Technical manual

deva .glide®

Your challenges are our fascination.

Bronze with solid lubricant plugs

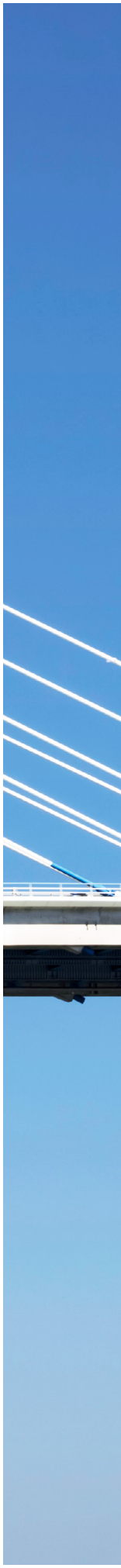
With maintenance-free, self-lubricating high-performance sliding materials from the DEVA® product range, it is now possible to realize sliding bearing concepts that operate reliably over long periods of time.

deva.glide® materials consist of highly wear-resistant cast copper alloys, whose sliding surfaces are uniformly provided with solid lubricant deposits in macro distribution. They are suitable for applications with high static and dynamic loads. In addition, the deva.glide® range of materials is characterized by the following properties:

- High wear resistance
- Insensitive to impact stress
- resistant to rough operating and environmental influences of both mechanical and chemical nature

We support you with the

- Selection of sliding materials
- Constructive design and individual adaptation to your requirements
- Estimation of bearing life
- Simulation of your sliding bearing application on our test rigs
- Assembly



OEVA

Maintenance-free,
self-lubricating
sliding bearings

Ready for tribological masterpieces.

With conventional, lubricated bronze materials, a separating lubricating film can only form if there are suitable movement conditions and requirements for lubrication.

With deva.glide®, lubrication is provided by the sliding material itself. Already during the first sliding movements, solid lubricant is released by micro-abrasion from the sliding material and enables maintenance-free operation over the service life.

Typical applications for deva.glide® sliding bearings can be found in these industries:


Iron and steel industry


Hydro-Civil Engineering


Bridges and steel construction


Mechanical engineering


Injection molding and tire molding


Shipbuilding and offshore industry


Onshore and offshore wind turbines


Gas and steam turbines


Agricultural and construction machines

Technical manual deva.glide®

Table of Contents

deva.glide® sliding bearings

Material properties

Maintenance-free and self-lubricating high-performance sliding material
The dry-running principle is the same for all deva.glide® materials. The plugs arranged in a particular pattern provide a solid lubricant.

A firmly adhering solid lubricant film forms on the sliding partners, which ensures lubrication even under high loads. This ensures extensive separation of the sliding surfaces and a permanently low coefficient of friction with minimum wear is possible.

It should be noted that the solid lubricant is distributed by sufficient movement of the sliding surface from plug to plug. in order to achieve the build-up of a transfer film for a stable operating condition of the sliding bearings. The direction of movement determines the arrangement of the lubrication plugs.

Performance promise Our deva.glide®

- Enables maintenance-free operation without lubrication
- Has a high static and dynamic load-bearing capacity
- Is insensitive to dirt, impact stress and edge loading
- Can be used in corrosive environments
- Can be used in a wide temperature range
- Can be used in seawater
- Absorbs no water and is therefore well suited for applications in seawater and many industrial liquids, where high dimensional stability is required
- Has a uniformly low coefficient of friction without stick slip
- Is electrically conductive and shows no electrostatic charging effects
- Has good thermal conductivity
- Can be used even with larger shaft misalignments
- Can also be used with additional, conventional lubrication
- Is suitable for translatory, rotatory, oscillatory movements with cylindrical guidance or also for straight surface use. These movements can occur individually or in combination

deva.glide® sliding bearings

Sliding bearing materials

Copper casting alloys with solid lubricant deposits

deva.glide® sliding bearings are available in preferred dimensions and as customized special parts. Customers benefit from our many years of experience in various applications and our service in the field of material selection and design for special sliding bearings.

2.1 Material structure and microstructure

The deva.glide® material system uses solid lubricants with optimum film formation, adhesion, surface affinity and corrosion resistance. deva.glide® is available with two standard solid lubricant formulations (dg12 and dg16). Additional variants are also available for special applications.

Graphite has a lamellar structure with low interfacial shear strength compared to the adjacent inter-molecular layers in the material. The use of highly pure, untreated natural graphite prevents any electrolytic and chemical activity. Furthermore, it has the lowest coefficients of friction among the available graphite types.

Due to its special structure, PTFE behaves similarly to solid lubricants and achieves some of the best tribo-logical properties.

Festschmierstoffe

Stopfentyp	Basis	Farbe
dg 12	Grafit and Zusätze	schwarz
dg 16	PTFE and Zusätze	weiß

Table 2.1.1

In technical dry running, deva.glide® is provided with a running-in film, dg22 (black) or dg26 (blue), which enables a solid lubricant transfer to the mating material already during the first contact of the sliding partners. The thickness of the running-in film is not taken into account when considering bore tolerances, as this coating is usually consumedduring the running-in process. For optical reasons, the running-in film is not shown on most illustrations and drawings in this manual.

Microsection and structure deva.glide®

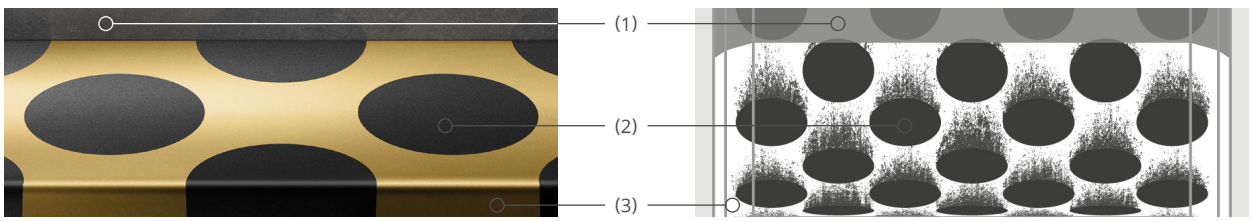


Diagram 2.5.1

(1) Sliding surface with running-in-film (2) Solid lubricant insert (3) Supporting body (bronze)

2.2 Overview deva.glide® materials

deva.glide®	DIN EN	Material number	Description	ASTM Standard		Weight shares	
			Delivery form (1)	Standard	Alloy number	DIN	ASTM
01 	1982	CC493K (formerly 2.1090)	CuSn7Zn4Pb7-C-GS CuSn7Zn4Pb7-C-GZ CuSn7Zn4Pb7-C-GC	B 584 B 271 B 505	C932 00 C932 00 C932 00	Cu 81.0–85.0 Ni max. 2.0 P max. 0.1 Pb 5.0–8.0 Sn 6.0–8.0 Zn 2.0–5.0 **max. permissible proportions** Al 0.01 Fe 0.2 S 0.10 Sb 0.3 Si 0.01	Cu 81.0–85.0 Ni 1.0 Pb 6–8 Sn 6.3–7.5 Zn 2–4 Sb 0.35
03 	1982	CC333G (formerly 2.0975)	CuAl10Fe5Ni5-C-GS CuAl10Fe5Ni5-C-GM CuAl10Fe5Ni5-C-GZ CuAl10Fe5Ni5-C-GC	B 584 B 30 B 271 B 505	C955 00 C955 00 C955 00 C955 00	Cu 76.0–83.0 Al 8.5–10.5 Fe 4.0–5.5 Mn max. 3.0 Ni 4.0–5.5 **max. permissible proportions** Bi 0.01 Cr 0.05 Mg 0.05 Pb 0.03 Si 0.10 Sn 0.10 Zn 0.50	Cu min. 78 Al 10–11.5 Fe 3–5 Mn max. 3.5 Ni 3–5.5
04 	1982	CC762S (formerly 2.0598)	CuZn25Al5Mn4Fe3-C-GS CuZn25Al5Mn4Fe3-C-GM CuZn25Al5Mn4Fe3-C-GZ	B 584 B 30 B 271	C863 00 C863 00 C863 00	Cu 60.0–67.0 Zn rest Al 3.0–7.0 Mn 2.5–5.0 Fe 1.5–4 **max. permissible proportions** Ni 3.00 Pb 0.20 Sn 0.20 Si 0.10 P 0.03 Sb 0.03	Cu 60–66 Zn 22–28 Al 5–7.5 Mn 2.5–5 Fe 2–4 Ni max. 1

Table 2.2.1

(1) Delivery form:
GS = Sand casting
GM = Gravity die casting
GC = Continuous casting
GZ = Centrifugal casting

(2) Related to base bronze

Physical properties [1]							Storage properties								
Density **ρ | [g/cm³]**	Linear coefficient of thermal expansion **α | [10⁻⁶/K]**	0.2 % Elongation $R_{p0.2}$ **| [MPa]**	Tensile strength R_m **| [MPa]**	Elongation **[%]**	Young's Modulus **[MPa]**	Hardness **[HB]**	Max. permissible stat. load $\bar{p}_{stat/max}$ **| [MPa]**	Max. permissible dyn. load $\bar{p}_{dyn/max}$ **| [MPa]**	Max. glide speed U_{max} **| [m/s]**	Max. pU value $\bar{p}U_{max}$ **| [MPa × m/s]**	Temperature-application range **T | [°C]**	Friction coefficient (dry)	Friction coefficient (water)	Minimum hardness mating material **[HB]**	Recommended surface roughness of mating material **Ra | [µm]**
8.83	18.3	120 180 120	230 260 260	15 12 12	106.000 106.000 106.000	60 70 70	140	60	0.4	1.0	−100 to 250	0.10 to 0.12	0.08 to 0.12	180	0.2 to 0.8
7.60	16.5	250 280 280 280	600 650 650 650	13 7 13 13	122.000 122.000 122.000 122.000	140 150 150 150	300	180	0.4	1.5	−100 to 250	0.10 to 0.13	0.08 to 0.12	300	0.2 to 0.8
8.20	18.0	450 480 480	750 750 750	8 8 5	115.000 115.000 115.000	180 180 190	340	120	0.4	1.5	−100 to 250	0.12 to 0.15	0.08 to 0.12	300	0.2 to 0.8

deva.glide®	DIN EN	Material number	Description	ASTM Standard		Weight shares	
			Delivery form (1)	Standard	Alloy number	DIN	ASTM
05 	1982	CC483K (formerly 2.1052)	CuSn12-C-GS CuSn12-C-GZ CuSn12-C-GC	B 584 B 271 B 505	C908 00 C908 00 C908 00	Cu 85.0–88.5 Ni max. 2.0 P max. 0.6 Pb max. 0.7 Sn 11.0–13.0 **max. permissible proportions** Al 0.01 Fe 0.20 Mn 0.20 S 0.05 Sb 0.15 Si 0.01 Zn 0.05	Cu 89 Sn 10–13 Pb 0.5 Ni 0.5
06 	1982	CC334G (formerly 2.0980)	CuAl11Fe6Ni6-C-GS CuAl11Fe6Ni6-C-GM CuAl11Fe6Ni6-C-GZ	–	–	Cu 72.0–82.5 Al 10.0–12.0 Fe 4.0–7.0 Mn max. 2.5 Ni 4.0–7.5 **max. permissible proportions** Mg 0.05 Pb 0.05 Si 0.1 Sn 0.20 Zn 0.50	–

Table 2.2.1

(1) Delivery form:
GS = Sand casting
GM = Gravity die casting
GC = Continuous casting
GZ = Centrifugal casting

(2) Related to base bronze

Physical properties [1]							Storage properties								
Density **ρ | [g/cm³]**	Linear coefficient of thermal expansion **α | [10⁻⁶/K]**	0.2% Elongation $R_{p0.2}$ **| [MPa]**	Tensile strength R_m **| [MPa]**	Elongation **[%]**	Young's Modulus **[MPa]**	Hardness **[HB]**	Max. permissible stat. load $\bar{p}_{stat/max}$ **| [MPa]**	Max. permissible dyn. load $\bar{p}_{dyn/max}$ **| [MPa]**	Max. glide speed U_{max} **| [m/s]**	Max. pU value $\bar{p}U_{max}$ **| [MPa × m/s]**	Temperature-application range **T | [°C]**	Friction coefficient (dry)	Friction coefficient (water)	Minimum hardness mating material **[HB]**	Recommended surface roughness of mating material **Ra | [µm]**
8.72	18.1	140 150 150	260 280 300	7 5 6	110.000 110.000 110.000	80 90 90	175	100	0.4	1.0	−100 to 250	0.10 to 0.12	0.08 bis 0.12	180	0.2 to 0.8
7.60	17.2	320 380 380	680 750 750	5 5 5	125.000 125.000 125.000	170 185 185	320	200	0.4	1.5	−100 to 250	0.11 to 0.17	0.11 to 0.16	340	0.2 to 0.8

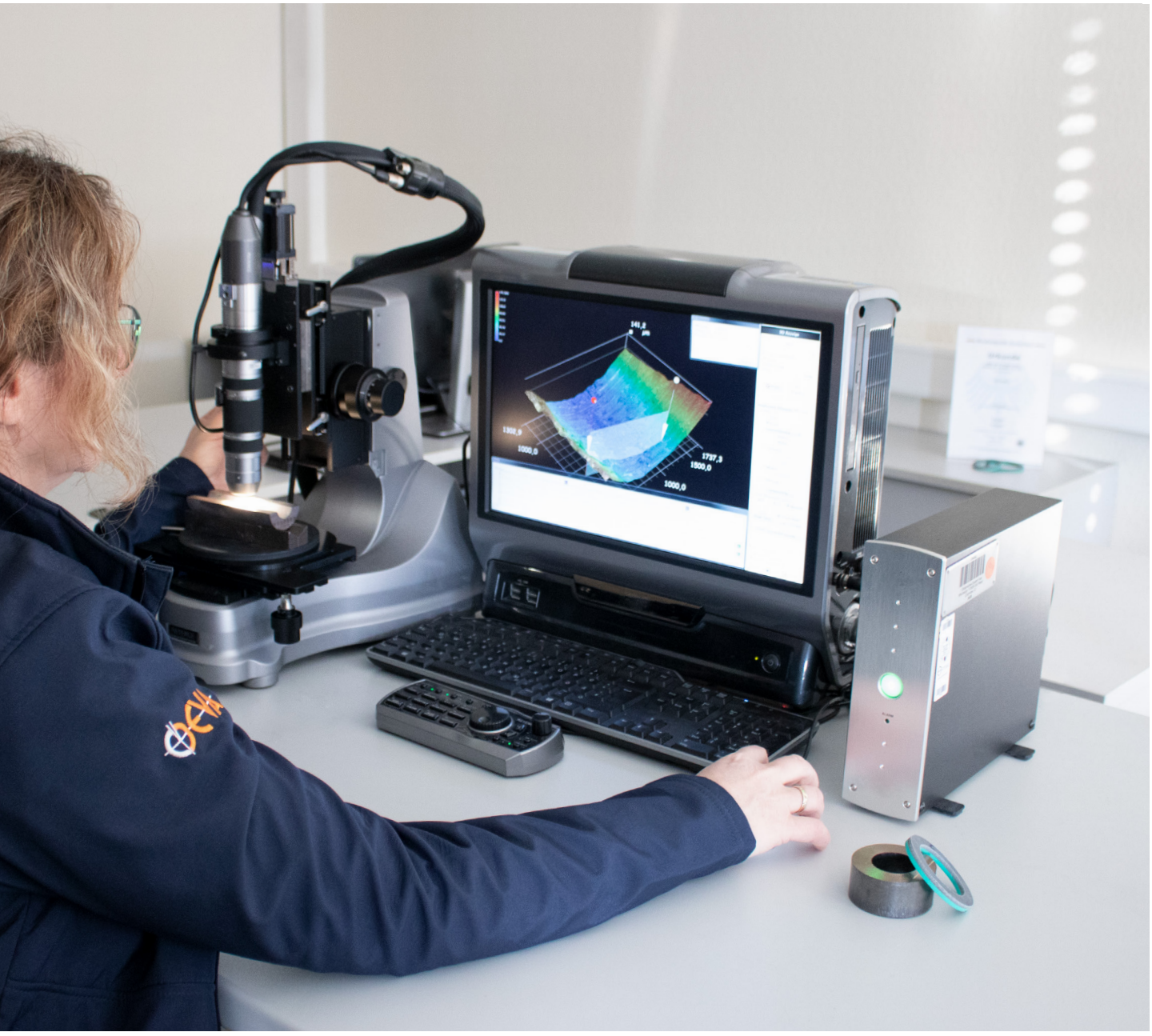
deva.glide® sliding bearings

Quality and certificates

Environmental protection and production safety

We attach great importance to qualitative, environmentally conscious and safe production. We are committed to this through the application of a variety of internationally recognized standards for quality assurance, emission control and workplace safety.

- RoHS and REACH compliant
- Certificate of origin
- Acceptance test certificates DIN EN 10204–2.1; 2.2; 3.1 and 3.2
- Certified according to ISO 9001; ISO 14001 and ISO 45001



deva.glide® sliding bearings

Load cases

The four cases of bearing load

DEVA® differentiates between four load cases. We do this to take into account the fatigue influences under dynamic load. The percentage values refer to the limit values given in the material data sheets and technical manuals.

The specifications should be understood as guide values. With alternation of loads in particular, the frequency and the number of cycles need to be considered with regard to the fatigue properties. Please contact us for a detailed analysis in a personal discussion.

Load case 0

The acting normal force is constant or can be assumed to be constant without frequent or rapid load changes or load alternations. There is no sliding movement.

Zulässige Grenzlast: 100% of the max. permissible static load according to material data sheet

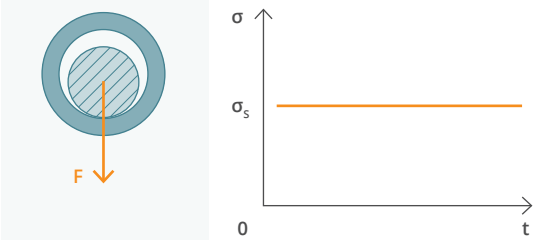


Diagram 4.1.1

Load case 1

The acting normal force changes frequently or quickly or oscillates strongly around a nominal force. There is no sliding movement.

Zulässige Grenzlast: 100% of the max. permissible static load according to material data sheet

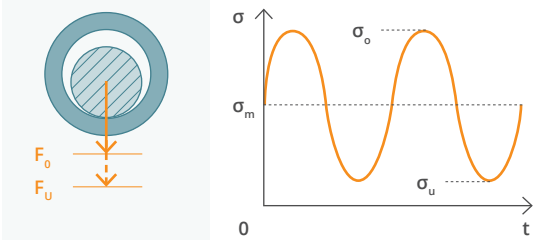


Diagram 4.1.2

Load case 2

The acting normal force is constant or can be assumed to be constant without frequent or rapid load changes or load alternations. In addition, a sliding movement takes place.

Zulässige Grenzlast: 100% of the max. permissible dynamic load according to material data sheet

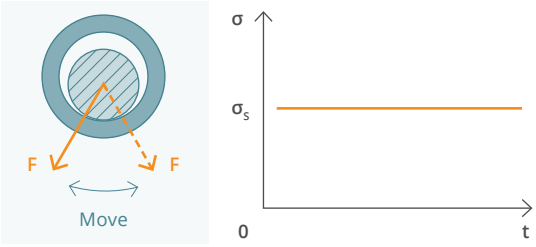


Diagram 4.1.3

Load case 3

The acting normal force changes frequently or quickly or oscillates strongly around a nominal force. In addition, a sliding movement takes place.

Zulässige Grenzlast: 100% of the max. permissible dynamic load according to material data sheet

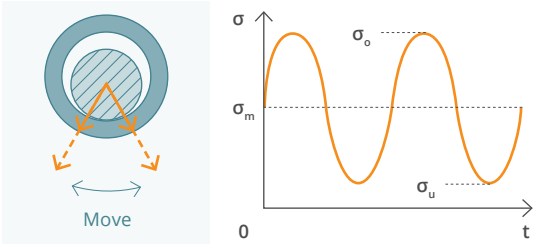


Diagram 4.1.4

deva.glide® sliding bearings

Mating materials

Roughness and surface finish

The deva.glide® sliding materials require the use of a mating material with a hardness of at least 180 HB (for detailed information see material data sheets). In the case of long sliding distances or abrasive effects from the environment, a hardened surface 35 HRC/45 HRC should be used. The surface roughness is ideally Ra = 0.2 to 0.8 µm, produced by grinding. Depending on the operating conditions, higher surface roughness can be accepted.

Normally, shafts and end faces that run against deva.glide® are made of steel. For humid and corrosive environments, the use of stainless steel is recommended. For repairs or cost reduction, the use of sleeves with the appropriate hardness can be used. Overlay welding or other protective coatings (hard chrome plated, electroless nickel, etc.) can also be used under certain conditions. The corrosion requirements met by the mating material must be determined based on the individual operating conditions.

Roughness of the mating materials

Influence of the surface roughness of the mating material on the microwear of the sliding material (Model representation from various investigations)

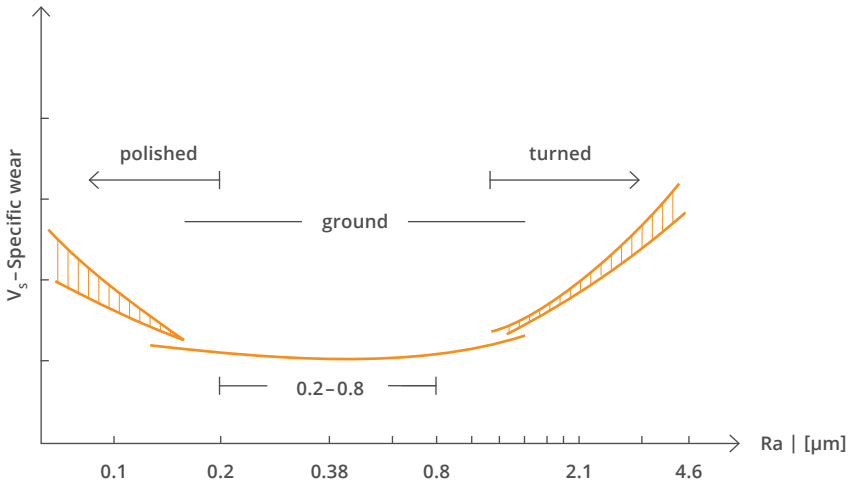


Diagram 5.1.1

Constructive design of the mating surface

Shaft and end faces in use against deva.glide® sliding bearings or thrust washers must be wider or have a larger diameter (Fig. 5.1.1) than the bearing to prevent running-in. Grooves and flat spots in the shafts must be avoided. The shaft ends must be chamfered. All sharp edges or protrusions that could damage the bearing must be removed.

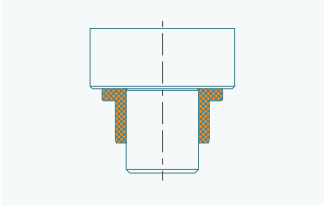


Figure 5.1.1

Suggested materials

The following table gives an overview of some possible mating materials.

Material number	DIN designation	Comparable standards		
		USA – ANSI	GB – BS 970	F – AFNOR
Mating materials for normal applications				
1.0543	ZSt 60-2	Grade 65	55C	A60-2
1.0503	C45	1045	080M46	CC45
1.7225	42CrMo4	4140	708M40	42CD4

Table 5.1.1

Mating materials for corrosive environment				
1.4021	X20Cr13	420	420S37	Z20C13
1.4057	X17CrNi-16-2	431	432S29	Z15CN16.02
1.4112	X90CrMoV18	440B	–	(Z70CV17)
1.4122	X35CrMo17	–	–	–
1.4418	X4CrNiMo16-5-1	S165M	–	Z6CND16-05-01

Table 5.1.2

Mating materials for use in seawater				
1.4462	X2CrNiMoN22-5-3	UNS531803	318513	Z3CND24-08
1.4501	X2CrNiMoCuWN25-7-4	UNSS32760	–	Z3CND25.06Az
2.4856	Inconel 625	–	–	–

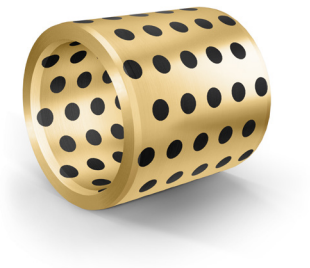
Table 5.1.3

deva.glide® sliding bearings

Cylindrical sliding bearings

Cast copper alloy

deva.glide® alloys are produced by different casting processes depending on the size and number of pieces. The material properties depend on the manufacturing process. The dimensions that can be produced, such as the maximum size, are limited by the casting process.



6.1 Recommended standard dimensions - cylindrical bushings

Table 6.1.1 shows production-related typical bearing dimensions (other sizes are available on request). For standard designs $D_1 \leq 500$ mm, the plugs are located in through holes. For standard designs Ø $D_1 > 500$ mm and for special designs, the solid lubricant inserts are located in blind holes, if necessary.

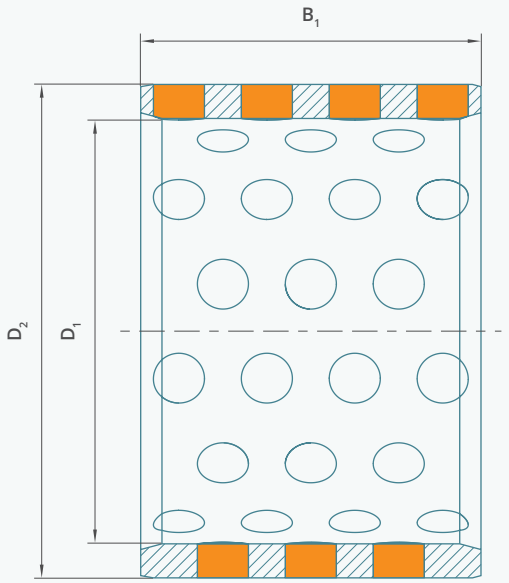


Figure 6.1.1

Recommended dimensions deva.glide® radial sliding bearing

D_1	D_2	B_1		
50	60	50	35	65
55	65	55	40	70
60	75	60	45	75
65	80	65	45	80
70	85	70	50	85
75	90	75	55	90
80	95	80	60	100
85	100	85	60	105
90	105	90	65	115
95	115	95	70	120
100	120	100	75	125
110	130	110	80	140
120	140	120	90	150
140	160	140	100	175
150	170	150	110	185
180	205	180	135	225
200	225	200	150	250
225	250	225	170	280
250	278	250	190	315
280	310	280	210	350
300	332	300	225	375
350	385	350	260	435
400	440	400	300	500
450	495	450	350	580
500	550	500	375	625
550	605	550	415	690
600	660	600	450	750 (1)
650	715	650	490	815 (1)
700	770	700	525	875 (1)
750	825	750 (1)	560	940 (1)
800	880	800 (1)	600	1000 (1)
850	935	850 (1)	640	1060 (1)
900	990	900 (1)	675	1125 (1)
950	1045	950 (1)	710 (1)	1200 (1)
1000	1100	1000 (1)	750 (1)	1250 (1)
1200	1320	2000 (1)	900 (1)	1500 (1)

Table 6.1.1

B_1 – Bearing width

D_1 – Inner diameter
D_2 – Outer diameter

(1) Width of the sliding bearing divided for production reasons (2 × 0.5). Special dimensions on request

6.2 Recommended dimensions - flanged sliding bushing

For diameters D_1 > 150 mm, a combination of sliding bearing and thrust washer may be advantageous. (please contact DEVA® for advice). The flanged of the bushing is only equipped with solid lubricant plugs if the operating conditions require this.

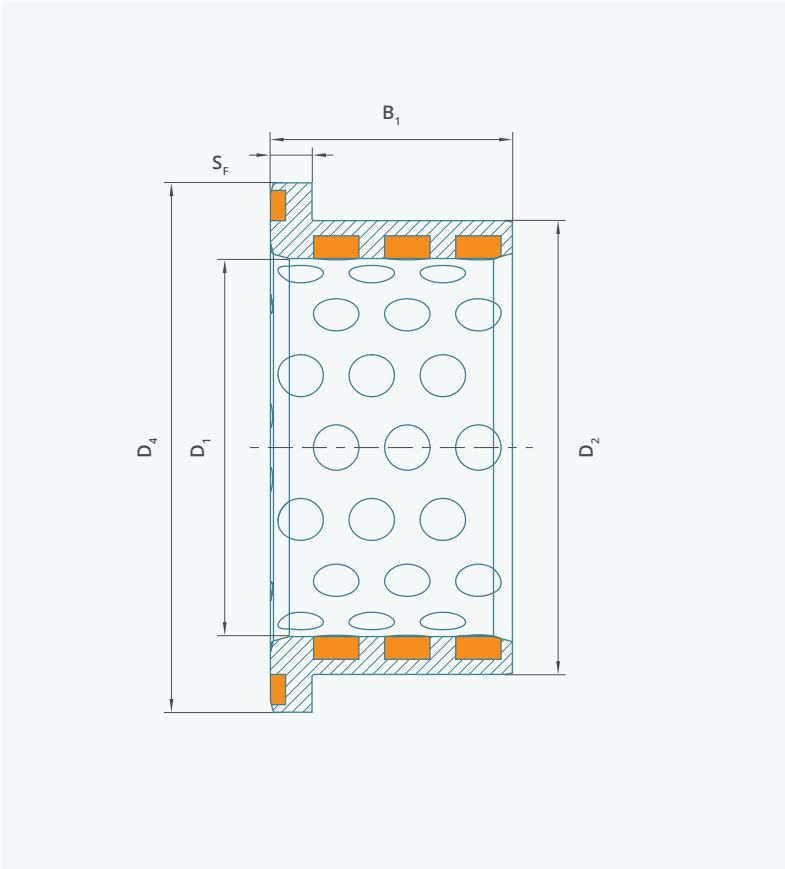


Figure 6.2.1

Recommended dimensions deva.glide® flange sliding bearing

D_1	D_2	D_4	S_F	B_1
50	60	80	5.0	On request
55	65	85	5.0	
60	75	90	7.5	
65	85	95	7.5	
70	85	100	7.5	
75	90	105	7.5	
80	95	110	7.5	
85	100	115	7.5	
90	105	120	7.5	
95	115	125	10.0	
100	120	140	10.0	
110	130	150	10.0	
120	140	160	10.0	
140	160	180	10.0	
150	170	190	10.0	
180	205	230	12.5	
200	225	250	12.5	
225	250	275	12.5	
250	278	300	14.0	
280	310	340	15.0	
300	332	360	16.0	
350	385	420	17.5	
400	440	480	20.0	
450	495	530	22.5	
500	550	600	25.0	
550	605	650	25.0	
600	660	720	25.0	
650	715	780	25.0	
700	770	840	25.0	
750	825	900	25.0	
800	880	960	25.0	
850	935	1020	25.0	
900	990	1080	25.0	
950	1045	1140	25.0	
1000	1100	1200	25.0	
1200	1320	1440	25.0	

Table 6.2.1

B_1 – Bearing width
D_1 – Inner diameter
D_2 – Outer diameter
D_4 – Flange diameterr
S_F – Flange height

6.3 Fits and surfaces

deva.glide® sliding bearings are pressed in with overlap between the housing inside diameter and bearing outside diameter. Bearing outside, bearing inside, shaft and housing inside diameters must be manufactured within the recommended tolerances to ensure satisfactory bearing operation.

Permissible fit and tolerance ranges

Figure 6.3.1 and table 6.3.1 show the recommended fits and tolerance options. For sliding bearings with diameter D_1 greater than 500 mm, the fits must be determined according to the requirements. Please contact our application engineering department for this. For sliding bearings with diameter D_1 smaller than 500 mm, the following suggestions apply. To produce more accurate fits after assembly (IT7 or better), finish machining should be carried out after installation. For this purpose, deva.glide® can be manufactured with a machining allowance. The adaptation of the bearing tolerances to deviating shaft tolerances is possible on request.

deva.glide® flange sliding bearing

For deva.glide® flanged sliding bearings, the transition radius between the back of the flange and the outer diameter of the radial sliding bearing must be taken into account by means of a free rotation on the housing.

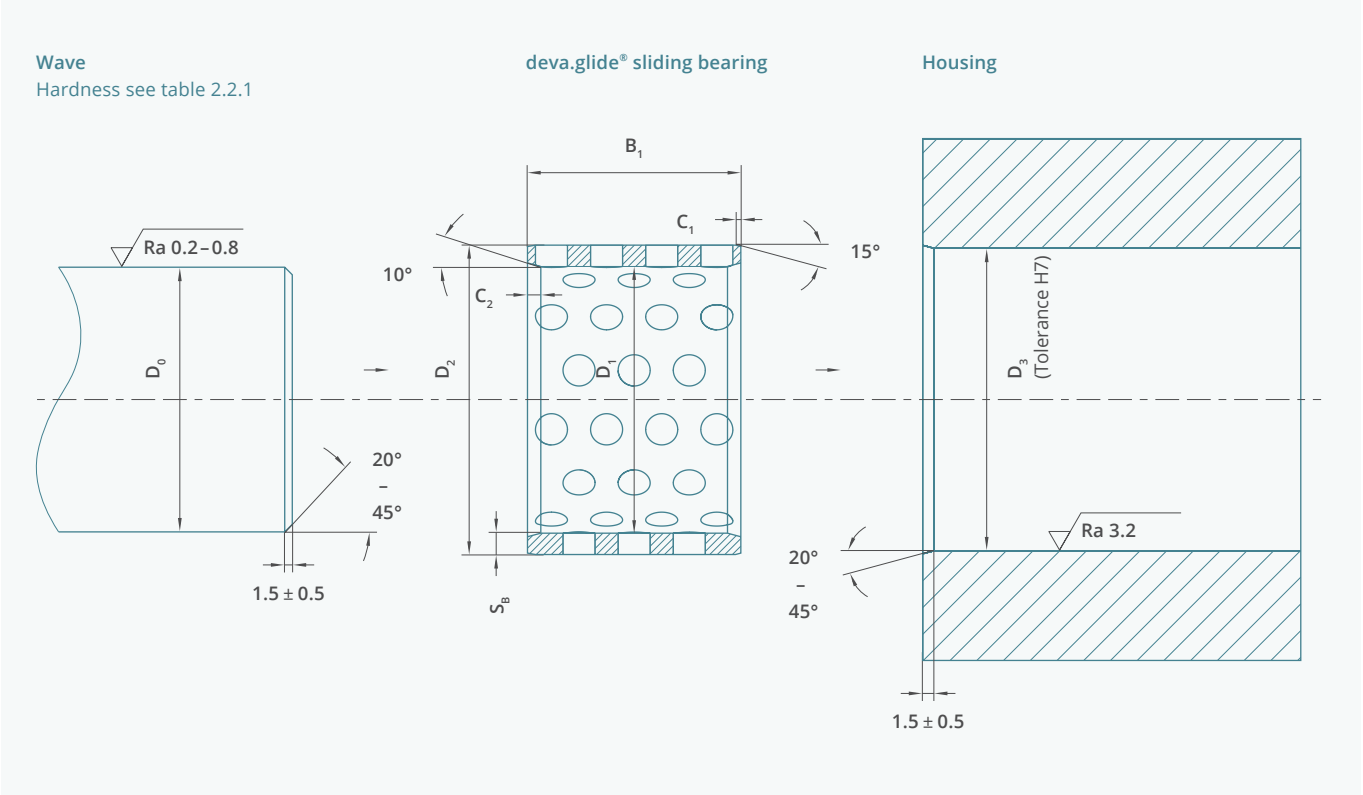


Figure 6.3.1

B_1 – Bearing width

C_1 – Chamfer outer diameter
C_2 – Chamfer inner diameter

D_0 – Shaft outer diameter
D_1 – Bearing inner diameter
D_2 – Bearing outer diameter
D_3 – Housing inner diameter

S_B – Wall thickness

Recommended fit and tolerance ranges

Valid for ambient temperatures < 80°C

Dimension	Tolerance
D_3	H7
D_2 (< 200 mm) D_2 (200 – 500 mm)	s6 r6
D_1 (before installation)	E7
D_1 (after installation) (1)	H9
B_1	Free size – medium
D_0	c8 / d8

Table 6.3.1

6.4 Installation by means of press-fitting

Press-fit is a universally applicable installation method for deva.glide® bushings. deva.glide® radial sliding bearings can be mounted with a screw press or a hydraulic press. It is important to ensure that the mounting force is applied centrically. See also Figure 6.4.1 below, installation by press-fitting. As installation support it is recommended to use a press-in mandrel. Driving in with a hammer is not permitted, as it can damage the deva.glide® material.

Installation description

- A light oiling of the housing bore supports the installation and protects the components from seizure
- Insert the press-in mandrel into the bushing and position it on the housing bore
- The force must be applied evenly to the slide bearing via the press-in mandrel to avoid tilting

We would be pleased to provide you with further information and documentation relating to sliding bearing assembly. Please contact us!

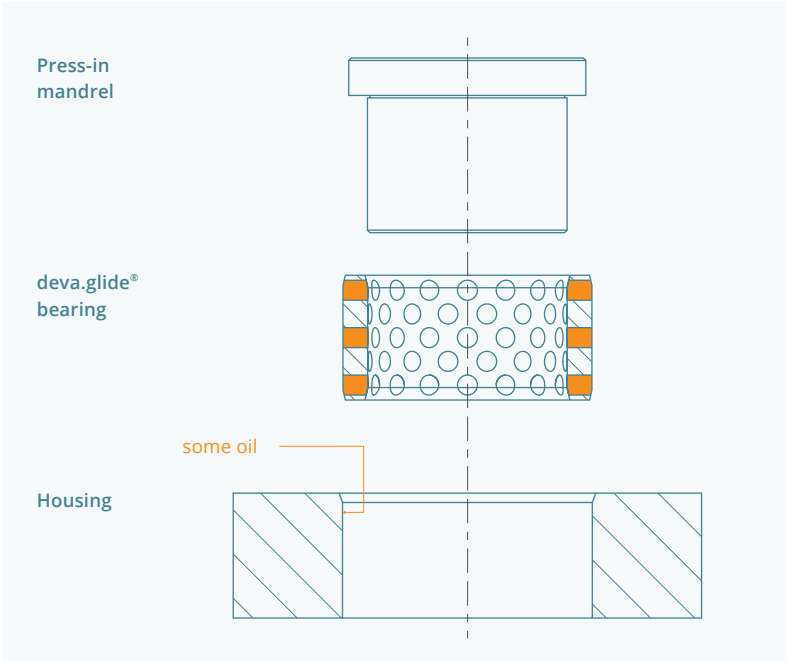


Figure 6.4.1

(1) Bore in the sliding bearing after pressing into the bearing housing. Experience shows that the bore of the sliding bearing narrows from E7 to H9 when the bearing is pressed into the bearing housing

6.5 Installation by supercooling

deva.glide® bearings may also be subcooled as an assembly aid. Cooling media are dry ice and liquid nitrogen. Both substances are classified as hazardous substances. Due to the different material pairings (bronze and plugs), depending on the selected overlap between bearing and housing, subcooling with liquid nitrogen is recommended for D_1 < 200 mm and subcooling with dry ice for bearings D_1 > 200 mm. More detailed installation instructions are available on request.

Determination of α_1

α_1 (for dry ice) = 0.83 × α

α_1 (for nitrogen) = 0.77 × α

In order to fundamentally check whether subcooling the bearing is the correct installation method, the shrinkage dimension (s) must be calculated. It is calculated according to the following equation:

$$s = n \times \alpha_1 \times \Delta T \times D$$

Shrink dimensions

The following diagram serves for a quick estimation of the shrinkage depending on the cooling medium. The curves apply to a coefficient of thermal expansion of α= 16.5 × 10^{-6} 1/K

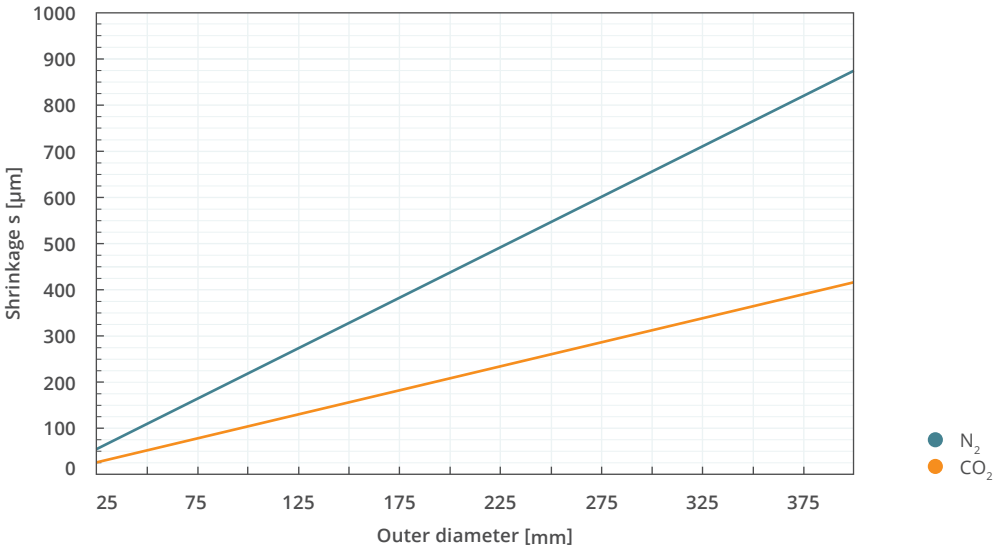


Diagram 6.5.1

The supercooled parts can be inserted into the mounting hole without any effort. Especially in the case of large parts, make sure that the parts to be mounted are neatly aligned during assembly.

Dry ice and liquid nitrogen are classified as hazardous substances. In this context, we expressly point out the handling of hazardous materials.

ΔT = Temperature difference [K]
s = Shrinkage dimension [mm]
D = Outer diameter of the bearing [mm]
α = Coefficient of linear thermal expansion [1/K]
α_1 = Linear coefficient of thermal expansion for low temperature [1/K]
n = 0.8 is an empirical value for the consideration of heat transfer and the heating of the bearing during handling

deva.glide® sliding bearings

Spherical sliding bearing

Fixed bearing

You can find further information in our separate manual for spherical sliding bearings with information on standard as well as special bearings.

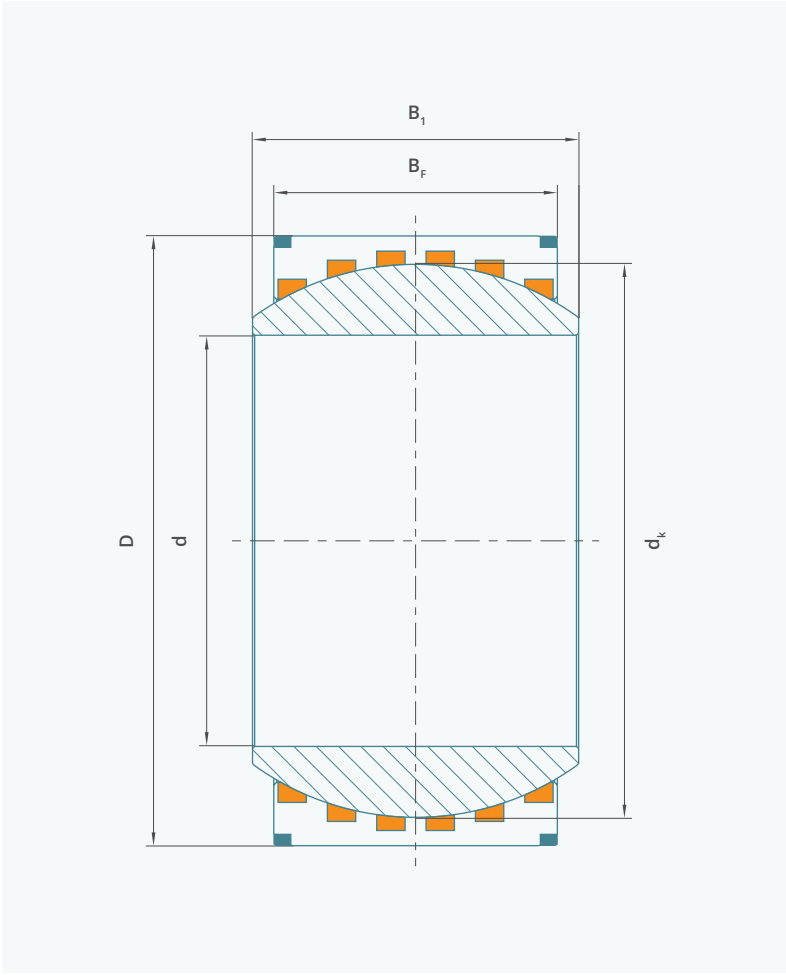


Figure 7.1.1

Recommended dimensions deva.glide® fixed spherical bearing

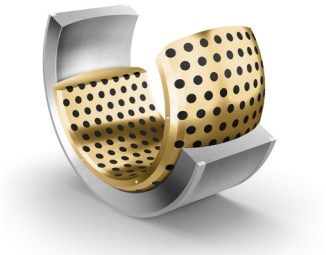
d	D	d_k	B_1	B_F
100	150	130	70	55
110	160	140	70	55
120	180	160	85	70
140	210	180	90	70
160	230	200	105	80
180	260	225	105	80
200	290	250	130	100
220	320	275	135	100
240	340	300	140	100
260	370	325	150	110
280	400	350	155	120
300	430	375	165	120
320	440	380	160	135
340	460	400	160	135
360	480	420	160	135
380	520	450	190	160
400	540	470	190	160
420	560	490	190	160
440	600	520	218	185
460	620	540	218	185
480	650	565	230	185
500	670	585	230	195
530	710	620	243	205
560	750	655	258	215
600	800	700	272	230
630	850	740	300	260
670	900	785	308	260
710	950	830	325	275
750	1000	875	335	280
800	1060	930	355	300
850	1120	985	365	310
900	1180	1040	375	320
950	1250	1100	400	340
1000	1320	1160	438	370

Table 7.1.1

B_1 – Bearing width
B_F – Outer ring width
d – Inner diameter
D – Outer diameter
d_k – Ball diameter

Floating bearing

Further information can be found in our separate manual for spherical sliding bearings with information on standard as well as special bearings.



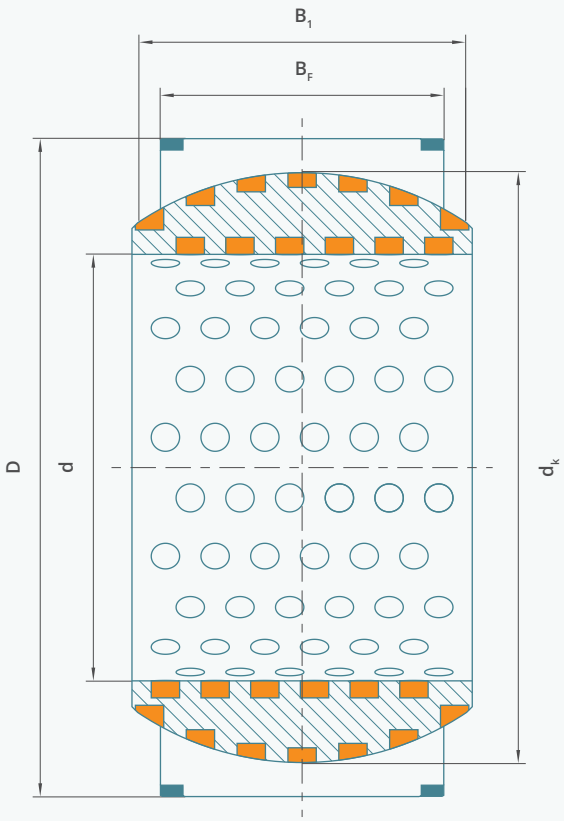


Figure 7.1.2

Recommended dimensions deva.glide® self-aligning bearing

d	D	d_k	B_1	B_F
100	160	140	70	55
110	180	160	85	70
120	210	180	90	70
140	230	200	105	80
160	260	225	105	80
180	290	250	130	100
200	320	275	135	100
220	340	300	140	100
240	370	325	150	110
260	400	350	155	120
280	430	375	165	120
300	440	380	160	135
320	460	400	160	135
340	480	420	160	135
360	520	450	190	160
380	540	470	190	160
400	560	490	190	160
420	600	520	218	185
440	620	540	218	185
460	650	565	230	195
480	670	585	230	195
500	710	620	243	205
530	750	655	258	215
560	800	700	272	230
600	850	740	300	260
630	900	785	308	260
670	950	830	325	275
710	1000	875	335	280
750	1060	930	355	300
800	1120	985	365	310
850	1180	1040	375	320
900	1250	1100	400	340
950	1320	1160	438	370

Table 7.1.2

B_1 – Bearing width
B_F – Outer ring width

d – Inner diameter
D – Outer diameter

d_k – Ball diameter

deva.glide® sliding bearings

Slide plates and Thrust washers

Flat and shaped parts

deva.glide® can basically be produced in almost any machinable form (plate, angle piece, element with radii, ...). All dimensions on request.

8.1 Thrust washers

The standard designs start at D_5 > 150 mm. Diameters D_5 ≤ 150 mm are special designs. In this size range, flanged sliding bearings are advisable if a radial bearing is planned.

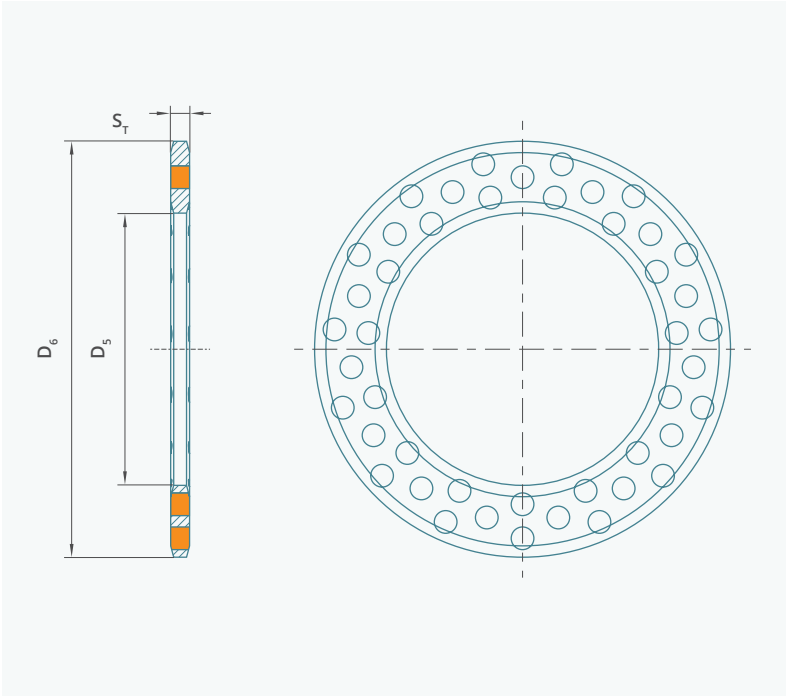


Figure 8.2.1

D_5 – Inner diameter
D_6 – Outer diameter
S_T – Thickness

Recommended dimensions deva.glide® Thrust washers

D_5	D_6	S_T
On demand	80	5.0
	85	5.0
	90	7.5
	95	7.5
	100	7.5
	105	7.5
	110	7.5
	115	7.5
	120	7.5
	125	10.0
	140	10.0
	150	10.0
	160	10.0
	180	10.0
150	190	10.0
185	230	12.5
205	250	12.5
230	275	12.5
255	300	14.0
285	340	15.0
305	360	16.0
355	420	17.5
405	480	20.0
455	530	22.5
510	600	25.0
560	650	25.0
610	720	25.0
660	780	25.0
710	840	25.0
760	900	25.0
810	960	25.0
860	1020	25.0
910	1080	25.0
960	1140	25.0
1010	1200	25.0
1210	1440	25.0

Table 6.2.1

8.2 Mounting of thrust washers

Thrust washers should be centered on the outside diameter, e.g. in a undercut for seating. The inner diameter of the thrust washer must not touch the shaft in order to prevent unintentional wear and thus chip accumulation.If it is not possible to create undercuts in the housing, thrust washers can also be fastened with holding pins or screws.

For attention

- Locate retaining pins deep enough from the tread so that there is no contact until the wear limit is reached
- Make countersinks for retaining screws deep enough so that there is no contact up to the wear limit
- Make sure that the inner diameter of the disc does not touch the shaft after assembly

Attachment of deva.glide® thrust washers

Retaining pin

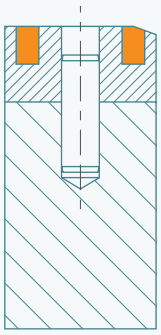


Figure 8.2.1

Screws

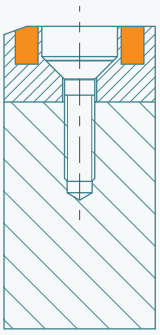
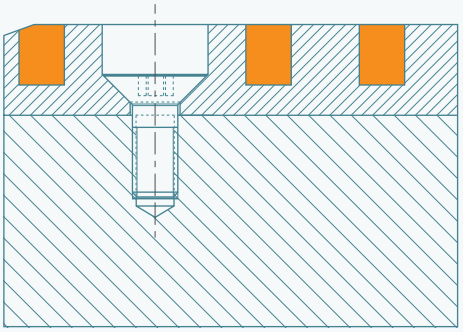


Figure 8.2.2

8.3 Fastening of sliding plates

Countersunk screws



Mechanical fastening by form fit

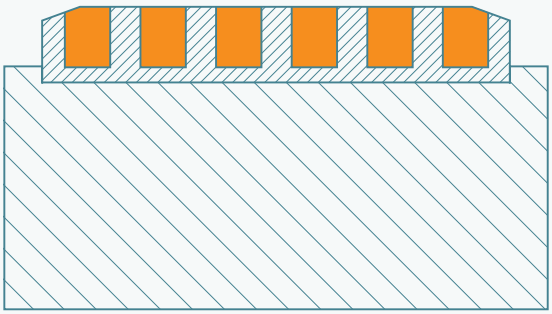


Figure 8.2.3

deva.glide® sliding bearings

Chemical resistance

deva.glide® and various media

Table 9.1.1 provides information on the chemical resistance of deva.glide® alloys. It is recommended to prove the actual behavior of a selected deva.glide® alloy by means of in-service tests.

Medium / chemical substance	Concentration [%]	Temperature [°C]	deva.glide® alloys dg01	dg03	dg04	dg05	dg06
Strong acids							
Hydrochloric acid	5	20	×	×	×	×	×
Hydrofluoric acid	5	20	○	○	×	○	○
Nitric acid	5	20	×	×	×	×	×
Sulphuric acid	5	20	○	●	×	×	●
Phosphoric acid	5	20	○	●	×	●	●
Weak acids							
Acetic acid	5	20	×	●	×	●	●
Formic acid	5	20	×	●	×	●	●
Boric acid	5	20	×	●	×	●	●
Citric acid	5	20	×	●	×	●	●
Bases							
Ammonia	10	20	×	×	×	×	×
Potassium hydroxide	5	20	○	●	○	●	●
Sodium hydroxide	5	20	○	●	○	●	●
Solvent							
Acetone		20	○	●	○	●	●
Carbon tetrachloride		20	○	●	○	●	●
Ethyl alcohol		20	○	●	○	●	●
Ethyl acetate		20	○	●	○	●	●
Ethyl chloride		20	○	●	○	●	●
Glycerine		20	○	●	○	●	●
Salts							
Ammonium nitrate			×	×	×	×	×
Calcium chloride			●	●	●	●	●
Magnesium chloride			●	●	●	○	●
Magnesium sulfate			●	●	●	○	●
Sodium chloride			●	●	●	●	●
Sodium nitrate			●	●	●	●	●
Zinc chloride			×	●	×	×	●
Zinc sulfate			○	●	○	●	●

Table 9.1.1

Medium / chemical substance	Concentration [%]	Temperature [°C]	deva.glide® alloys dg01	dg03	dg04	dg05	dg06
Gases							
Ammonia gas			○	○	○	○	○
Chlorine gas			×	×	×	×	×
Carbon dioxide			●	●	○	●	●
Fluorine			×	×	×	×	×
Sulphur dioxide			○	●	×	●	●
Hydrogen sulfide			○	○	○	○	○
Nitrogen			○	●	×	●	●
Hydrogen			○	●	×	●	●
Lubricants / Fuels							
Paraffin		20	●	●	●	●	●
Petrol		20	●	●	●	●	●
Heating oil		20	●	●	●	●	●
Diesel		20	●	●	●	●	●
Mineral oil		70	●	●	●	●	●
HFA ISO46 Oil Water Emulsion		70	●	●	●	●	●
HFC Water Ethylene		70	●	●	●	●	●
HFD Phosphate ester		70	●	●	●	●	●
Other							
Water		20	●	●	○	●	●
Seawater		20	○	●	×	●	●
Resin			●	●	○	●	●
Hydrocarbon			●	●	○	●	●

Table 9.1.1

● Resistant

○ Conditionally resistant, depending on environmental conditions

× Not recommended

/ No data available

deva.glide® sliding bearings

Design examples and applications

deva.glide® Calotte

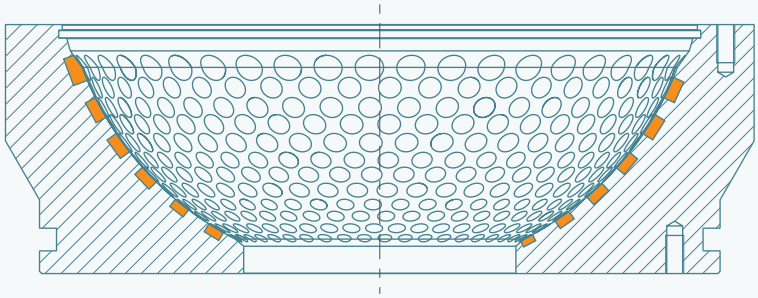


Figure 11.1.1

deva.glide® Bone bearing

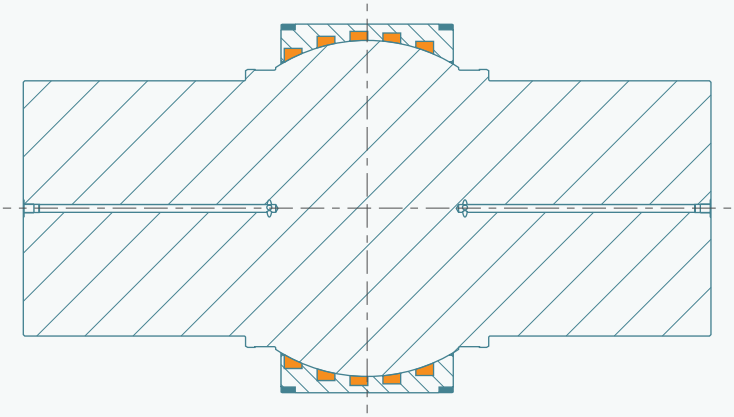
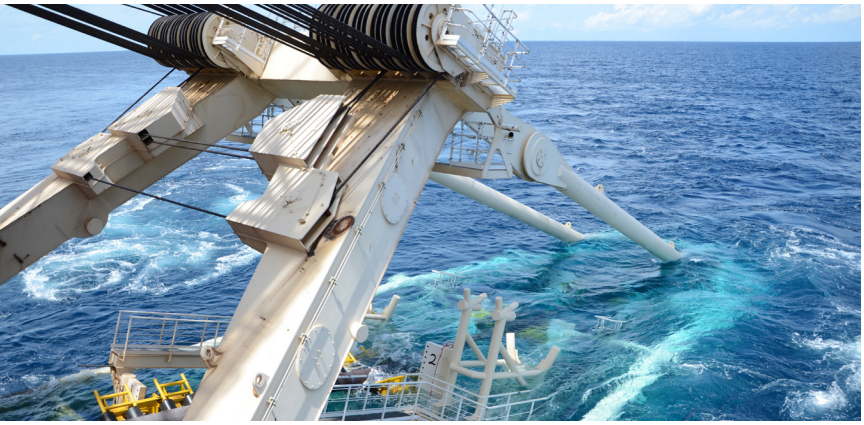


Figure 11.1.2



deva.glide® Window socket

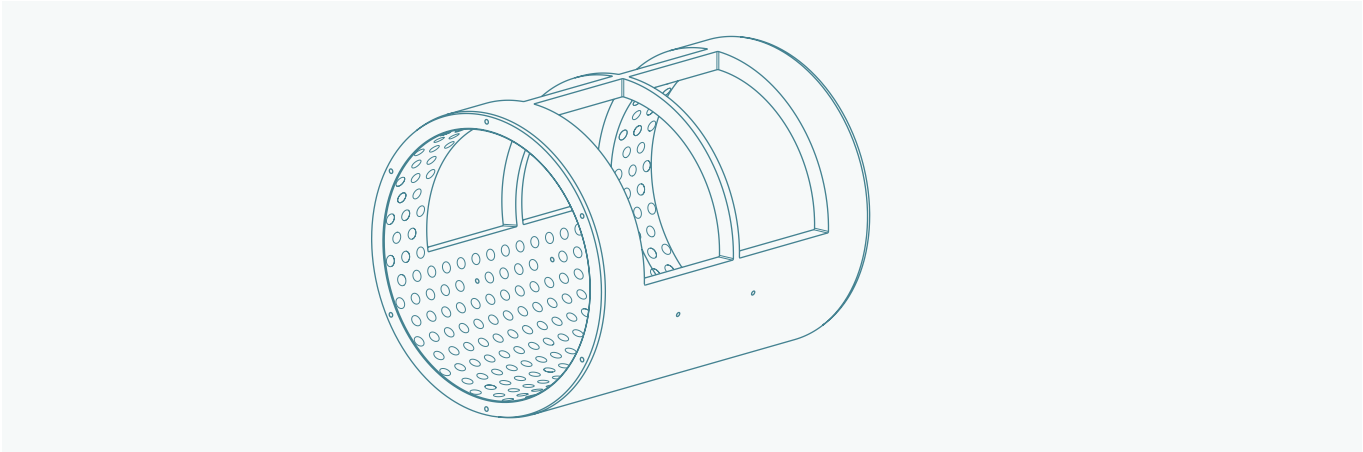


Figure 11.1.3

deva.glide® Half shell

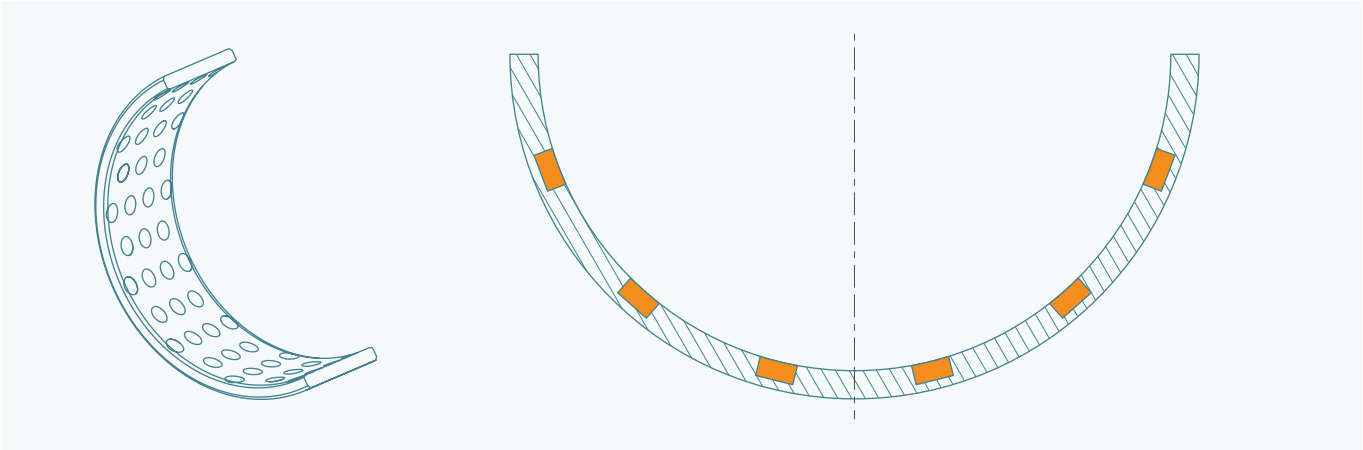


Figure 11.1.4

deva.glide® sliding bearings

Data for the design of DEVA® sliding bearings

Personal data

Company name

Project number

Address

Contact person

Phone

Fax

Mobile phone

Email

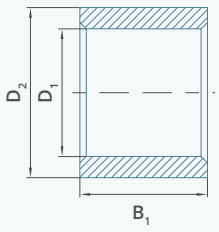
Description of the application

- ○ New design
- ○ Existing design
- ○ Steel industry
- ○ Wind energy
- ○ Rubber and plastics industry
- ○ Steam and Gas Turbines
- ○ Offshore and Marine
- ○ Heavy-duty Vehicles
- ○ Railway
- ○ Hydro Power
- ○ Other

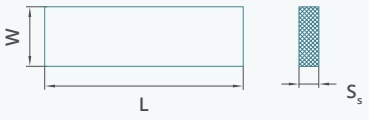
Bearing type

- ○ Shaft rotates
- ○ Bearing rotates
- ○ Angular motion
- ○ Axial motion

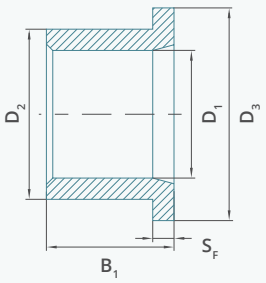
○ Bushing



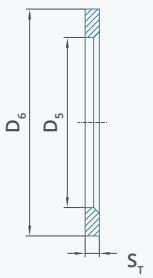
○ Sliding plate



○ Flanged bushing bearing

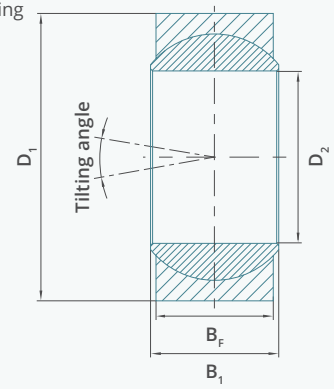


○ Thrust washer



○ Spherical bearing

- ○ Floating bearing
- ○ Fixed bearing



	Pos. 1	Pos. 2	Pos. 3
Quantity			
Dimensions [mm]			
Inner diameter D_1 (D_5)			
Outer diameter D_2 (D_6)			
Bearing width B_1			
Outer ring width B_F			
Flange outer diameter D_3			
Flange thickness S_F			
Wall thickness S_T			
Plate length L			
Panel width W			
Plate thickness S_S			
Load			
Static	○	○	○
Dynamic	○	○	○
Alternating	○	○	○
Shock loads	○	○	○
Radial load **[kN]**			
Axial load **[kN]**			
Surface pressure			
Radial **[MPa]**			
Axial **[MPa]**			
Mating material			
Material no./type			
Hardness **[HB/HRC]**			
Roughness R_a **[µm]**			
Housing material			
Material no./type			

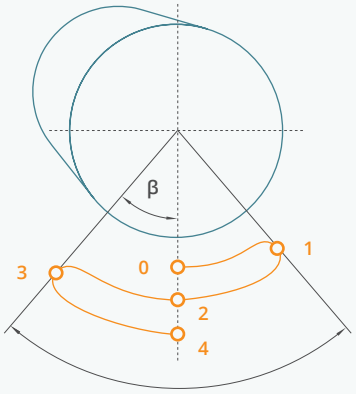
	Pos. 1	Pos. 2	Pos. 3
Lubrication			
Dry run	○	○	○
Permanent lubrication	○	○	○
Medium lubrication	○	○	○
Medium			
Lubricant			
Initial lubrication	○	○	○
Hydrodynamic lubrication	○	○	○
Dynamic viscosity			
Move			
Speed **[rpm]**			
Sliding speed **[m/s]**			
Stroke length **[mm]**			
Double strokes **[/min]**			
Rotation angle **[°]**			
Frequency **[n/min]**			
Tilt angle (spherical bearing) **[°]**			
Operating time			
Continuous operation			
Intermittent operation			
Duty operation **[%/h]**			
Days / Year			
Frictional distance **[km]**			
Fits/Tolerances			
Shaft			
Bearing housing			
Environmental conditions			
Temperature at bearing			
Contact medium			
Other influences			
Lifetime			
Desired operating time **[h]**			
Permissible wear **[mm]**			

Comments

- Certificate required (e.g., 3.1)
- Acceptance procedure (e.g., 3.2)

Angle
The angle β is defined by the movement from the middle position to one end point.

Cycle
A cycle is four times the angle β. The calculation of the expected friction distance is based on this.



Example
Bushing D_1 = 50 mm and angle β = 5°
1 cycle shows a friction distance of 8.73 mm

Disclaimer

The present technical documentation has been prepared with care and all the information verified for its correctness. No liability, however, can be accepted for any incorrect or incomplete information. The data given in the documentation are intended as an aid for assessing the suitability of the material. They are derived from our own research as well as generally accessible publications. The sliding friction and wear values stated by us or appearing in catalogues and other technical documentation do not constitute a guarantee of the specified properties. They have been determined in our test facilities under conditions that do not necessarily reflect the actual application of our products and their service environment or permit comprehensive simulation in relation to them.

We provide guarantees only after written agreement of the test procedures and parameters and of all the relevant characteristics which the product is required to have. All transactions conducted by DEVA® are subject, in principle, to our terms of sale and delivery as indicated in our offers, product brochures and price lists. Copies are available upon request. Our products are subject to a constant process of development. DEVA® reserves the right to amend the specification or improve the technological data without prior notice.

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