HANDBOOK

ceramet

CER.BM

Self-lubricating, maintenance free
sliding material, bimetallic composite material

ceramet.com.pl

Contents

Introduction

WHO WE ARE

Ceramet, trusted manufacturer of plain bearings, bushings, sliding plates and wear parts made of sintered self–lubricating material containing graphite as solid lubricant uniformly distributed throughout the metallic matrix. The companys' know-how is drawn from more than 55 years of experience. Ceramet, a well-known specialty powder metallurgy manufacturer, was founded in 1965 in Poland.

Integrated manufacturing and supply chain at their best

Our supply chain is completely integrated. Starting from own powder metallurgy manufacturing featuring a high efficiency state-of-the-art continuous sintering line the process is followed by an advanced CNC machining plant. Battery of computer controlled milling machines, lathes, grinding centers, drilling and bending machines allow for variability and custom designed production at its best.

Exclusively focused on metallic sintered parts

As unique as we are, less than a handful of manufacturers may be proud of finding themselves exclusively in the business of metallic sintered self-lubricating parts. Our focused approach is providing us with competitive edge offering in-depth knowledge. Expertise and know-how is put in service of our customers

recruiting from various parts of world and nearly every industry including wind and hydropower, steel, tire and rubber, food and beverage, oil and gas, marine, aerospace, and many more.

WHY CHOOSE US

Custom made is our standard

We understand that your bearing requirements are special. Our team supports you with customer specific designs and a wide range of materials making sure we provide the best technical and commercial solution.

Fitting and installation facility

Besides our own metal compounds sintering and machining plants we run fitting and installation facility. When replacement parts need to be put in place proper tooling may not always be available. We are here to help with a range of inhouse presses and professional tooling extending lifetime of your critical parts and machines and maintaining warranty.

Easy to deal with

Customer first – We provide a personal and easy way of communication from initial inquiry to after sales service.
Put us to the test.

Reliable partner

Choosing the right partner for your bearing needs is a matter of trust. Consistency in product and service quality, loyalty and respect are our core values. We strive to be long term partners for our customers. Building up on decades of successful development we are here to keep providing reliable tribological solutions to the industry for the years to come.

Unique Know-How, Highest Quality Standards

We deploy our unique powder metallurgy recipes resulting from 55+ years of primary manufacturing experience and thousands of successful applications. Our know-how has been globally proven and verified in countless demanding industrial utilizations. Customer projects are carefully reviewed and evaluated based on our rigorous in house testing and control processes. We can therefore guarantee that they will pass our high internal quality standards and will be fully in accordance with our customers´ needs and specifications.

Application Engineering Support

Our team of dedicated Application Engineers is ready to assist, consult and generate lifecycle predictions. Our engineering support covers replacing existing bearings, technical upgrades, eliminating additional lubrication, or replacing plastic or roller bearings to achieve additional value for our customers. No commitment is required. Feel free to consult our application engineers.

Materials

Ceramet Bimetal / CER.BM general characteristics

CER.BM is a maintenance free, self-lubricating high performance bearing material. It is based on a steel or bronze supporting layer with a sliding layer of sintered metal, produced by a special sintering process. The sliding layer is composed of a metallic matrix of tin bronze with fine and homogeneously embedded solid lubricants. An extra solid lubricant film, the so-called running-in film, can be applied in advance to help the formation of a self-lubricating film onto the working surface.

Besides the equal-to-CER.BM self-lubricating properties the CER.BM provides further benefits, such as improved mechanical characteristics and reduced cost thanks to the supporting base structure.

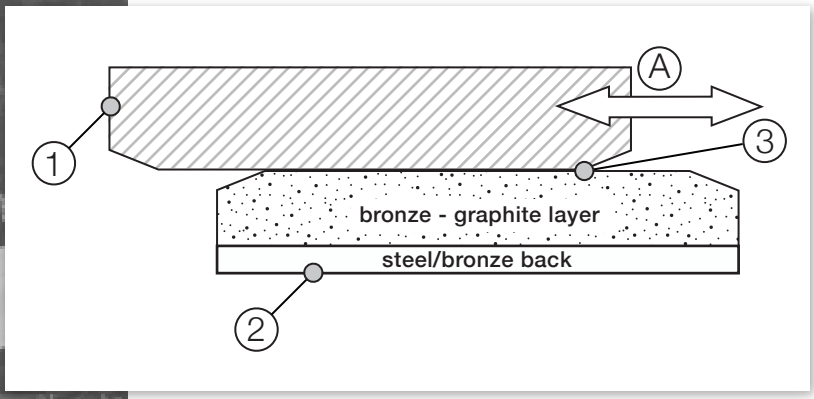
Advantages of CER.BM:

- The concentrated micro dispersion of graphite throughout the metallic matrix ensures consistent lubricating properties over the entire wear area of the part
- Excellent tribological behavior in dry or wet environment with low
- coefficient of friction and low wear
- Insignificant stick-slip effects
- High static and dynamic load capacity
- Can withstand high edge pressure
- Suitable for micro-movements
- Useable in a wide temperature range from -150°C to 280°C
- High corrosion resistance against many chemicals, dependent on alloy selection

- Does not absorb water, has optimal dimensional stability and shows no swelling in water environment
- Can be used in radioactive environments
- No electrostatic charging, electrically conductive
- Useable in dusty / abrasive environments
- External lubrication typically not necessary, but permissible
- Machinable
- Can be used in hydrodynamic applications with water lubrication or as back-up system
- Can be used in sea water, dependent on alloy selection
- All types of movement are permissible, for example rotational, translational and oscillating, or combinations of them
- Can be installed by press-fitting or by super-cooling

The mechanism of solid lubrication

The self-lube parts are sliding against their mating parts with linear or rotational motion. The solid lubricant is drawn out of the CER.BM matrix covering both surfaces with a thin film. As the solid lubricant film is being worn out, it is continuously replenished from the metallic layer throughout the entire life cycle of the product.



A - direction of motion
1 - mating part
2 - CER.BM bimetallic sliding part
3 - Film of continuously released solid lubricant

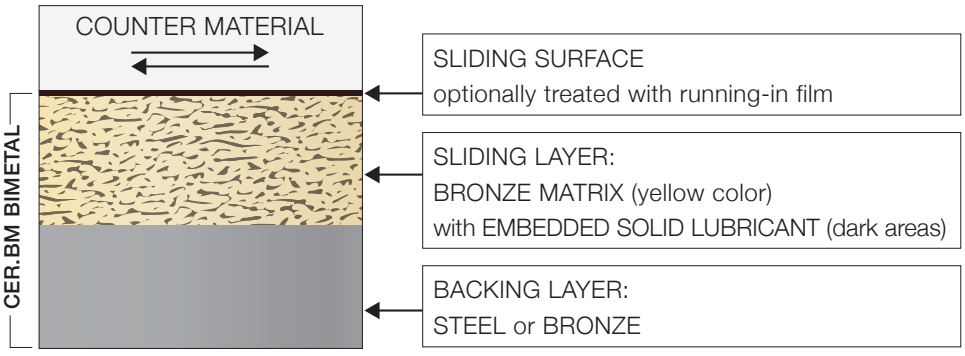
Structure, physical & mechanical properties of materials

The material is a composite bimetal, where:

- the sliding layer is composed of tin bronze with uniformly dispersed embedded graphite
- the supporting/backing layer can be made of:
  - mild steel
  - corrosion resistant steel
  - sea water resistant steel
  - bronze
- an optional layer of pure graphite can be sprayed onto the sliding layer (running-in film)

Each application and environmental conditions require specific material selection.

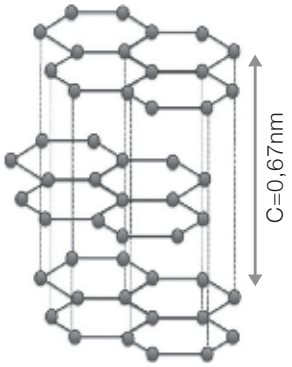
CER.BM structure



Graphite and its tribological properties

Graphite is an excellent solid lubricant. It has a lamellar structure, so layers move easily thanks to the low shear stress. Thus achieving a low coefficient of friction.

Low shear stress in lamellar planes results in easy release of graphite for self-lubrication purpose. When the CER.BM sliding material skids on the mating surface the solid lubricant is released forming an interface lubrication. The film is continuously renewed when more graphite permeates to the surface (heal-up effect).



Different grades of graphite and particle size fractions are available. Bearing properties are strongly dependent on type of graphite used.

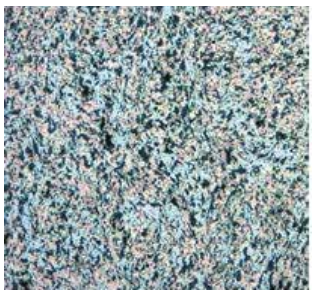
Properties	Graphite
Density [g/cm³]	2.25
Coefficient of friction in air	0.10 – 0.18
Operating temperature range	-150°C – 280°C
Crystalline structure	hexagonal
Performance in air	very good
Performance in water	very good
Performance in vacuum	not recommended
Chemical resistance	very good
Corrosion resistance	good
Radioresistance	very good

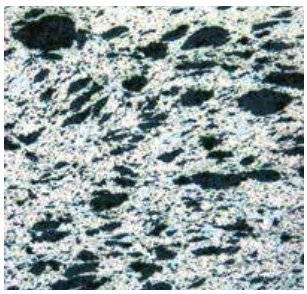
The following pictures show the distribution of solid lubricants within the metallic matrix, regardless of the type of metal.

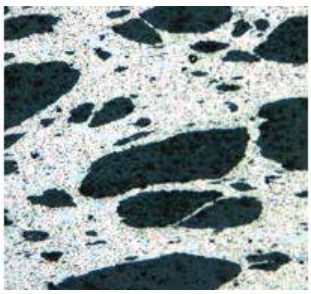
Three different solid lubricant particle size fractions are available. The bearing properties are strongly dependent on the type of solid lubricant used.

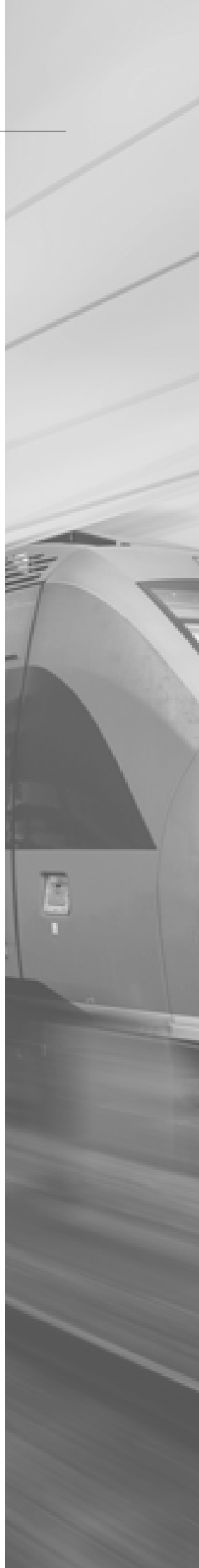
Solid lubricants with lamellar structure and low shear strength between the single molecular layers are embedded in the metallic matrix with preload. When the CER.BM sliding material skids on the mating surface the solid lubricant is released forming an interface lubrication.

Micro-wear of bearing surface ensures that new solid lubricant is continuously released renewing the active film (heal-up effect). Therefore such system becomes self-lubricating maintenance-free.









Compound selection

For the appropriate metallic matrix selection, knowing the operating conditions is essential. These are:

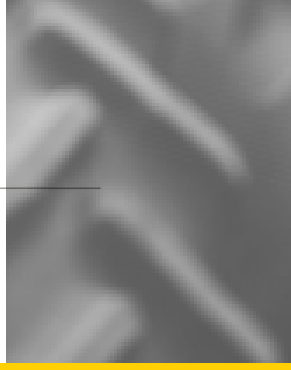
- temperature
- corrosiveness
- sliding speed
- load

As a result, the optimum metallic matrix as well as the type, content and structure will be specified.

Refer to our application engineering team for selection of the right compound for each individual application and specific working conditions.

Typical applications for CER.BM alloys

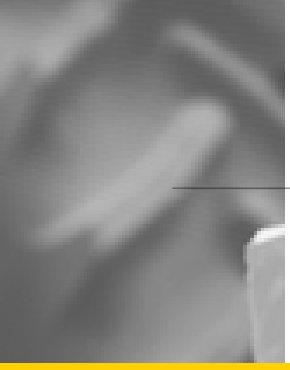
Compound	Application	Characteristics
CER.BM 601	General, tire and iron-steel-aluminum industry	Standard material for general engineering
CER.BM 301	General	Standard material for general engineering
CER.BM 417,411	Water turbines, food and beverage	High sliding speed
CER.BM 421,441	Injection moulding, heavy duty	High abrassion resistance



Physical & mechanical properties

COMPOUND NAME The same base compound, with running in film	**CER.BM 601** CER.BM 602	**CER.BM 301** CER.BM 302
STEEL CARRIER	low carbon	stainless
Linear coeff. of thermal exp. [10^{-6} /K]	12	16
SLIDING LAYER, MECHANICAL PROPERTIES		
Compression strength [MPa]	320	320
Hardness [HBW 2,5/31, 25/15], minimum	40	40
Density [g/cm^3]	6.7	6.7
Type of solid lubricant	C	C
APPLICATION DATA		
Max. stat. load [MPa]	260	320
Max. dyn. load [MPa]	150	150
Max. sliding speed, dry [m/s]	0.3	0.3
Max. pv dry [N/mm^2 x m/s]	0.5	0.5
Typical coefficient of friction, dry	0.1 - 0.2	0.1 - 0.2
Typical coefficient of friction, wet	0.1 - 0.15	0.1 - 0.15
Service temperature min/max [°C]	-150/280	-150/280
Min. hardness counter material [HB]	180	180
Recommended surface roughness of counter material Ra [µm]	0.2 - 0.8	0.2 - 0.8
TYPICAL APPLICATIONS	General mechanical engineering, tire molds and containers	General mechanical engineering

Important remark: the listed material properties, in particular friction coefficients, are no assured properties. They are to be used only as guidelines for selection of materials.



COMPOUND NAME The same base compound, with running in film	**CER.BM 417** CER.BM 418	**CER.BM 411** CER.BM 412	**CER.BM 421** CER.BM 422	**CER.BM 441** CER.BM 442
STEEL CARRIER	low carbon	stainless	low carbon	stainless
Linear coeff. of thermal exp. [10^{-6} /K]	12	16	12	16
SLIDING LAYER, MECHANICAL PROPERTIES				
Compression strength [MPa]	320	320	300	300
Hardness [HBW 2,5/31, 25/15], min.	40	40	40	40
Density [g/cm^3]	6.3	6.3	6.2	6.2
Type of solid lubricant	C	C	C	C
APPLICATION DATA				
Max. stat. load [MPa]	260	290	260	290
Max. dyn. load [MPa]	80	80	100	100
Max. sliding speed, dry [m/s]	0.5	0.5	0.5	0.5
Max. pv dry [N/mm^2 x m/s]	1	1	1	1
Typical coefficient of friction, dry	0.1 - 0.2	0.1 - 0.2	0.1 - 0.2	0.1 - 0.2
Typical coefficient of friction, wet	0.1 - 0.15	0.1 - 0.15	0.1 - 0.15	0.1 - 0.15
Service temperature min/max [°C]	-150/280	-150/280	-150/280	-150/280
Min. hardness counter material [HB]	180	180	250	250
Recommended surface roughness of counter material Ra [µm]	0.2 - 0.8	0.2 - 0.8	0.2 - 0.8	0.2 - 0.8
TYPICAL APPLICATIONS	General mechanical engineering	General mechanical engineering, water turbines	General mechanical engineering, injection molding presses	General mech. engineering, injection molding presses, water & wind turbines

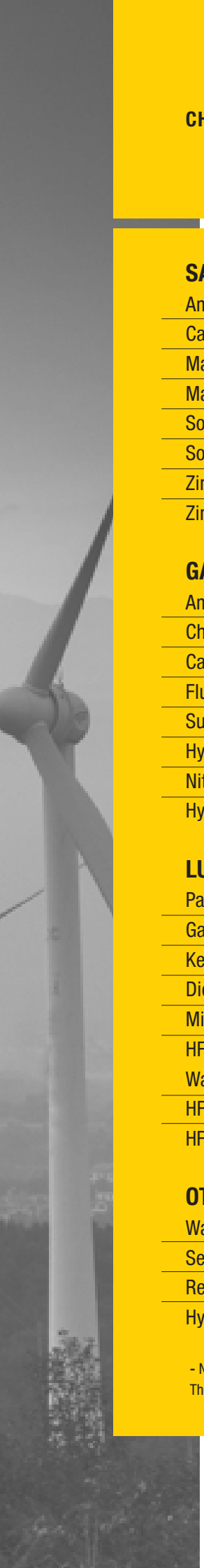
All our materials are lead free.

Chemical resistance

The following table provides an indication of the chemical resistance of CER.BM. It is recommended to test the chemical resistance in the actual environment.

CHEMICAL	concentration [%]	temperature [°C]	CER.BM carbon steel backing	CER.BM with stainless steel backing
STRONG ACIDS				
Hydrochloric Acid	5	20	-	-
Hydrofluoric Acid	5	20	-	⊙
Nitric Acid	5	20	-	-
Sulphuric Acid	5	20	-	+
Phosporic 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	-	-
Sodium Hydoxide	5	20	-	+
Potassium Hydroxide	5	20	-	+
SOLVENTS				
Acetone		20	-	+
Carbon Tetrachloride		20	-	+
Ethanol		20	-	+
Ethyl Acetate		20	-	+
Ethyl Chloride		20	-	+
Glycerin		20	⊙	+

- Not resistant; + Resistant; ⊙ Conditionally resistant depending on temperature, O_2-concentration, concentrations etc.
The listed chemical properties are no assured properties. They provide a basis for estimating suitability for various applications.



CHEMICAL	temperature [°C]	CER.BM with unalloyed / carbon steel backing	CER.BM with stainless steel backing
SALTS			
Ammonium Nitrate		-	-
Calcium Chloride		-	+
Magnesium Chloride		-	+
Magnesium Sulphate		-	+
Sodium Chloride		-	+
Sodium Nitrate		-	+
Zinc Chloride		-	-
Zinc Sulfate		-	+
GASES			
Ammonia		-	⊙
Chlorine		-	-
Carbon Dioxide		-	+
Fluor		-	-
Sulphur Dioxide		-	+
Hydrogen Sulphide		-	⊙
Nitrogen		-	+
Hydrogen		-	+
LUBRICANTS & FUELS			
Paraffin	20	+	+
Gasolene	20	+	+
Kerosene	20	+	+
Diesel Fuel	20	+	+
Mineral Oil	70	+	+
HFA – ISO46 High Water Fluid	70	+	+
HFC – Water-Glycol	70	+	+
HFD – Phosphate Ester	70	+	+
OTHERS			
Water	20	-	+
Sea Water	20	-	+
Resin		+	+
Hydrocarbon		-	+

- Not resistant; + Resistant; ⊙ Conditionally resistant depending on temperature, O_2-concentration, concentrations etc.
The listed chemical properties are no assured properties. They provide a basis for estimating suitability for various applications.

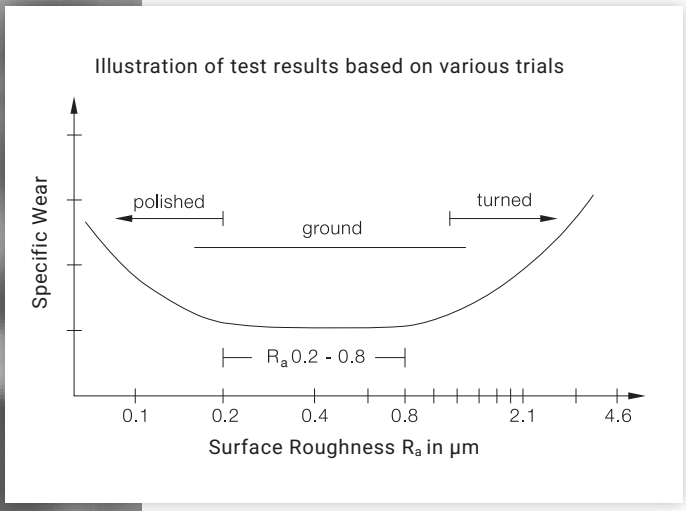
Mating Materials

Performance of bearings is directly dependent on the surface roughness and hardness, as well as the type and properties of the mating material. Stainless and carbon steel usually work very well as mating materials. Use of non-iron materials or application of special coatings need to be tested (e.g., chrome plating, plasma coating).

Dry running hardness of the counter material needs to be at least 180 HB. In case if conditional conventional lubrication, hardness of 130 HB can be accepted.

If abrasive particles are present 35 HRC minimum hardness is recommended.

MATERIAL NUMBER	DIN DESIGNATION	USA ANSI	UK BS970	FRANCE AFNOR
MATING MATERIALS FOR GENERAL APPLICATIONS				
1.0543	ZSt 60-2	Grade 65	55C	A60-2
1.0503	C45	1045	080M46	CC45
1.7225	42CrMo4	4140	708M40	42CD4
MATING MATERIALS FOR SEA WATER ENVIRONMENTS				
1.4460	X3CrNiMoN27-5-3	329	-	-
1.4462	X2CrNiMoN22-5-3	UNS531803	318513	Z3CND24-08
2.4856	Inconel 625	-	-	-
MATING MATERIALS FOR CORROSIVE ENVIRONMENTS				
1.4021	X20C13	420	420S37	Z20C13
1.4057	X17CuNi-16-2	431	431S29	Z15CN16.02
1.4112	X90CrMoV18	440B	-	Z70CV17
1.4122	X35CrMo17-1	-	-	-



Disadvantages of polished mating material:

- Lower hills and valleys on the surface
- Graphite cannot lock and fill the valleys
- Friction and wear increases
- High adhesive forces, shaft and bush stick together

Disadvantages of turned mating material:

- Hills and valleys of the surface are too deep
- Fill-gaps effect resulting in high wear rates

The best performance is achieved with ground mating material:

- Hills and valleys of the surface are in right shape to reach optimum conditions with low friction and wear. Refer to the above chart, the optimum surface roughness Ra is between 0.2 - 0.8 µm.

Running-in film

- Running-in film consists of a thin layer (of a typical thickness of 0.02 - 0.03 mm) of pure graphite applied onto the sliding surface of CER.BM parts, aiming at forming an initial transfer film on both CER.BM and mating surfaces. The thickness of the film is NOT to be considered in any thickness tolerance because it will be rapidly consumed during the running-in period.

CER.BM sliding plate

The same plate, with running-in film applied

Fits, clearance, installation

Specific load and the operational temperature are the basic factors defining operating clearance for dry running applications.

This operational clearance is necessary to assure optimum performance. Self-lubricated, dry running sliding bearings commonly require higher clearance compared to externally lubricated bearings.

If the bushing inner diameter has to be manufactured with finished size, the inner diameter of bush reduction by pressing it into the housing needs to be taken into account. The following table shows recommendations and examples for different operationing conditions.

It is essential to maintain optimum fits and clearances, for the best performance of our materials.

Installation of CER.BM bushings should be carried out with interference fit between outer diameter of bush and the inner diameter of the housing. CER.BM bearings have to be pressed into a housing by screw press, hydraulic press or press-fit mandrel. Tapping or driving into place is not recommended. Hitting the bearing, for example by a hammer, will cause damage.

	Recommendations for housing
Tolerance of housing inner diameter	H7
Max. recommended surface roughness Ra	3,2 µm
Chamfers (for easier mounting)	20° – 40°

To achieve minimum tolerances of inner diameter of CER.BM bushings after mounting (IT7 or better), final machining should take place in mounted condition. CER.BM bushings are optionally supplied with machining allowance. When using running-in film, it has to be applied after finishing.

Recommended fits and tolerances

BUSH		SHAFT	
inner diameter	tolerance class excl. running-in film	Standard applications	Precision applications
[mm]	Installed state	Tolerance class	
< 20	H9	d7	e7
> 20	H8 / H9	d7	e7
> 45	H8 / H9	d7	e7
> 180	H8 / H9	d7	e7

Installation of CER.BM cylindrical bearings

- Radial bearings should be pressed into the housing using a hydraulic or screw press together with pressing tools as shown in the picture on the next page
- Light oiling of the inside of the housing bore can ease the bearing assembly
- The press-in force has to be applied evenly
- Installation by hammer will damage the bearing and is not permitted. The bearing will deform, reducing the bore by an amount equal to a part of the measure of interference with the housing. This has been considered for recommending tolerances.

Recommended tolerances

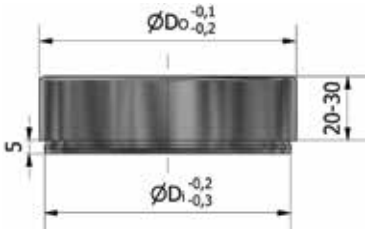
Housing diameter Dh	H7
Shaft diameter Ds	c7, d7, e7
Bearing inner diameter Di	after installation: H8 (Precision* >20 mm) H9 (standard)

*for temperatures up to 100°C. For temperatures above 100°C or special tolerances, please contact Glebus.

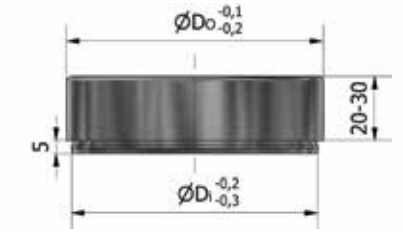
Installation of cylindrical bearings dia < 550mm by press fitting

Installation of
H9 standard bearings
H8 precision bearings 180 ≤ Di <500mm
Bearings with machining allowance

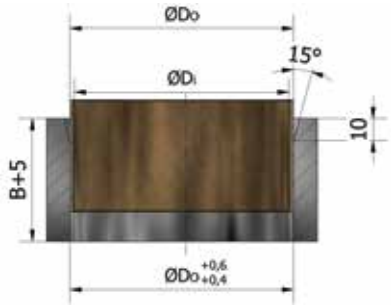
PRESS TOOL



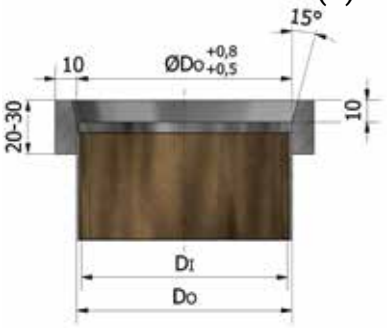
PRESS TOOL note (a)



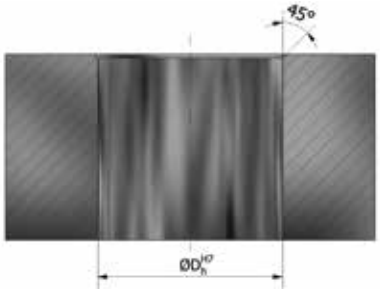
GUIDE RING



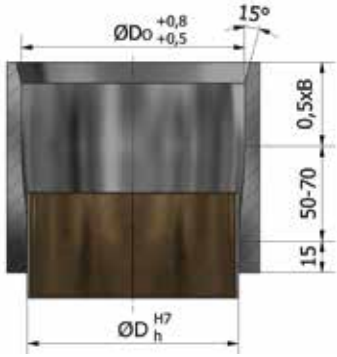
SUPPORT RING note (b)



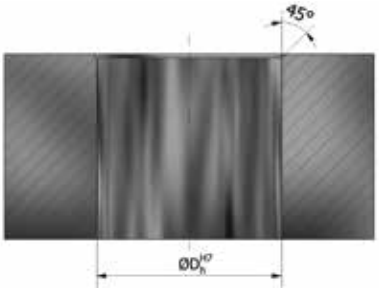
HOUSING BORE



GUIDE RING note (c)



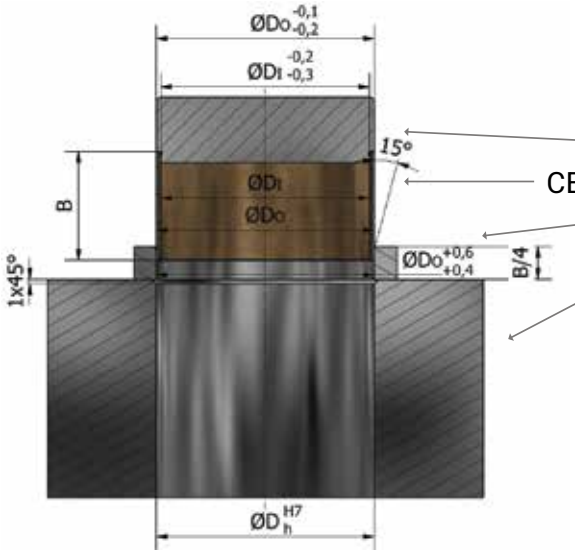
HOUSING BORE note (d)



$ØD_o$ = bearing OD
$ØD_i$ = bearing ID
B = bearing height
$ØD_h$ = housing ID

Notes:
(a) For standard and precision bearings, D_i should be reduced accordingly if with machining allowance
(b) Only for long bearings where B / OD > 2
(c) Made of cast iron or carbon steel; for regular use to be hard steel
(d) Slight oiling is recommended

Installation of CER.BM plain bearings dia > 550 mm by press fitting

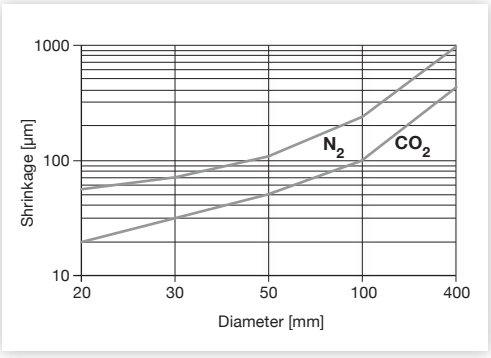


$ØD_o$ = bearing OD
$ØD_i$ = bearing ID
B = bearing height
$ØD_h$ = housing ID
NOTE: slight oiling is recommended

Installation by supercooling

Supercooling is permitted only for bronze-based materials. Supercooling of other materials may result in undesired microstructural changes.
Use of liquid nitrogen or solid carbon dioxide (dry ice) is recommended.
Shrinkage can be determined by the following formula:

$$s = 0.8 \times a_1 \times \Delta T \times D_2$$



s shrinkage [µm]
ΔT temperature difference [°C] or [K]
a_1 linear coeff. of thermal expansion [1/K]
D_2 outer diameter

Use caution during supercooling. Use of cooling box, covered with polystyrene, approx. 30 mm thick is recommended.
A top cover prevents loss of cooling and leads to faster cooling of the part. Cooling time depends on size and should take between 0.5 and 2 hours. Supercooled bushes can be easily installed into the housing without using excessive force.

Fixation of CER.BM sliding plates using countersunk screws

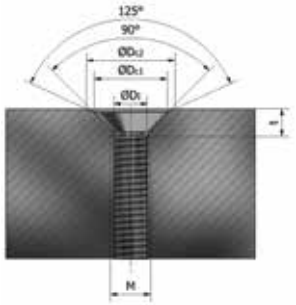
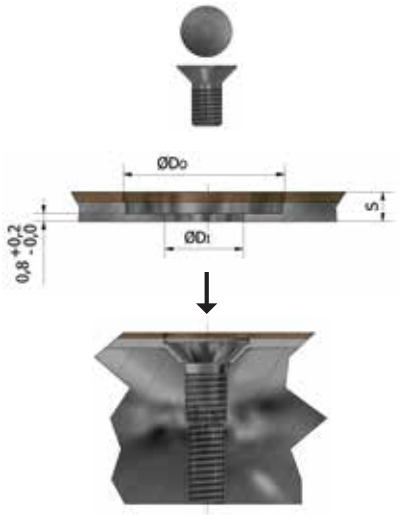
- The tapping drill hole, countersunk bore and thread should be machined in the housing part according to the below / next page guidelines
- Before installation, the sliding plate has to be tightly fixed with the housing part using suitable clamping tools (e.g., clamping tongs)

INSTALLATION

- The sliding plate must be fixed with EN ISO 10642 countersunk screws.

ADDITIONAL SCREW SECURING

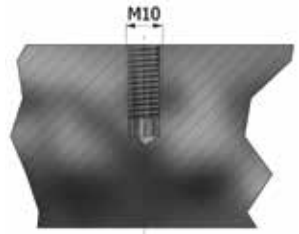
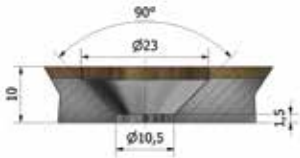
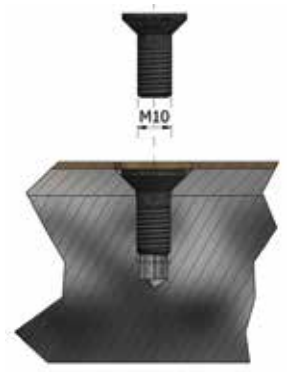
- If required, the screws may be secured with metal adhesives like "Loctite 603" or “Loctite 278”. Follow the glue manufacturer recommendations.

PREPARATION	INSTALLATION
	

ISO 10642	SLIDING PLATE BORE			HOUSING PLATE BORE		
M	D_1	D_0	S	D_{C1}	D_{C2}	t_{min}
M6	6.4	16	1.5 / 2 / 2.5 / 3 / 5	14	15	5
M8	8.4	20	1.5 / 2 / 2.5 / 3 / 5	18	19	6
M10	10.5	25	2 / 2.5 / 3 / 5	22	23	8

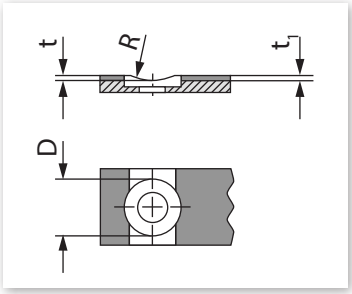
Installation of 10mm thick plates with M10 hexagon socket

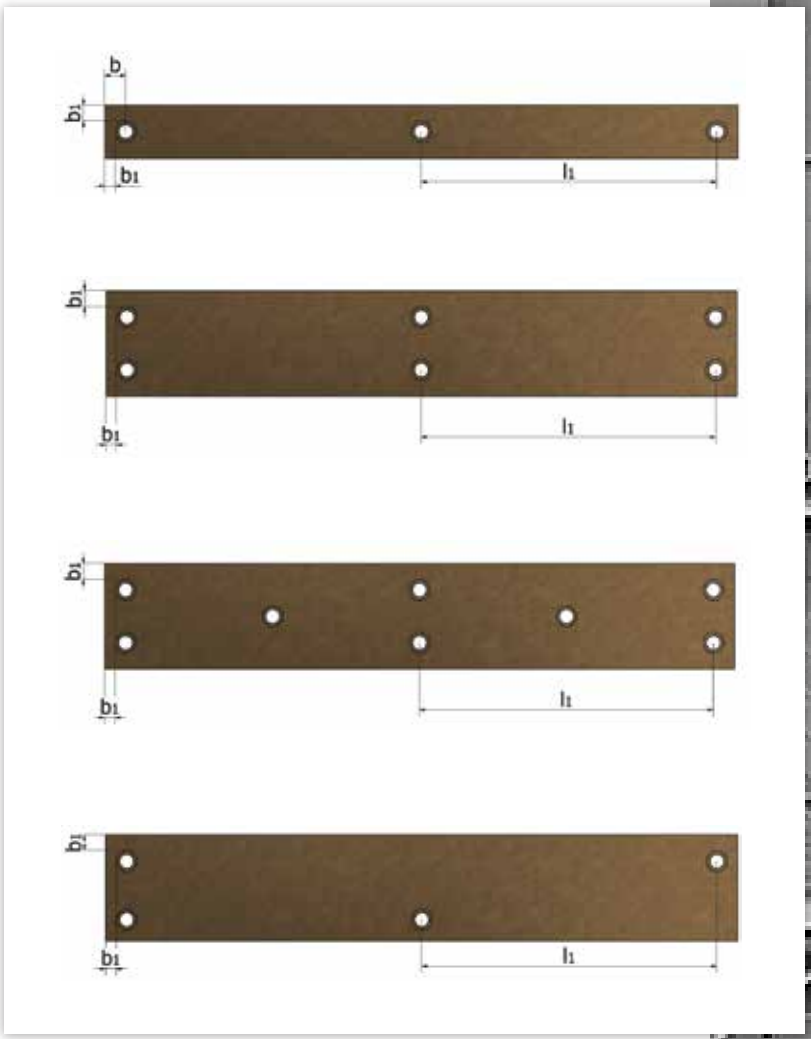
Example:

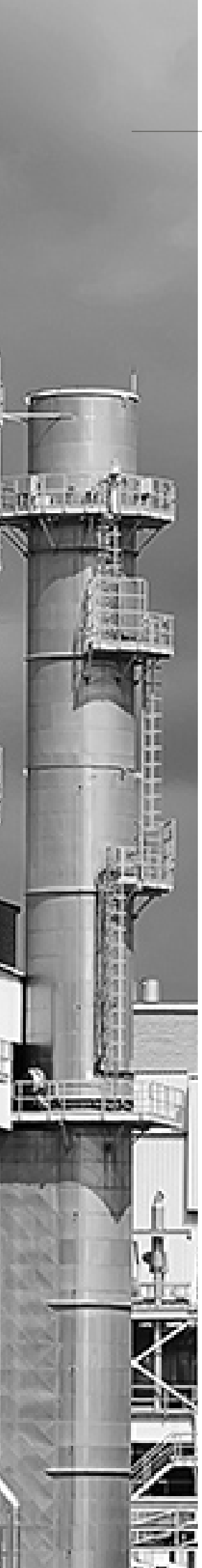
[1] PREPARATION	[2] PREPARATION OF PLATE	[3] INSTALLATION
		

Hole spacing & installation

The number and size of the screws depends on the actual load stress and shearing forces. Recommended guiding values:
b1 = 10 - 30 mm
If b1 < 4 mm, in order to avoid chipped sliding layer edges, nicks should be made as shown in the figure below.
l1 = 60 - 150 mm
b ≈ (1 - 1.5) D







Available designs

Examples of available sliding plates & plain bearings

Split bushing

Split bushing with lubrication dimples

Split bushing with cross cleaning grooves

Bushing with welded joint

SLIDING PLATE, radial

SLIDING PLATE, axial

T-GUIDE

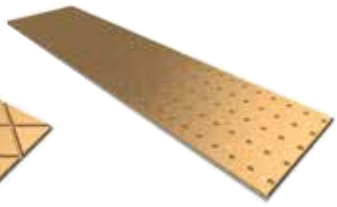
SLIDING PLATE without running-in film

SLIDING PLATE, with running-in film

SEGMENT RING with running-in film

For standard applications, the sliding layer can be plain. A graphite running-in film helps during the initial stage of the service life

For harsh enviroments and non lubricating conditions, cleaning grooves can prolong the service life

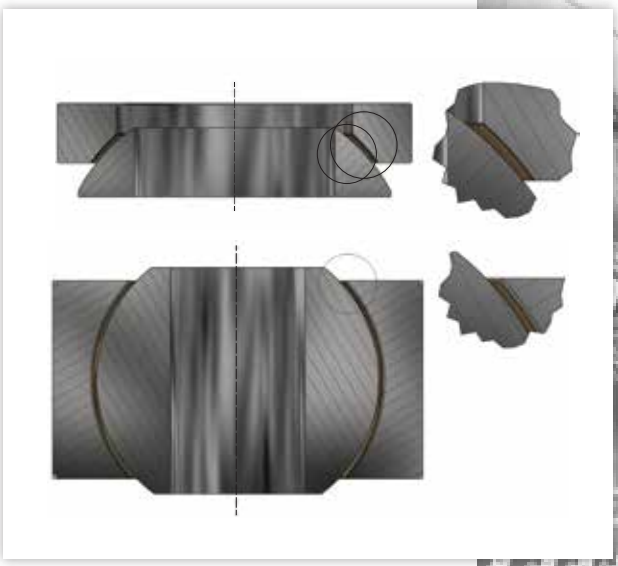


For grease-lubricating conditions, dimples act as a lubricant reservoir to prolong the service life

Special design solutions

Spherical bearings

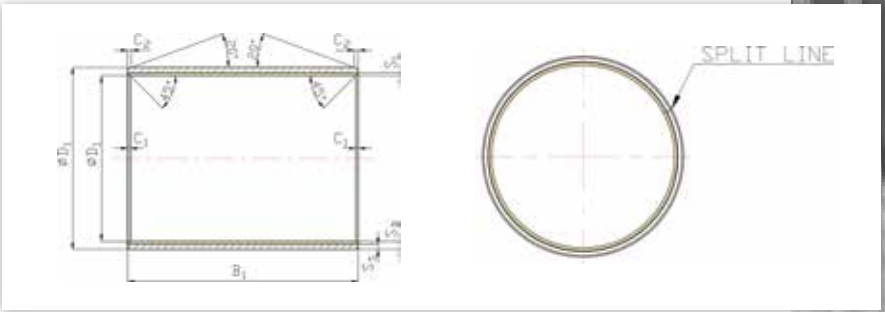
One of the most required advanced design bearings is the spherical joint featuring self-alignment of its rotation axis and thus providing many desired functional benefits.

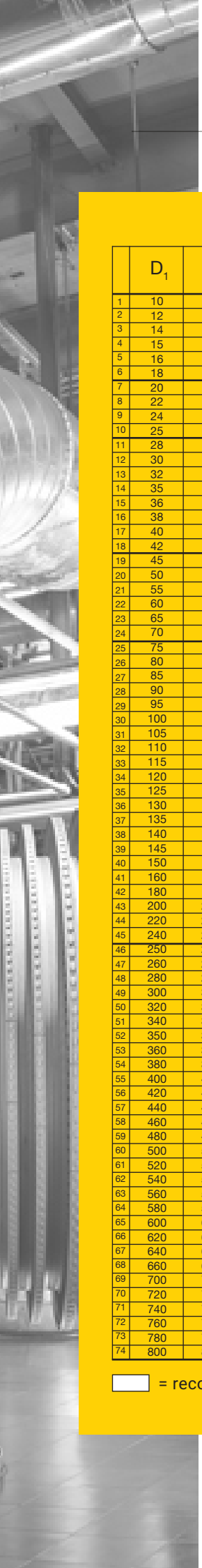


Our engineers utilize cutting-edge modelling and in-house expertise when designing customized spherical bearings solutions. Their knowledge and expertise are put in service when helping our customers finding the right answers for their engineering challenges. Contact us now for more information.

Recommended dimensions of CER.BM cylindrical bearings

CER.BM bearings are made according to ISO 3547 standard. Other sizes and tolerances are also available on demand. Cross cleaning grooves are feasible on deand for any size.





	D_1	D_2	S_B	S_S	S_L	C_1	C_2	B1 = ±0.25																			
								10	15	20	25	30	40	50	60	70	80	100	120	140	150	160	180	200			
1	10	12	1,0	0,5	0,5	0,5	0,6																				1
2	12	14																									2
3	14	16																									3
4	15	17																									4
5	16	18																									5
6	18	20																									6
7	20	23	1,5	0,8	0,7	0,5	0,6																				7
8	22	25																									8
9	24	27																									9
10	25	28																									10
11	28	32	2,0	1,2	0,8	0,5	1,0																				11
12	30	34																									12
13	32	36																									13
14	35	39																									14
15	36	40																									15
16	38	42																									16
17	40	44																									17
18	42	46																									18
19	45	50	2,5	1,5	1,0	0,8	1,2																				19
20	50	55																									20
21	55	60																									21
22	60	65																									22
23	65	70																									23
24	70	75																									24
25	75	81	3,0	2,0	1,0	1,0	1,5																				25
26	80	86																									26
27	85	91																									27
28	90	96																									28
29	95	101																									29
30	100	106																									30
31	105	111																									31
32	110	116																									32
33	115	121																									33
34	120	126																									34
35	125	131																									35
36	130	136																									36
37	135	141																									37
38	140	146																									38
39	145	151																									39
40	150	156																									40
41	160	166																									41
42	180	186																									42
43	200	206																									43
44	220	226																									44
45	240	246																									45
46	250	260	5,0	4,0	1,0	1,0	2,5																				46
47	260	270																									47
48	280	290																									48
49	300	310																									49
50	320	330																									50
51	340	350																									51
52	350	360																									52
53	360	370																									53
54	380	390																									54
55	400	410																									55
56	420	430																									56
57	440	450																									57
58	460	470																									58
59	480	490																									59
60	500	510																									60
61	520	530																									61
62	540	550																									62
63	560	570																									63
64	580	590																									64
65	600	610																									65
66	620	630																									66
67	640	650																									67
68	660	670																									68
69	700	710																									69
70	720	730																									70
71	740	750																									71
72	760	770																									72
73	780	790																									73
74	800	810																									74

□ = recommended dimensions

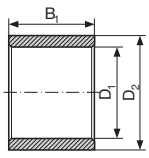
Design questionnaire

Application data for the design of CER.BM bearing / thrust washer / spherical bearing / sliding plate

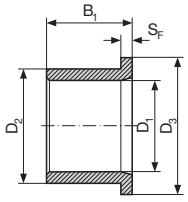
CUSTOMER	
CONTACT PERSON	
ADDRESS	
TEL./EMAIL	

EXISTING DESIGN	☐
NEW DESIGN	☐

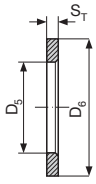
DESCRIPTION OF APPLICATION		
Steel industry	☐	
Wind energy	☐	
Rubber and Plastic Industry	☐	
Steam and Gas Turbines	☐	
Offshore and Marine	☐	
Heavy-duty Vehicles	☐	
Hydro power	☐	
Other	☐	specify:



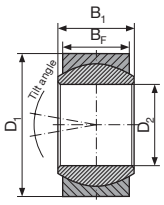
Plain bearing ☐



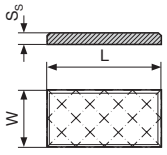
Flanged bearing ☐



Thrust washer ☐



Spherical bearing floating / fixed ☐



Sliding plate ☐

QUANTITY TO BE SUPPLIED (PCS)	Item #1	Item #2	Item #3
Type of part (select from list)			
Type of motion 1 (select from list)			
Type of motion 2 (select from list)			

DIMENSIONS (MM)	Item #1	Item #2	Item #3
Inner diameter D_1 (D_5)			
Outer diameter D_2 (D_6)			
Bearing width B_1			
Outer ring width B_F			
Flange outer diam. D_3			
Flange thickness S_F			
Wall thickness S_T			
Plate length L			
Plate width W			
Plate thickness S_S			

LOAD	Item #1	Item #2	Item #3
Static			
Dynamic			
Alternating			
Impact			
Radial load (kN)			
Axial load (kN)			

SURFACE PRESSURE	Item #1	Item #2	Item #3
Radial			
Axial			

MATING MATERIAL	Item #1	Item #2	Item #3
Material spec/type (W. Nr.)			
Hardness (HB or HRC)			
Roughness R_a (µm)			

HOUSING MATERIAL	Item #1	Item #2	Item #3
Material spec/type (W.Nr.)			

LUBRICATION	Item #1	Item #2	Item #3
Dry running			
Permanent lubrication			
Initial lubrication supplied			
Lubricant type			
Dynamic lubricant viscosity			

MOTION DATA	Item #1	Item #2	Item #3
Rotational speed (rpm)			
Sliding speed (m/s)			
Stroke length (mm)			
Linear freq. (strokes/min)			
Angle “β” (see image)			
Oscill.frequency (n/min)			

MOTION DATA	Item #1	Item #2	Item #3
Rotational speed (rpm)			
Sliding speed (m/s)			
Stroke length (mm)			
Linear freq. (strokes/min)			
Angle “β” (see image)			
Oscill.frequency (n/min)			

OPERATING TIME	Item #1	Item #2	Item #3
Continuous operation			
Intermittent operation			
Working time (hours/day)			
Working time (days/year)			
Frictional distance (km)			

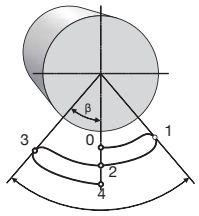
ISO FITS & TOLERANCES	Item #1	Item #2	Item #3
Shaft			
Bearing housing			

ENVIRONMENT	Item #1	Item #2	Item #3
Operating temperature (°C)			
Min. op. temperature (°C)			
Max. op. temperature (°C)			
Chemical medium in touch with the bearing			

LIFETIME	Item #1	Item #2	Item #3
Desired operating time (h)			
Permissible wear (mm)			

ANGLE β

For oscillating motion, one cycle is four time the angle β



REMARKS

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