaft is stationary, the oil is sucked back into the bearing as a result of the capillary effect of the pores.



Coefficient of friction

The coefficient of friction depends on many factors, including the surface quality of the mating material, the circumferential speed and the bearing temperature. If these factors are taken into account, the following values can be calculated:

Oil-impregnated bearings: 0.05 - 0.10
Dry lubricated bearings: 0.15 - 0.25

A lower friction coefficient for oil-impregnated bearings can be achieved by low load and high sliding speed.

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Bearing surface and mating materials (shaft

In order for a sintered plain bearing to realise its full potential, the selection of the right shaft material - i.e. the so-called mating partner - plays a central role. It is not only the hardness and material properties that are decisive, but also the surface quality and geometric precision.

Recommended materials for shafts and journals

High-strength steels with a tensile strength of at least 600 N/mm² and hardened steels from 55 HRC are ideal. Under certain operating conditions, unhardened, stainless, chrome-plated or nickel-plated materials can also be used. However, caution is advised with galvanised surfaces: Excessively smooth or non-adhesive coatings - as with galvanised shafts - can hinder lubricant distribution or clog the pore structure of the bearing

Surface quality - the key to longevity

The lubricating film on sintered plain bearings is particularly thin. This makes a finely machined shaft surface with a roughness of Ra ≤ 0.8 µm all the more important. Smooth and load-bearing surfaces can be achieved using processes such as superfinishing, lapping, roller burnishing or vibratory grinding. A surface that is too rough or irregular, on the other hand, can damage the bearing and significantly impair its self-lubricating properties.

Corrosion protection and special environments

In humid or aggressive environments, we recommend hard chrome-plated shafts or alternatively stainless materials - supplemented by molybdenum disulphide coatings or chrome-plating to further improve the sliding properties. Roller burnishing or hard chrome plating of the surface is particularly useful for stainless steels in order to minimise the abrasive effect of nickel.

Geometry - precise shape instead of compromise

Not only the surface, but also the shape of the shaft is crucial. Major deviations from the ideal circular or cylindrical shape can lead to pumping effects that cause oil loss and noise. We therefore recommend keeping shape tolerances as low as possible.

For dusty or contaminated areas of application, the bearing point should also be protected by axial seals to prevent the ingress of particles and to ensure long-term functional reliability.

Service life of SIBRO sintered plain bearings

The service life of a sintered plain bearing depends largely on the operating conditions and the lubricant supply. Under optimum conditions - i.e. at constant speed in continuous operation and with a stable hydrodynamic lubricating film and room temperature - running times of over 100,000 hours can be achieved. The prerequisite for this is a sufficient quantity of oil in the bearing, which is provided by the open-pored structure of the sintered material.

The centrepiece of a self-lubricating sintered plain bearing is its finely interconnected pore space. It accounts for around 15-25 % of the total volume and serves as a reservoir for liquid or solid lubricants. These are continuously released onto the sliding surface and keep the lubricating film stable even during long periods of operation - without any external lubricant supply.

As long as this lubricating film remains intact, there is no direct contact between the shaft and bearing - wear is therefore virtually eliminated. In practice, however, certain conditions such as high temperatures, vibrations, contamination or an uneven load can affect the service life. Oil losses due to evaporation, decomposition or leakage must also be taken into account in the design.

Special materials are used for more demanding environments: sintered bronzes containing MoS_2, for example, are designed for continuous operation up to 300 °C (even up to 400 °C for short periods) and offer a high level of operational reliability even under extreme conditions.

Conclusion: Sintered plain bearings are durable, maintenance-free and highly resilient design elements. The right design, the right material and a lubrication strategy tailored to the application form the basis for maximum service life - even under difficult conditions.

Installation

It is important that great care is taken when installing sintered bearings, as the porous bearings can be damaged very easily. The installation should ideally be carried out using a fitting mandrel. The pressing force is approx. 2–3 N per mm^2 of the lateral area of the bearing. Sintered bearings can also be set, affixed or injected into other materials. The bearings should therefore not yet be impregnated with oil. Anti-rotation devices on the bearing are recommended, but these are not absolutely essential due to the porous structure of the bearings. Tests are recommended in this case. When carrying out the tests, it must be ensured that the inner-diameter tolerance of the bearings does not change. The bearing's sliding surface can then be adjusted by means of calibration or machining.

Properties
Suitable for high speeds at low loads.

Materials
Carrier material CuSn10 (compliant with SINT B50)

Tolerances
see product-specific instructions

Shaft material
Steel > 200HB ground
Surface roughness Rz 4

Installation instructions
The use of a fitting mandrel is advisable

Our sintered plain bearings are high-precision design elements that are manufactured to exact dimensions and optimised for their installation situation. The H7/r7 fit has proven itself for the housing seat - it ensures a secure hold and reliable function during operation.

Professional press-fitting for precise results

We recommend the use of a press-fit mandrel to ensure the dimensional accuracy and surface quality of the bearings in the long term. This should be at least three times as long as the bearing itself and should be hardened and ground. Ground and lapped carbide mandrels are particularly suitable for series mounting.

Alternative mounting methods for special applications

In addition to classic press-fitting, there are also other mounting techniques available depending on the requirements, including:

- Paste
- Pouring
- Injecting
- Vulcanising
- Flanging (e.g. for bearing made of sintered bronze)

These methods are particularly suitable for special materials or operating conditions - we will be happy to advise you on the selection of the optimum solution.

Application conditions			
Maximum specific load statisch	static dynamic	P P	10 N/mm² 5 N/mm²
Maximum sliding speed		v	6.0 m/s
Maximum sliding bearing load		pv	1.6 N/mm² × m/s
Temperature		T	-10 – + 100 °C
Friction coefficient		m	0.05 to 0.20 µ

Storage

In order for our self-lubricating sintered plain bearings to perform to their full potential, proper bearing support is crucial. These bearings contain approx. 25 per cent oil by volume, which contributes significantly to their reliable function.

Important for storage

Avoid storage conditions in which the oil can escape - for example by placing it on absorbent materials such as wood, paper or cardboard. These extract oil from the bearing, which can lead to a loss of function in the long term.

Our recommendation

until installation. These not only protect against oil loss, but also reliably protect against dust, dirt and other contaminants that could impair operation.

However, if oil leaks do occur, the bearings must be re-impregnated. This is because heat build-up can only be prevented and a long service life of the bearing guaranteed if there is sufficient lubricant.

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CELRO - PLASTIC SLIDING BUSHINGS

CELRO – sliding bushings - the smart solution

CELRO plastic sliding bushings offer an innovative solution for various industrial applications where lightweight, durable and maintenance-free bearing solutions are required. With high resistance to corrosion and wear, they provide smooth functionality, even under demanding conditions. CELRO bushings are ideal for applications where precision and reliability are essential.

CELRO®
PLASTIC SLIDING BUSHINGS

CELRO-OMC

OMC is an oil-impregnated nylon material. It is a high-strength and self-lubricating plastic made from a nylon monomer and which stores lubricant as a result of a catalysing polymerization reaction.

CELRO-OMC is popular in hydroelectricity technology, metallurgical machinery, rubber roller machinery and vulcanisation machinery.

Profile	Design	Tensile trength	Temperature range	Friction coefficien	Hardness	Linear expansion
	CELRO-OMC	14 MPa 20 MPa	-40°C to +80°	0.12 to 0.16	HRC R118	1 × 10/°C

CELRO-GMC

GMC is a reinforced nylon material. It is filled with fibreglass, which gives it impressively high levels of stability and rigidity along with low stick-slip.

This material is commonly used in the mining industry, in shipyards and in the paper manufacturing industry.

Profile	Design	Tensile trength	Temperature range	Friction coefficien	Hardness	Linear expansion
	CELRO-GMC	14 MPa 20 MPa	-40°C to +80°	0.45 to 0.5	HRC R118	1 × 10/°C

Production

Plastic sliding bushings are mainly manufactured by injection molding from high-performance plastics such as polyamide (PA), polyoxymethylene (POM), polytetrafluoroethylene (PTFE) and polyetheretherketone (PEEK). After injection molding, post-processing is often carried out in order to achieve precise tolerances and surface qualities. Individual productions and custom-made products are possible in order to meet special customer requirements.

High quality

To ensure the high quality of our plastic sliding bushings, we use high-quality raw materials and strictly monitor the entire production process. Regular material tests and machine inspections are crucial. Precise manufacturing tolerances and a homogeneous material structure, as well as the application advice offered by ttv, ensure optimum performance and durability.

Mounting

The installation of plastic sliding bushings is simple. At the same time, mounting is often a common factor in handling damage. Sliding bushings must not be hammered into the housing. The bearings are pressed into the intended housings or bores using an appropriate press-in mandrel.

It is essential that the mounting surface is clean and free from contamination to ensure optimum fit and function. Bearings with a larger diameter can be cooled using liquid nitrogen and then placed in the bore.

Advantages

Plastic sliding bushings offer excellent sliding properties, high wear resistance and corrosion resistance. corrosion resistance. They often require no additional lubrication and can be used in many aggressive environments in which metal bearings are not suitable.

When used outdoors, the UV resistance of the respective material must be taken into account. In addition, there are further advantages in terms of design flexibility. In addition to collars and cylindrical as well as thrust washers and sliding plates, any special shape that can be formed from a two-part tool can also be implemented.

TESON - SPECIAL TECHNICAL PARTS

Teson - Special technical parts offer customized perfection for industrial requirements.

With TESON special parts, such as pistons for shock absorbers, X-rings, O-rings or special components, you receive solutions that have been specially developed for extreme conditions and maximum precision. TESON meets exact customer-specific requirements and focuses on quality, reliability and efficiency.

TESON®
SPECIAL TECHNICAL PARTS

TESON-FD-B – Automotive special parts

The TESON-FD-B automotive special parts solution is a piston developed for shock absorbers in motor vehicles. This piston offers the best coefficients of friction and maximum precision. Car manufacturers overseas have been successfully using these products as special automotive parts for years. The assembly of all components in our company ensures the highest quality and precision.

Profile	Design	Base material	Load capacity	Temperature range	Friction coefficient
	TESON-FD-B	Fe + PTFE	> 5000 N	-80°C to +260°C	< 0.05

Customised solutions and special designs

In addition to standardised designs, we offer extensive customised adaptations and complete special designs for a wide range of applications in the automotive sector.

Thanks to our many years of experience in design, material selection and precision machining, we develop components that are precisely tailored to your technical requirements load profiles and installation situations.

Whether special geometries, alternative material combinations, modified damping characteristics or individual coatings: we realise tailor-made solutions from prototype to series production.

SEALING
BUSHING

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